0000109668

Transcript Exhibit(s)

Docket #(s): E-01575A-08-0328

E-01575A-09-0453

Exhibit # : A1-A3

RECEIVED
2010 MAR 31 P 1:19
AZ CORP COMMISSION
DOCKET CONTROL

Arizona Corporation Commission
DOCKETED
MAR 31 2010
DOCKETED BY

Arizona Court Reporters Association

Arizona Reporting Service, Inc.

Court Reporting & Videoconferencing Center

e-mail: azrs@az-reporting.com
www.az-reporting.com

NCRA MEMBER Guardians of the Record

Marta T. Hetzer
Administrator/Owner

Suite 502
2200 North Central Avenue
Phoenix, AZ 85004-1481
MAIN (602) 274-9944
FAX (602) 277-4264

To: Docket Control

Date: March 31, 2010

Re: SSVEC / Rates
E-01575A-08-0328, etc.
Volumes I through III, Concluded
March 24 through 26, 2010

STATUS OF ORIGINAL EXHIBITS

FILED WITH DOCKET CONTROL

SSVEC (A Exhibits)

1 through 13

Staff (S Exhibits)

1

Intervenor James F. Rowley, III (Rowley Exhibits)

1 through 3

Intervenor Susan Scott (Scott Exhibits)

1 and 2

Intervenor Susan J. Downing (Downing Exhibits)

1 and 2

Copy to:

Jane L. Rodda, ALJ
Bradley S. Carroll, Esq. – SSVEC
Charles H. Hains, Esq. – Staff
Mr. James F. Rowley, III
Ms. Susan Scott
Ms. Susan J. Downing

BEFORE THE ARIZONA CORPORATION COMMISSION

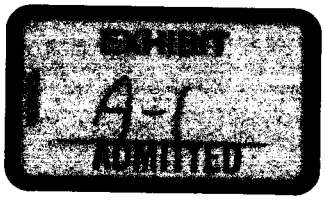
COMMISSIONERS

KRISTIN K. MAYES, Chairman
GARY PIERCE
PAUL NEWMAN
SANDRA D. KENNEDY
BOB STUMP

IN THE MATTER OF THE APPLICATION OF SULPHUR SPRINGS VALLEY ELECTRIC COOPERATIVE, INC. FOR A HEARING TO DETERMINE THE FAIR VALUE OF ITS PROPERTY FOR RATEMAKING PURPOSES, TO FIX A JUST AND REASONABLE RETURN THEREON, TO APPROVE RATES DESIGNED TO DEVELOP SUCH RETURN AND FOR RELATED APPROVALS.	DOCKET NO. E-01575A-08-0328
IN THE MATTER OF THE APPLICATION OF SULPHUR SPRINGS VALLEY ELECTRIC COOPERATIVE, INC. FOR AN ORDER INSTITUTING A MORATORIUM ON NEW CONNECTIONS TO THE V-7 FEEDER LINE SERVING THE WHETSTONE, RAIN VALLEY, ELGIN, CANELO, SONOITA, AND PATAGONIA, ARIZONA AREAS.	DOCKET NO. E-01575A-09-0453

PRE-FILED DIRECT TESTIMONY OF JODY SEVERSON
ON BEHALF OF SEVERSON & ASSOCIATES
FOR
SULPHUR SPRINGS VALLEY ELECTRIC COOPERATIVE, INC.
(A.R.S. §40-252 Proceeding)

FEBRUARY 23, 2010



Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Jody Severson, and my business address is 3102 Stockade Drive, Rapid City, South Dakota 57702.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am the owner of Severson & Associates. It is a sole proprietorship that provides political and marketing consulting services and polling design and interpretation services. We help clients figure out what the sampling method should be and what topics to include in their polls. We write the questions and then we subcontract with polling firms to provide the physical phone calling, data entry, statistical validation, and tables. We then study the numbers and translate them into plain English analysis and recommendations. Usually this means telling clients what their strategy and message should be, based on the numbers. With rare exception, our clients do not have the background to understand which numbers are meaningful or whether a given number is good or bad. The principal value we provide is having had decades of experience reading these numbers and seeing what happens when you apply the poll findings to a real life situation like a political campaign or overcoming a challenge faced by a utility.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND AND WORK EXPERIENCE.

A. I have been a reporter, a low-income housing advocate, Special Assistant to a United States Senator, Director of Policy for the Governor of South Dakota, and since 1983, have worked as an independent marketing, communication, and political consultant. For the past 23, years I have worked with electric cooperatives around the U.S. facing hostile takeovers, territorial conflict, mergers, rate increases,

transmission siting, and other local controversies. I have also from time to time assisted telephone cooperatives and small, independent local telephone companies on various matters and have been a presenter at various rural telecom association conferences at the state and national levels. This experience includes having conducted focus groups on such issues as cable and phone packages, interest in cellular service, a territorial squabble or tow, and competitive pricing strategy.

I attended George Washington University, majoring in Political Science and Economics but did not complete my degree. By the time that should have happened, I was already working for the U.S. Senate as a speechwriter and community development specialist. I was on the National Board of Directors of Rural America, Inc., a low-income and environmental advocacy group, and I have assisted with a number of environmental ballot issues in the Black Hills of South Dakota, including restrictions on open pit mining and banning a proposed low level nuclear waste site. Recently, I've been involved in efforts to prevent a new WalMart from building on sites that would clutter the view on the way to Mt. Rushmore.

Q. WHAT OTHER UTILITY CLIENTS HAVE YOU BEEN WORKING WITH RECENTLY THAT MIGHT FURTHER ILLUSTRATE YOUR EXPERIENCE?

A. In 2008, we did an extensive survey of ratepayers throughout the entire State of Nebraska to determine how much people would be willing to pay for wind or other renewables, their knowledge of where electricity comes from, their attitude about building new transmission lines to move wind energy from the prairie to urban markets, and their opinion about climate change. It was a groundbreaking study that found that people in Nebraska, a very conservative state politically, were much

more concerned about climate change than directors and managers had surmised.

We are currently working on a poll in Colorado to determine whether voters want to renew an investor-owned utility's franchise to serve a city for another 25 years or would be willing to entertain another offer, as part of a long-standing tussle about which utility gets to serve new industrial load. In Texas, we are working with a co-op that has experienced rapid growth and wants to figure out how to build cooperative awareness and participation among younger, suburban members. In Hawaii, last year I worked with a new, embattled co-op that is seeking to raise its rates by 10% even though their rates are already 34 cents per kWh and have gone as high as 49 cents when oil prices spike. And we have a number of co-ops or public power districts for whom we do more-or-less routine customer satisfaction polling.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE ARIZONA CORPORATION COMMISSION ("COMMISSION")?

A. No.

Q. ON WHOSE BEHALF ARE YOU TESTIFYING IN THIS MATTER?

A. I have been asked to testify by Sulphur Springs Valley Electric Cooperative, Inc. ("SSVEC" or the "Cooperative").

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of my testimony is to report the findings of a scientific, random sample telephone poll of SSVEC members who are the individuals in their households responsible for paying the electric bill. The poll was conducted

January 18 to 20, 2010, and is attached as Exhibit A.

Q. WHO AUTHORIZED THE POLL, AND HOW DID IT COME INTO BEING?

A. Transworld Network ("TWN") has an ongoing business relationship with SSVEC and was interested in doing a poll to measure customer satisfaction and interest in some of their services. They agreed to include the questions for SSVEC as part of that poll. There was an entire battery of TWN questions in the poll that were not included in the poll report we are discussing today. I prepared a completely separate report for TWN that covered our findings about the TWN questions. This kind of partnering on polling is not unusual. Just last month, I completed a poll that was a joint project by a local Mayor and a State Senator, and we often piggyback candidate questions into ballot issue polls, or vice versa. SSVEC expressed concern about claims that a lot of people were opposed to the new line. Experience has taught me that anecdotal reports about community sentiment on a controversial local issue are very often wrong because the participants on both sides naturally assume that everyone agrees with them and cares about the issue as much as they do. My thought was that if in fact the numbers were to show that there is substantial opposition to the line, that would mean that co-op management should re-examine its assumptions about the plan because co-ops are democratically controlled organizations, and, sooner or later, the will of the majority will prevail, so you can avoid a lot of pain and expense if you know with some accuracy how the member-owners feel about the issue. Likewise, if the poll were to show substantial member support for the co-op's management and plan, that would be valuable for obvious reasons and would give management the confidence to proceed.

At the time, I had no idea that this poll would become part of the Commission's proceedings. In fact, this is the first time it has ever happened in my experience. Normally, I structure these polls primarily for internal consumption so we can figure out a strategy to solve a problem. You cannot keep 600 phone calls into a community this size a secret, so we sometimes plan on releasing a summary of the findings, but at least half of the time do not.

Q. WHAT DID THE POLL DISCOVER?

A. The member-owners of SSVEC support the line by landslide margins. Within the Sonoita, Patagonia, and Elgin area ("Affected Areas"), the proposed line is supported by a margin of 70% in favor to 18% opposed. Among the entire membership, it is supported 63% to 8%, while the undecided number among the membership as a whole is higher, 29%, as compared to 11% undecided in the affected area. You would expect the undecided rate to be lower in the affected area because it is an issue of direct concern there, and people are paying more attention to it.

Q. ONE PLACE IN THE POLL SAYS THAT 63% FAVOR THE LINE. LATER ON, IT SAYS THAT 83% DO. HOW DO YOU EXPLAIN THE DIFFERENCE?

A. What you have there are before and after pictures. I designed this survey using a standard political polling technique in which very early on in the survey, with the minimum amount of background information, we ask how they'd vote if the election were tomorrow. That found support of the line at 63%, opposition at 8%, and an undecided / don't know of 29% among the entire membership. That's the score as it stands today – in the membership as a whole. Then we asked a series of

questions about the various pros and cons and their opinion about how well the co-op performs its job. After they've heard those pros and cons and have had more time to consider the issue, we ask a second time how they would vote. That score was 83% in favor, 8% opposed. Almost all of the undecided people in the first round moved to support the line, though opponents did pick up a little strength in the Affected Areas – but still lose 3 to 1 there.

As I said earlier, I designed this poll thinking it would be used principally for internal consumption to shape strategy. I tried very hard to put the best foot forward for the opponents in the design of these questions. I have been in similar shoes often enough myself, but my reasons for doing so are practical ones. I have learned that it is much better to give the client a worst-case set of numbers upon which to base their planning than it is to give them a more cheerful and rosy set of numbers which may have an unfortunate collision with reality further down the road. I want my clients planning and preparing for the worst case.

Q. DID THE SURVEY EXPLORE WHY MEMBERS SUPPORT THE LINE IN SUCH LARGE NUMBERS?

A. Yes. We included questions on a number of aspects of the co-op's performance. Those questions used the standard wording on questions about the co-op's reliability, and this poll was memorable because in the Affected Areas, consumers gave SSVEC the worst scores for reliability that I have ever seen in 20+ years of doing these polls. On "keeping blinks and outages to a minimum" the co-op got a 46% positive job rating and a 24% negative rating. On "keeping longer outages to a minimum," the co-op received a 58% positive to 15% negative. These scores are 30 or 40 points worse than one typically sees.

. . .

For the rest of the service territory, I'd say that cost is the major factor because of concerns about the economy. "Jobs and the economy" are always in the top three spontaneously-offered issue concerns when you poll rural communities, but in this survey, it blew the doors off.

Q. HOW RELIABLE IS THE POLL DATA?

A. We completed 600 interviews of names randomly drawn from the list of residential members provided by SSVEC. We deliberately over-sampled the Affected Areas so that we would have enough completed interviews to get a decent look at opinion within that small subset of the entire membership. This is a standard and accepted statistical technique for subgroup analysis. Within the Affected Areas, the margin of error in this poll is plus or minus 8.5%. For the overall sample, the margin of error is +/- 4.4%.

Q. HOW SIGNIFICANT IS THAT 8.5% MARGIN OF ERROR IN THE AFFECTED AREAS?

A. We worry about those margins of error in a political campaign, for example, where the results for the two candidates are within a few points of each other, but in this case, it is such a landslide that the statistical margin of error is not going to change the outcome. The hardest number to hit accurately in a poll is one in which opinion is split 50/50. As the amount of difference of opinion increases, the chances decline dramatically that there is some sort of flaw that would change the outcome. The greater the difference in the score, the more confident you can be that you are looking at the truth of the situation.

. . .

. . .

Q. FOLLOWING THE FILING OF THE POLL WITH THE COMMISSION, THE COOPERATIVE BECAME AWARE OF CLAIMS THAT SOME SSVEC MEMBERS OPPOSING THE 69 KV LINE HAD BEEN DELIBERATELY EXCLUDED FROM THE POLL. IS THERE ANY TRUTH TO THESE CLAIMS?

A. That is completely untrue. In fact, we did interview a number of people in the Affected Areas and in the overall territory who were opposed to the line. The procedure was this: We asked SSVEC to give us a list of all of their residential members that included name, address, phone number, which director district they live in, how much their monthly bills are, etc. This is standard procedure that we do for every co-op poll. We then selected the names to be called using two different random sorts of the list.

You may be confident that there was no effort to select 600 people based on their sentiment about the issue beforehand for the very simple reason that we had no such data on the file. The basic procedures we used in this poll were no different than the way we do it for any other cooperative, whether they've got a tough issue of some kind or just want to do a routine check of their standing with the consumers.

Q. HOW WOULD YOU SUMMARIZE THE POLL'S FINDINGS?

A. Among the membership as a whole, support is nearly 8 to 1 in favor of the line among those who have made up their mind. In the affected area, the line is favored by a 4 to 1 ratio among those who have made up their minds, and they are extremely unhappy with the reliability of their electric service. In the Affected Areas they give SSVEC the worst grade on reliability that I have ever seen.

In every argument we tested pro versus con about the line, the cooperative's position wins overwhelmingly. This means that the more the average member learns about this issue, the more likely he or she is to side with the co-op. Part of the reason for such strength is that in the service territory as a whole, SSVEC gets solidly good grades for its performance, for its customer service, and for its efforts to keep rates as low as possible.

Overall satisfaction with SSVEC stands at 88% satisfied and 7% dissatisfied and that is on the high end compared to other co-ops we have polled. A few very small and very rural cooperatives can do a few points better than that, and most co-ops this size do slightly less well.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.

11196366.2

Exhibit A

SSVEC Survey Report - Executive Summary -January 26, 2010

TO: Jack Blair

FROM: Jody Severson / Severson & Associates

By landslide margins, the member-owners of SSVEC favor building the 69kV line to the Sonoita, Elgin and Patagonia area (SEP). Within that area itself, ground zero for the opposition, the new line is favored by 70% with 18% opposed and 11% undecided. Among the entire membership, 63% favor the line while 8% oppose it and 29% are undecided.

Within the SEP area, SSVEC receives the lowest scores for the reliability of its service that we have seen in more than 20 years of polling electric cooperative memberships around the nation.

In that area, merely 46% give SSVEC a positive rating for "keeping blinks and momentary outages to a minimum," while 24% give the co-op a negative rating. On "keeping longer outages to a minimum," the score is 58% positive to 15% negative, and on "restoring power quickly after an outage," the score is 65% positive and 15% negative.

These questions were asked with the same wording and methodology we've used through the years, at co-ops large and small, rural and suburban. Typically a co-op would expect to see its positive ratings on these questions in the mid-to-high 80s and the negatives in the single digits, occasionally breaking into double digits. You're below the national norm in the SEP area by 30 to 50 points on these reliability questions. It's not surprising that they want that new line by such overwhelming numbers.

We used the same technique in this poll that is often used in political campaign polling. Without indicating who was paying for the survey, we asked to speak to the person responsible for paying the electric bills.

We then asked an open-ended question, "*What would you say is the most important issue facing your community today?*" As would be expected, "jobs and

the economy" top the list, with immigration trailing a far distant second, utility and electric bills coming in behind that, and a smattering of other issues getting a mention (schools, government spending, crime, health care, taxes, etc.).

By way of introducing the topic for this evening's poll, we then asked the standard question about overall member satisfaction with SSVEC, and received an 88% positive rating over 7% negative, which is slightly above average.

We then asked members how much they had heard about SSVEC's plans to build a new power line to the SEP area. As would be expected, 95% of those in the area had heard about it, including 58% who said they have heard "a lot." For the membership as a whole, 48% said they've heard either a lot or a fair amount about the line, while 52% had heard not much or nothing.

Then we asked the "first horse race" question. Without explaining any of the justification for the line or any of the reasons given to oppose it we asked, *"Based on everything you've heard about this issue so far, do you think the new power line to the Sonoita / Elgin / Patagonia area should be allowed to built or not?"* People who were uncertain were asked which way they lean (standard technique). That produced the result referred to a moment ago: among all members, the new line is favored 63% to 8% and in the SEP area it is favored 70% to 18%.

If an election were held tomorrow, it would be a landslide of those proportions. That's the score as it stands right now.

We then asked a series of standard questions to probe member attitudes about the co-op's performance (including those reliability questions).

Then we introduced the Sonoita line. We gave them some background information, explaining that only one feeder line serves the area, that it has 270 hours of outages per year compared to under 3 for the rest of the system, and that SSVEC requested a ban on new hookups because the line is overloaded. We told them that the co-op wants to build a second line to relieve

the overloading and provide a backup route for power. Little of this would be news to anyone in the SEP area, nor would it be news to about half of the other members.

We then tested four sets of pro and con arguments, juggling the order in which they were asked as much as practical from one interview to the next so as to minimize the bias that naturally comes when people hear questions and the information presented by the questions in sequence.

We asked about the view-shed issue versus SSVEC's right of way, as follows:

"Opponents say that the new line will hurt their property values because it will interfere with their view of the mountains. The cooperative says that it has owned the right of way to build that line for 28 years and that it was public record when property owners bought their property. As regards concerns about the view of the mountains, which of these two sides do you most agree with -- even if neither is exactly your opinion?"

By 81% to 12%, the overall membership sided with SSVEC and 12% sided with the opponents. Within the SEP area, 71% sided with SSVEC while 18% sided with the opponents. In the affected area, then, the opponents' view-shed argument nets about 16 points better than it does overall, but it's still a blowout. Please note that our statement of the opponents' position deliberately referenced the protection of property values, which we thought would play favorably in a conservative place like Arizona. Our goal in writing these questions is to allow both sides to put their best foot forward.

We asked the view-shed argument another way, this time raising the issue of unfairness visited upon property owners, versus the study's finding that the chosen route affects the fewest people. The exact wording:

"Opponents say that putting the new line in the view of the mountains is unfair to them because one of the primary reasons they bought their property was the view of the mountains. The cooperative says that the path they chose for

the new line is the path that affects the fewest number of people, a statement with which an independent study has agreed."

Among all members, 80% side with the co-op and 12% with the opponents. In the SEP area, again the opponents did a little better (72% for the co-op, 19% for opponents), but still a landslide. Please note that we are not using any hot-button language to describe opponents, such as "a small handful" or "tiny minority" or "extremists" or even "environmentalist." Indeed, by referring to the "unfairness" cited by opponents, we perhaps gave them whatever advantage there may be in being seen as the underdog against the big utility.

We then tested another major pairing of pro and con statements, as follows:

"Opponents say that alternative energy sources, like wind or solar power, could take care of much of the problem. They want the cooperative to build enough alternative energy sources in the area to reduce the need for a new line and say that would be positive for the environment as well. The cooperative says that renewable energy would not solve the reliability and power quality problems caused by having only one line into the area, would not provide enough electricity when it is needed, would be only a short term fix and would be far more expensive, a statement with which an independent study on the matter has agreed."

Overall the membership sided with the co-op by 78% to 14%, and in the SEP area they sided with the co-op 74% to 21% for the opponents.

Next we related the findings of the Navigant study and paired that against the notion of further studies, as follows:

"I'd like to ask your opinion on another issue. Opponents of the Sonoita/ Elgin/ Patagonia line asked the Arizona Corporate Commission, which regulates electric utilities, to order Sulphur Springs Valley Electric Cooperative to conduct an independent, third party study of the alternatives to building a new feeder

line, including wind and solar power. That study has just been completed and found that the proposed new feeder line is the most realistic, affordable and long term way to solve the reliability and power quality problems. Opponents are expected to criticize the study or ask for more studies of the various alternatives. The cooperative says that further delays will significantly increase costs to put in the new line to the Sonoita/ Elgin/ Patagonia area and that such cost increases are unfair to all other ratepayers who have to pay for the new line."

Overall the membership sided with the co-op 84% to 11%, and in the SEP area 75% to 17%.

Overall, members gave SSVEC a solid ranking on "being good stewards of the environment," with 58% rating the co-op "pretty good" or "excellent" on this issue. Merely 7% gave SSVEC a negative rating on environmental stewardship. In the SEP area it was a tad softer: 51% positive, 18% negative.

When political campaigns use this polling technique, they do what we've done. First, almost immediately into the survey and with the minimum amount of information introduced to bias the answers, they ask which side the respondent will support. Then they test a variety of issues, as we just did. Then they ask a "re-vote" question to see what has happened now that respondents have spent a little more time thinking about the issue and after having heard more of the pros and cons. Here's the wording (again, it's a standard way of phrasing the question):

"Sometimes, over the course of a survey like this one, with more information, people change their minds. Do you think the new power line to the Sonoita/ Elgin/ Patagonia area should be allowed to be built or not? (IF OPINION GIVEN:) Is that strongly SUPPORT/OPPOSE or just somewhat SUPPORT/OPPOSE? (IF UNDECIDED:) Well, which way would you say you lean?"

Among all members, support for the line is overwhelming: 83% in favor, 8% opposed. In the SEP area, only slightly less overwhelming: 72% favor the line 22% oppose it.

Taken together, this means that when the entire membership hears the pros and cons, support for the line rises from its initial 63% to an astounding 83%, while opposition remains the same at 8%. The undecideds fell 20 points and support for the line gained 20 points.

In the SEP area, after hearing all the pros and cons, support for the line rose by 2 points from its initial standing while opposition to the line increased by 4 points. Residents of the area favored the line by 3 to 1 after hearing the pros and cons, with 72% favoring it, 22% opposed, and 5% undecided.

In designing the questions, we wanted to test what appeared to be the most effective arguments advanced by the opposition (property rights, unfairness, renewables, environment). If indeed that's the best they've got, then opponents don't yet have a case with any prayer of prevailing. That's a key point to remember in a utility that is 100% owned by its members. Cooperative members cast 100% of the votes for the board of directors that governs the organization.

Fewer than 1 in 10 members oppose the line, and in the SEP area itself, one in five. In the minds of the members, SSVEC's responses powerfully overwhelm the concerns raised by opponents.

If we were to offer consolation to opponents, it would be to say that it's possible they might fare better if the economy were not such a large concern and if people in the affected area were not as torqued off about blinks and outages as they appear to be, but based on years of experience reading such polls and absent an earth-shattering new event, we don't think that would change the final outcome.

For whatever it may be worth as your rate case moves forward, members give SSVEC a 2:1 positive over negative rating on "working to keep rates low."

Fully 45% said you are either "pretty good" or excellent in your efforts to keep rates low, while 21% rated SSVEC either "fair" or "very poor." Since no one will ever tell a pollster, "Your service is so good you ought to raise my rates," this 2:1 positive is about as good as it ever gets on the rate question. Occasionally we see a system that does slightly better than this, and often we see worse.

In the SEP area, it was 38% positive over 25% negative on "working to keep rates low." In such surveys, sentiment about rates is always correlated to sentiment about the quality of the service. The more outages you have, the more it seems your rates are too high. You have way too many outages in the SEP area to expect a strong rating on your rates.

Methodology

This survey was jointly sponsored by Transworld Network and Sulphur Springs Valley Electric. The Transworld portion of the survey measured customer awareness of, interest in, satisfaction with, and market penetration levels of its Internet and digital phone service. Those findings have been provided to Transworld in a separate written report.

The survey was conducted by Severson & Associates and RBI Strategies & Research. We completed 600 interviews of SSVEC residential members, limited to people who indicated that they were the person in the household responsible for paying the household electric bill.

A total of 500 interviews was conducted among a statistically valid cross-section of all residential members of SSVEC. In order to increase the statistical validity of the Sonoita, Elgin, and Patagonia area, an oversample of 100 interviews was conducted among only SSVEC members in director district seven. The base sample and subsample have margin of errors of +/-4.4% and +/-8.5% at the 95% confidence level respectively. Survey interviews were conducted from January 18 – January 20, 2010 by professional telemarketers using a statistically valid random sample drawn from a list of SSVEC member households.

Severson & Associates has provided polling and communication services to electric and telecom cooperatives since 1987 through electric cooperative statewide associations, generation & transmission cooperatives, the co-ops' national trade association (NRECA), the National Rural Utilities Cooperative Finance Corporation (CFC), and a host of individual cooperatives facing territorial, rate, facility siting, board controversies, and other challenges, from Delaware to Hawaii and from the north woods of Minnesota to Louisiana bayous.

On the political side, Severson's clients have included current or former Presidential candidates, U.S. Senators and U.S. Representatives Tom Daschle, James Abourezk, George McGovern, Ben Nelson, Robert Kerrey, J.J. Exon, Gary Hart, Dick Gephardt, and Tim Johnson, among others. The roster also includes scores of progressive or moderate candidates for Legislature, statewide office, and local office (and a few conservatives here and there). Ballot issues include voter approval of the Denver International Airport and a series of successful statewide ballot initiatives aimed at limiting open pit mining, nuclear waste disposal, and industrial garbage dumps in the Black Hills of South Dakota.

RBI's clients have included Congressman Mark Udall, the National Wildlife Action Fund, the National Wildlife Federation, Coloradans United for Bears, Colorado Conservation Voters, Bill Bradley for President, the Colorado Council of Teamsters, the AFL-CIO, Howard Dean for President, the Democratic National Committee, Social Democrats of Sweden, AFSCME, Trust for Public Lands, the Leadership Conference on Civil Rights, Fund for Animals, and the Sierra Club.

Public Opinion in Sulphur Springs Valley, Arizona
Transworld Network
A Survey by RBI Strategies and Research / Severson & Associates
Survey Conducted January 18 – January 20, 2010
N=600; Base Sample Margin of Error is ±4.4% | Oversample Margin of Error is ±8.5%

TOPLINE REFERENCE
BASE SAMPLE | OVERSAMPLE

Screen

My name is _____ from Standage Market Research, a public opinion polling firm. We're not selling anything. We are conducting a survey about some issues people have been talking about lately. It will take only a few minutes and all responses will remain anonymous and used only for research purposes.

ASK IF THEY ARE THE PERSON IN THE HOUSEHOLD IN CHARGE OF PAYING ELECTRIC BILLS.

IF YES: PROCEED WITH SURVEY
IF NO: ASK FOR THE PERSON IN THE HOUSEHOLD IN CHARGE OF PAYING ELECTRIC BILLS.

Mood of Consumers

1. What would you say is the most serious problem facing your community today? (OPEN ENDED WITH PRECODES)

Jobs and the economy	39%	40%
Immigration	11	8
Utility bills/ electric bills	8	18
Schools/ education	6	4
Government spending/budget	5	5
Crime	4	-
Health care	3	1
Bills (general)	2	1
Taxes	2	0
Roads and public transportation	1	-
City services	1	-
Other	6	8
REFUSED	1	-
DK/NA	12	15

2. Please consider all your experiences to date with Sulphur Springs Valley Electric Cooperative. Can you tell me if you are very satisfied, somewhat satisfied, neither satisfied nor dissatisfied, somewhat dissatisfied or very dissatisfied with Sulphur Springs Valley Electric Cooperative?

Very satisfied	59%	46%	**TOTAL SATISFIED: 88% 75%**
Somewhat satisfied	29	29	
Neither satisfied nor dissatisfied	5	9	**TOTAL DISSATISFIED: 7% 15%**
Somewhat dissatisfied	5	10	
Very dissatisfied	2	5	
Unsure (VOL.)	-	2	
REFUSED	-	-	
DK/NA	-	-	

Power line

3. Recently, there has been some publicity you may or may not have heard about Sulphur Springs Valley Electric Cooperative's plans to build a new power line to the Sonoita (sun-OY-tah) / Elgin (EL-jin)/ Patagonia (pat-uh-GO-nyuh) area. How much would you say you have heard about this: (READ LIST)

A lot	18%	58%	**TOTAL HIGH INFO: 48% 95%**
A fair amount	30	37	
Not much	30	5	**TOTAL LOW INFO: 52% 5%**
Nothing at all	21	-	
Unsure (VOL.)	-	-	
REFUSED	-	-	
DK/NA	-	-	

4. Based on everything you have heard about this issue so far, do you think the new power line to the Sonoita/ Elgin/ Patagonia area should be allowed to be built or not? (IF UNSURE:) Well, which way would you say you lean?

Build	52%	64%	**TOTAL BUILD: 63% 70%**
Lean build	11	6	
Lean not built	2	2	**TOTAL NOT BUILD: 8% 18%**
Not build	7	16	
Hard undecided (VOL.)	24	11	
REFUSED	-	-	
DK/NA	5	-	

Basic Performance

I'm going to read you a list of qualities that might be used to evaluate an electric utility. I'd like you to use a scale from 1 to 5 to rate how well Sulphur Springs Valley Electric Cooperative is performing on each one. Give a rating of 1 if you think it does a very poor job, 2 for only a fair job, 3 for an average job, 4 for a pretty good job or 5 for an excellent job. Here's the first question: how would you rate Sulphur Springs Valley Electric Cooperative on:

ALL AREAS

ROTATE ALL	TOTAL GOOD/EXC	TOTAL FAIR/POOR	Very Poor	Fair	Avg	Pretty good	Exclnt	Unsure	DK
5.a. Keeping blinks and momentary outages to a minimum	78%	5%	1%	4%	14%	35%	43%	2%	1%
6.a. Restoring power quickly after an outage	77%	5%	1	4	12	34	43	4	2
7.a. Communicating with you and keeping you informed	67%	12%	5	8	18	33	34	1	1
8.a. Handling customer questions and complaints	58%	7%	3	4	13	25	33	12	10
9.a. Working to keep rates low.	45%	21%	9	12	25	25	20	6	3
10.a. Being good stewards of the environment.	57%	7%	2	5	17	29	28	12	7
11.a. Keeping longer power outages to a minimum.	80%	4%	1	3	11	34	46	3	2

ONLY SONOITA/ PATAGOINA/ ELGIN AREA

ROTATE ALL	TOTAL GOOD/EXC	TOTAL FAIR/POOR	Very Poor	Fair	Avg	Pretty good	Exclnt	Unsure	DK
5.b. Keeping blinks and momentary outages to a minimum	46%	24%	11%	13%	29%	30%	16%	2%	%
6.b. Restoring power quickly after an outage	65%	15%	5	10	20	45	20	1	-
7.b. Communicating with you and keeping you informed	73%	16%	10	6	10	30	43	-	1
8.b. Handling customer questions and complaints	55%	12%	6	6	17	20	35	8	9
9.b. Working to keep rates low.	38%	25%	13	12	28	24	14	5	5
10.b. Being good stewards of the environment.	51%	18%	12	6	16	28	23	9	6
11.b. Keeping longer power outages to a minimum.	58%	15%	6	9	24	35	23	2	-

Sonoita Line

I want to ask a few questions about the proposed power line to the Sonoita/ Elgin/ Patagonia area but first let me give you some background information. There is currently only one feeder line serving the Sonoita, Patagonia and Elgin area and the electric cooperative says demand for electricity there has outgrown the line. As a result, that area has averaged 270 hours of outages a year, compared with an average of under 3 hours of outages in the rest of their service territory. Sulphur Springs Valley Electric Cooperative requested a ban on new hookups in the area because the feeder line serving the Sonoita, Elgin and Patagonia area is overloaded.

The co-op wants to build a second feeder line to the area to relieve that overloading and provide a backup route to deliver electricity and protect power quality. As you may have heard, some opposition to the proposed new line has arisen. I am going to read you some statements made by supporters and by opponents of the proposed new power line.

(ROTATE Q12 AND Q13)

12. Opponents say that the new line will hurt their property values because it will interfere with their view of the mountains. The cooperative says that it has owned the right-of-way to build that line for 28 years and that was public record when property owners bought their property. As regards concerns about the view of the mountains, which of these two sides do you most agree with -- the co-op or the opponents -- even if neither is exactly your opinion? (IF UNDECIDED:) Well, which way do you lean?

Coop	73%	67%	**TOTAL COOP: 81% 71%**
Lean coop	8	4	
Lean opponents	2	-	**TOTAL OPPONENTS: 12% 18%**
Opponents	9	18	
Undecided (VOL.)	7	9	
REFUSED	-	-	
DK/NA	-	2	

13. Opponents say that putting the new line in the view of the mountains is unfair to them because one of the primary reasons they bought their property was the view of the mountain. The cooperative says that the path they chose for the new line is the path that will affect the fewest number of people, a statement with which an independent study on the matter has agreed. As regards concerns about the view of the mountains, which of these two sides do you most agree with -- the co-op or the opponents -- even if neither is exactly your opinion? (IF UNDECIDED:) Well, which way do you lean?

Coop	74%	66%	**TOTAL COOP: 80% 72%**
Lean coop	6	6	
Lean opponents	3	2	**TOTAL OPPONENTS: 12% 19%**
Opponents	10	17	
Undecided (VOL.)	7	8	
REFUSED	-	-	
DK/NA	-	-	

14. Opponents say that alternative energy sources, like wind or solar power, could take care of much of the problem. They want the cooperative to build enough alternative energy sources in the area to reduce the need for a new line and say that would be positive for the environment as well. The cooperative says that renewable energy would not solve the reliability and power quality problems caused by having only one line into the area, would not provide enough electricity when it is needed, would be only a short term fix and would be far more expensive, a statement with which an independent study on the matter has agreed. As regards the idea of using renewable energy to reduce the need for a new line, which of these two views do you most agree with -- the cooperative or the opponents -- even if neither is exactly your opinion? (IF UNDECIDED:) Well, which way do you lean?

Coop	70%	68%	**TOTAL COOP: 78% 74%**
Lean coop	8	6	
Lean opponents	3	2	**TOTAL OPPONENTS: 14% 21%**
Opponents	11	19	
Undecided (VOL.)	7	8	
REFUSED	-	-	
DK/NA	1	2	

Third Party Study

15. I'd like to ask your opinion on another issue. Opponents of the Sonoita/ Elgin/ Patagonia line asked the Arizona Corporate Commission, which regulates electric utilities, to order Sulphur Springs Valley Electric Cooperative to conduct an independent, third party study of the alternatives to building a new feeder line, including wind and solar power. That study has just been completed and found that the proposed new feeder line is the most realistic, affordable and long term way to solve the reliability and power quality problems. Opponents are expected to criticize the study or ask for more studies of the various alternatives. The cooperative says that further delays will significantly increase costs to put in the new line to the Sonoita/ Elgin/ Patagonia area and that such cost increases are unfair to all other ratepayers who have to pay for the new line.

As regards conducting more studies of the issue, which of these two views do you most agree with -- the cooperative or the opponents -- even if neither is exactly your opinion? (IF UNDECIDED:) Well, which way do you lean?

Coop	77%	72%	**TOTAL COOP: 84% 75%**
Lean coop	6	3	
Lean opponents	2	2	**TOTAL OPPONENTS: 11% 17%**
Opponents	9	15	
Undecided (VOL.)	4	4	
REFUSED	-	-	
DK/NA	-	4	

Revote

16. Sometimes, over the course of a survey like this one, with more information, people change their minds. Do you think the new power line to the Sonoita/ Elgin/ Patagonia area should be allowed to be built or not? (IF OPINION GIVEN:) Is that strongly SUPPORT/OPPOSE or just somewhat SUPPORT/OPPOSE? (IF UNDECIDED:) Well, which way would you say you lean?

Strong build	66%	63%	**TOTAL BUILD: 83% 72%**
Somewhat build	13	7	
Lean build	3	2	
Lean not built	1	2	**TOTAL NOT BUILD: 8% 22%**
Somewhat not build	1	2	
Strong not build	6	18	
Hard undecided (VOL.)	9	5	
REFUSED	-	-	
DK/NA	-	-	

17. **IF SUPPORT:** In your opinion, what is the best reason to support building a new power line to the Sonoita, Patagonia, and Elgin area? (OPEN ENDED)

SEE VERBATIMS

18. **IF OPPOSE:** In your opinion, what is the best reason to oppose building a new power line to Sonoita, Patagonia, and Elgin area? (OPEN ENDED)

SEE VERBATIMS

19. **IF UNDECIDED:** Of all of the things you have heard about the proposed new power line, whether in this survey or anywhere else, what are the one or two things that you think are the most important points to consider when deciding whether to build a new power line to the Sonoita, Patagonia, and Elgin area? (OPEN ENDED)

SEE VERBATIMS

Heating and Cooling Systems

20. What is the primary way you heat your home -- do you heat your home with electric heat, natural gas, propane, wood, solar, or something else?

Electric heat	31%	39%	(GO TO Q21)
Natural gas	46	17	(GO TO Q22)
Propane	13	19	(GO TO Q22)
Wood	6	23	(GO TO Q22)
Solar	-	1	(GO TO Q22)
Something else	2	1	(GO TO Q22)
REFUSED	-	-	(GO TO Q22)
DK/NA	-	2	(GO TO Q22)

21. **(ONLY ASK IF ELECTRIC IN Q20)** About how many years old is your electric heating system? **(N=156)**

Several months	4%	4%	**% OF TOTAL: 1% 2%**
About a year	9	12	**% OF TOTAL: 3% 5%**
Between a year and 3 years	23	18	**% OF TOTAL: 7% 7%**
Older than 4 years	47	63	**% OF TOTAL: 15% 24%**
Unsure (VOL.)	14	2	
REFUSED	1	-	
DK/NA	2	-	

22. Do you have a central air conditioning and heating system?

Yes	62%	54%
No	37	45
Unsure (VOL.)	-	-
REFUSED	-	-
DK/NA	-	1

Transworld Network

23. Again, we are not selling anything and these questions are for research purposes only. Are you aware that Sulphur Springs Valley Electric Cooperative offers Wi-power high speed internet and digital phone service throughout Cochise county?

(REGARDLESS OF RECORDED RESPONSE ON THIS QUESTION, IF RESPONDENT IS IN PATAGONIA/ ELGIN/ SONOITA AREA, ASK Q25; ALL OTHERS FOLLOW SKIP PATTERN)

Yes	59%	57%	
No	40	43	(GO TO Q29)
Unsure (VOL.)	1	1	(GO TO Q29)
REFUSED	1	-	(GO TO Q29)
DK/NA	-	-	(GO TO Q29)

24. **(SKIP IF IN PATAGONIA/ ELGIN/ SONOITA AREA)** Do you currently subscribe to this service?

Yes	18%	-	(GO TO Q26)	**% OF TOTAL: 10% -**
No	79	-	(GO TO Q28)	
Unsure (VOL.)	3	-	(GO TO Q29)	
REFUSED	-	-	(GO TO Q29)	
DK/NA	-	-	(GO TO Q29)	

25. **(ONLY ASK IF IN PATAGONIA/ ELGIN/ SONOITA AREA)** If Wi-power high speed internet and digital phone service were available in your area, how likely would you be to subscribe in the next twelve months.

Extremely likely	-	23%	(GO TO Q29)
Somewhat likely	-	22	(GO TO Q29)
Not very likely	-	43	(GO TO Q29)
Not sure (VOL.)	-	12	(GO TO Q29)
REFUSED	-	-	(GO TO Q29)
DK/NA	-	-	(GO TO Q29)

26. How satisfied are you with your internet and/or digital phone service? Please rate your satisfaction level on a scale of 1-5 where 1 is "extremely dissatisfied" and 5 means "extremely satisfied".

Very dissatisfied	6%	-	(GO TO Q27)
Somewhat dissatisfied	5	-	(GO TO Q27)
Neither satisfied nor dissatisfied	6	-	(GO TO Q29)
Somewhat satisfied	27	-	(GO TO Q29)
Very satisfied	56	-	(GO TO Q29)
Unsure (VOL.)	1	-	(GO TO Q29)
REFUSED	-	-	(GO TO Q29)
DK/NA	-	-	(GO TO Q29)

27. Why do you say that? (OPEN ENDED)

SEE VERBATIMS

(SKIP TO Q29)

28. What is the main reason you have chosen not to subscribe to this service? (OPEN ENDED)

SEE VERBATIMS

Demographics

I only have a few questions left for statistical purposes.

29. Is your home in this area a seasonal residence or your primary residence?

Primary	94%	93%
Seasonal	5	6
Both (VOL.)	1	1
REFUSED	1	-
DK/NA	-	-

30. Which of the following age groups do you fall into?

18-34	14%	5%
35-44	9	7
45-54	15	19
55-64	19	28
65+	42	39
REFUSED	1	1
DK/NA	-	2

31. Would you please tell me if you or one of your immediate family members is from a Hispanic or Spanish-speaking background?

Hispanic	15%	18%
Not Hispanic	83	78
REFUSED	1	1
DK/NA	-	3

32. How would you describe your race? (READ LIST)

White/Caucasian	81%	85%	**White non-Hispanic: 75% 75%**
Hispanic/Latino	8	1	**Hispanic/Latino: 15% 18%**
Black/African-American	2	6	**Black non-Hispanic: 2% -**
Asian	2	-	
Other	4	4	
REFUSED	2	2	
DK/NA	1	3	

33. What was your approximate household income for 2008 before taxes? (READ LIST)

Under $25,000	18%	15%
$25,000 to $49,999	24	21
$50,000 to $74,999	19	17
$75,000 to $99,999	10	12
$100,001 to $150,000	7	9
Over $150,000	4	6
DK/NA/REFUSED	18	20

34. What is the highest level of education you have completed?

Less than high school	5%	3%
High school grad	18	11
Some college	28	21
College grad	22	28
Grad school or advanced degree	22	33
Technical/junior college	3	2
DK/NA/REFUSED	2	2

35. Are you currently a student, unemployed, employed, retired or a homemaker? (IF EMPLOYED:) Is that fulltime or part time?

Full time	34%	37%
Part time	6	7
Unemployed	4	4
Student	1	1
Retired	48	45
Homemaker	6	5
REFUSED	1	-
DK/NA	-	2

That concludes our survey. Thank you VERY MUCH for your time.

CODE THE FOLLOWING

36. GENDER

Male	51%	49%
Female	49	51

37. CON DATE

2008 or after	26%	N/A
2005 – 2007	23	N/A
1998 – 2004	23	N/A
1997 or before	28	N/A

38. DISTRICT

Sierra Vista	59%	%
Benson	20	-
Wilcox	8	-
Elgin Sonoita Patagonia	4	100
Sunsites/Elfrida	8	-

39. BILL

0 - 55	23%	20%
56 - 85	23	19
86 - 130	26	21
130+	28	40

40. PATAGONIA SONOITA ELGIN

Y	4%	100%
N	96	-

RBI Strategies & Research

Crosstabs – SSVEC Survey

January 2010

A Survey of Sulphur Springs Valley Electric Cooperative Members

Table 2: Please consider all your experiences to date with Sulphur Springs Valley Electric Cooperative. Can you tell me if you are very satisfied, somewhat satisfied, neither satisfied nor dissatisfied, somewhat dissatisfied or very dissatisfied with Sulphur Springs Valley Electric Cooperative?

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	599	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	95 16%	51 9%	127 21%	472 79%	106 18%	141 24%	113 19%	128 21%	111 19%
Very satisfied	342 57%	169 56% 49%	173 58% 51%	55 45% 16%	117 53% 34%	163 66% 48%	258 57% 75%	53 56% 15%	31 61% 9%	58 46% 17%	284 60% 83%	62 58% 18%	86 61% 25%	65 58% 19%	69 54% 20%	60 54% 18%
SW satisfied	175 29%	86 29% 49%	89 30% 51%	45 37% 26%	77 35% 44%	52 21% 30%	134 30% 77%	31 33% 18%	10 20% 6%	37 29% 21%	138 29% 79%	34 32% 19%	36 26% 21%	34 30% 19%	41 32% 23%	30 27% 17%
Neither satisfied nor dissatisfied	33 6%	21 7% 64%	12 4% 36%	11 9% 33%	16 7% 48%	5 2% 15%	22 5% 67%	6 6% 18%	5 10% 15%	11 9% 33%	22 5% 67%	3 3% 9%	7 5% 21%	7 6% 21%	9 7% 27%	7 6% 21%
SW dissatisfied	33 6%	20 7% 61%	13 4% 39%	8 7% 24%	5 2% 15%	20 8% 61%	27 6% 82%	3 3% 9%	3 6% 9%	13 10% 39%	20 4% 61%	6 6% 18%	6 4% 18%	5 4% 15%	6 5% 18%	10 9% 30%
Very dissatisfied	13 2%	4 1% 31%	9 3% 69%	2 2% 15%	5 2% 38%	6 2% 46%	10 2% 77%	2 2% 15%	1 2% 8%	6 5% 46%	7 1% 54%	1 1% 8%	5 4% 38%	2 2% 15%	3 2% 23%	2 2% 15%
Unsure	3 1%	0 0% 0%	3 1% 100%	0 0% 0%	1 0% 33%	2 1% 67%	2 0% 67%	0 0% 0%	1 2% 33%	2 2% 67%	1 0% 33%	0 0% 0%	1 1% 33%	0 0% 0%	0 0% 0%	2 2% 67%
REF	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
Mean	1.68	1.68	1.68	1.82	1.67	1.63	1.68	1.63	1.75	2.04	1.58	1.58	1.66	1.63	1.70	1.83
Chi Square		8.96 .111		35.74 .001			8.16 .613			21.69 .001		15.57 .743				

Prepared by RBI Strategies and Research

A Survey of Sulphur Springs Valley Electric Cooperative Members

Table 2b: Please consider all your experiences to date with Sulphur Springs Valley Electric Cooperative. Can you tell me if you are very satisfied, somewhat satisfied, neither satisfied nor dissatisfied, somewhat dissatisfied or very dissatisfied with Sulphur Springs Valley Electric Cooperative?

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	599	264 44%	114 19%	30 5%	125 21%	66 11%	124 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	178 30%	365 61%	230 38%
Very satisfied	342 57%	157 59% 46%	74 65% 22%	18 60% 5%	55 44% 16%	38 58% 11%	65 52% 19%	67 58% 20%	74 63% 22%	89 63% 26%	86 63% 25%	82 61% 24%	84 56% 25%	90 51% 26%	216 59% 63%	124 54% 36%
SW satisfied	175 29%	72 27% 41%	31 27% 18%	9 30% 5%	37 30% 21%	26 39% 15%	46 37% 26%	36 31% 21%	28 24% 16%	37 26% 21%	30 22% 17%	40 30% 23%	47 31% 27%	58 33% 33%	105 29% 60%	69 30% 39%
Neither satisfied nor dissatisfied	33 6%	17 6% 52%	3 3% 9%	1 3% 3%	11 9% 33%	1 2% 3%	7 6% 21%	3 3% 9%	8 7% 24%	5 4% 15%	4 3% 12%	5 4% 15%	9 6% 27%	15 8% 45%	20 5% 61%	13 6% 39%
SW dissatisfied	33 6%	13 5% 39%	5 4% 15%	2 7% 6%	13 10% 39%	0 0% 0%	6 5% 18%	5 4% 15%	6 5% 18%	7 5% 21%	9 7% 27%	7 5% 21%	9 6% 27%	8 4% 24%	17 5% 52%	15 7% 45%
Very dissatisfied	13 2%	4 2% 31%	1 1% 8%	0 0% 0%	7 6% 54%	1 2% 8%	0 0% 0%	4 3% 31%	1 1% 8%	4 3% 31%	4 3% 31%	1 1% 8%	1 1% 8%	7 4% 54%	6 2% 46%	7 3% 54%
Unsure	3 1%	1 0% 33%	0 0% 0%	0 0% 0%	2 2% 67%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 33%	0 0% 0%	3 2% 100%	0 0% 0%	0 0% 0%	0 0% 0%	1 0% 33%	2 1% 67%
REF	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
Mean	1.68	1.63	1.49	1.57	2.09	1.48	1.63	1.63	1.60	1.59	1.71	1.56	1.64	1.79	1.62	1.77
Chi Square		37.55 .010					17.57 .286				27.83 .023				3.93 .559	

Prepared by RBI Strategies and Research

A Survey of Sulphur Springs Valley Electric Cooperative Members

Table 2c: Please consider all your experiences to date with Sulphur Springs Valley Electric Cooperative. Can you tell me if you are very satisfied, somewhat satisfied, neither satisfied nor dissatisfied, somewhat dissatisfied or very dissatisfied with Sulphur Springs Valley Electric Cooperative?

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	599	237 40%	291 49%	71 12%	517 86%	79 13%	383 64%	60 10%	156 26%	486 81%	62 10%	51 9%	201 34%	234 39%	84 14%	59 10%
Very satisfied	342 57%	110 46% 32%	196 67% 57%	36 51% 11%	342 66% 100%	0 0% 0%	248 65% 73%	18 30% 5%	76 49% 22%	305 63% 89%	17 27% 5%	20 39% 6%	109 54% 32%	153 65% 45%	44 52% 13%	28 47% 8%
SW satisfied	175 29%	91 38% 52%	62 21% 35%	22 31% 13%	175 34% 100%	0 0% 0%	101 26% 58%	23 38% 13%	51 33% 29%	129 27% 74%	26 42% 15%	20 39% 11%	62 31% 35%	56 24% 32%	26 31% 15%	24 41% 14%
Neither satisfied nor dissatisfied	33 6%	19 8% 58%	7 2% 21%	7 10% 21%	0 0% 0%	33 42% 100%	12 3% 36%	3 5% 9%	18 12% 55%	26 5% 79%	5 8% 15%	2 4% 6%	12 6% 36%	10 4% 30%	7 8% 21%	3 5% 9%
SW dissatisfied	33 6%	11 5% 33%	17 6% 52%	5 7% 15%	0 0% 0%	33 42% 100%	18 5% 55%	7 12% 21%	8 5% 24%	22 5% 67%	6 10% 18%	5 10% 15%	15 7% 45%	9 4% 27%	4 5% 12%	1 2% 3%
Very dissatisfied	13 2%	5 2% 38%	7 2% 54%	1 1% 8%	0 0% 0%	13 16% 100%	3 1% 23%	8 13% 62%	2 1% 15%	3 1% 23%	6 10% 46%	4 8% 31%	3 1% 23%	4 2% 31%	2 2% 15%	3 5% 23%
Unsure	3 1%	1 0% 33%	2 1% 67%	0 0% 0%	0 0% 0%	0 0% 0%	1 0% 33%	1 2% 33%	1 1% 33%	1 0% 33%	2 3% 67%	0 0% 0%	0 0% 0%	2 1% 67%	1 1% 33%	0 0% 0%
REF	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
Mean	1.68	1.79	1.57	1.77	1.34	3.75	1.51	2.45	1.79	1.54	2.42	2.08	1.71	1.55	1.77	1.76
Chi Square		35.53 .001			596.00 .001		76.39 .001			66.38 .001			21.45 .123			

Prepared by RBI Strategies and Research

A Survey of Sulphur Springs Valley Electric Cooperative Members

Table 3: Recently, there has been some publicity you may or may not have heard about Sulphur Springs Valley Electric Cooperative's plans to build a new power line to the Sonoita / Elgin / Patagonia area. How much would you say you have heard about this:

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	599	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	95 16%	51 9%	127 21%	472 79%	106 18%	141 24%	113 19%	128 21%	111 19%
A lot	152 25%	85 28% 56%	67 22% 44%	13 11% 9%	54 24% 36%	83 33% 55%	114 25% 75%	25 26% 16%	13 25% 9%	74 58% 49%	78 17% 51%	19 18% 13%	35 25% 23%	29 26% 19%	36 28% 24%	33 30% 22%
A fair amount	187 31%	93 31% 50%	94 31% 50%	25 21% 13%	79 36% 42%	80 32% 43%	144 32% 77%	30 32% 16%	13 25% 7%	47 37% 25%	140 30% 75%	27 25% 14%	50 35% 27%	42 37% 22%	36 28% 19%	32 29% 17%
Not much	157 26%	72 24% 46%	85 28% 54%	33 27% 21%	59 27% 38%	62 25% 39%	123 27% 78%	16 17% 10%	18 35% 11%	6 5% 4%	151 32% 96%	37 35% 24%	35 25% 22%	21 19% 13%	37 29% 24%	27 24% 17%
Nothing at all	102 17%	49 16% 48%	53 18% 52%	50 41% 49%	29 13% 28%	22 9% 22%	71 16% 70%	24 25% 24%	7 14% 7%	0 0% 0%	102 22% 100%	22 21% 22%	21 15% 21%	21 19% 21%	19 15% 19%	19 17% 19%
Unsure	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
REF	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	1 0%	1 0% 100%	0 0% 0%	0 0% 0%	0 0% 0%	1 0% 100%	1 0% 100%	0 0% 0%	0 0% 0%	0 0% 0%	1 0% 100%	1 1% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
Mean	2.36	2.30	2.41	2.99	2.29	2.11	2.34	2.41	2.37	1.46	2.60	2.63	2.30	2.30	2.30	2.29
Chi Square		4.37 .358		77.43 .001			10.49 .232			126.55 .001		19.95 .223				

Prepared by RBI Strategies and Research

Table 3b: Recently, there has been some publicity you may or may not have heard about Sulphur Springs Valley Electric Cooperative's plans to build a new power line to the Sonoita / Elgin / Patagonia area. How much would you say you have heard about this:

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	599	264 44%	114 19%	30 5%	125 21%	66 11%	124 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	178 30%	365 61%	230 38%
A lot	152 25%	47 18% 31%	15 13% 10%	4 13% 3%	71 57% 47%	15 23% 10%	5 4% 3%	22 19% 14%	25 21% 16%	41 29% 27%	29 21% 19%	34 25% 22%	45 30% 30%	44 25% 29%	92 25% 61%	59 26% 39%
A fair amount	187 31%	72 27% 39%	35 31% 19%	12 40% 6%	47 38% 25%	21 32% 11%	41 33% 22%	31 27% 17%	34 29% 18%	46 32% 25%	54 40% 29%	35 26% 19%	40 27% 21%	58 33% 31%	111 30% 59%	74 32% 40%
Not much	157 26%	81 31% 52%	43 38% 27%	7 23% 4%	6 5% 4%	20 30% 13%	33 27% 21%	36 31% 23%	37 31% 24%	45 32% 29%	30 22% 19%	40 30% 25%	40 27% 25%	47 26% 30%	101 28% 64%	56 24% 36%
Nothing at all	102 17%	64 24% 63%	21 18% 21%	6 20% 6%	1 1% 1%	10 15% 10%	44 35% 43%	26 23% 25%	22 19% 22%	10 7% 10%	23 17% 23%	26 19% 25%	25 17% 25%	28 16% 27%	61 17% 60%	40 17% 39%
Unsure	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
REF	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	1 0%	0 0% 0%	0 0% 0%	1 3% 100%	0 0% 0%	0 0% 0%	1 1% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 100%	0 0% 0%	1 0% 100%
Mean	2.36	2.61	2.61	2.67	1.50	2.38	2.98	2.57	2.47	2.17	2.35	2.43	2.30	2.36	2.36	2.36
Chi Square		143.86 .001					54.02 .001				12.09 .439				2.37 .668	

A Survey of Sulphur Springs Valley Electric Cooperative Members

Table 3c: Recently, there has been some publicity you may or may not have heard about Sulphur Springs Valley Electric Cooperative's plans to build a new power line to the Sonoita / Elgin / Patagonia area. How much would you say you have heard about this:

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	599	237 40%	291 49%	71 12%	517 86%	79 13%	383 64%	60 10%	156 26%	486 81%	62 10%	51 9%	201 34%	234 39%	84 14%	59 10%
A lot	152 25%	53 22% 35%	88 30% 58%	11 15% 7%	128 25% 84%	23 29% 15%	122 32% 80%	20 33% 13%	10 6% 7%	127 26% 84%	21 34% 14%	4 8% 3%	52 26% 34%	50 21% 33%	26 31% 17%	21 36% 14%
A fair amount	187 31%	66 28% 35%	101 35% 54%	20 28% 11%	160 31% 86%	26 33% 14%	133 35% 71%	22 37% 12%	32 21% 17%	154 32% 82%	22 35% 12%	11 22% 6%	67 33% 36%	73 31% 39%	22 26% 12%	21 36% 11%
Not much	157 26%	60 25% 38%	76 26% 48%	21 30% 13%	139 27% 89%	17 22% 11%	92 24% 59%	13 22% 8%	52 33% 33%	124 26% 79%	15 24% 10%	18 35% 11%	47 23% 30%	68 29% 43%	22 26% 14%	13 22% 8%
Nothing at all	102 17%	57 24% 56%	26 9% 25%	19 27% 19%	89 17% 87%	13 16% 13%	36 9% 35%	5 8% 5%	61 39% 60%	80 16% 78%	4 6% 4%	18 35% 18%	35 17% 34%	43 18% 42%	14 17% 14%	4 7% 4%
Unsure	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
REF	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	1 0%	1 0% 100%	0 0% 0%	0 0% 0%	1 0% 100%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 100%	1 0% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
Mean	2.36	2.53	2.14	2.68	2.38	2.25	2.11	2.05	3.08	2.33	2.03	2.98	2.32	2.44	2.29	2.00
Chi Square		32.42 .001			1.53 .822		105.18 .001			26.15 .001			11.80 .462			

Prepared by RBI Strategies and Research

A Survey of Sulphur Springs Valley Electric Cooperative Members

Table 4: Based on everything you have heard about this issue so far, do you think the new power line to the Sonoita/ Elgin/ Patagonia area should be allowed to be built or not?

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
Build	323 54%	178 59% 55%	145 48% 45%	58 48% 18%	111 50% 34%	150 60% 46%	249 55% 77%	55 57% 17%	19 37% 6%	81 64% 25%	242 51% 75%	47 44% 15%	76 54% 24%	66 58% 20%	82 64% 25%	52 47% 16%
Lean build	61 10%	26 9% 43%	34 11% 56%	13 11% 21%	23 10% 38%	24 10% 39%	42 9% 69%	7 7% 11%	12 24% 20%	8 6% 13%	52 11% 85%	9 8% 15%	23 16% 38%	11 10% 18%	8 6% 13%	10 9% 16%
Lean not build	13 2%	7 2% 54%	6 2% 46%	2 2% 15%	6 3% 46%	5 2% 38%	8 2% 62%	3 3% 23%	2 4% 15%	3 2% 23%	10 2% 77%	4 4% 31%	2 1% 15%	3 3% 23%	3 2% 23%	1 1% 8%
Not build	47 8%	15 5% 32%	32 11% 68%	6 5% 13%	21 10% 45%	20 8% 43%	35 8% 74%	8 8% 17%	4 8% 9%	20 16% 43%	27 6% 57%	12 11% 26%	11 8% 23%	7 6% 15%	7 5% 15%	10 9% 21%
Hard undecided	130 22%	62 21% 48%	68 23% 52%	31 26% 24%	55 25% 42%	41 17% 32%	97 21% 75%	21 22% 16%	12 24% 9%	14 11% 11%	116 25% 89%	30 28% 23%	24 17% 18%	22 19% 17%	20 16% 15%	34 31% 26%
REF	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	26 4%	12 4% 46%	14 5% 54%	11 9% 42%	5 2% 19%	8 3% 31%	22 5% 85%	2 2% 8%	2 4% 8%	1 1% 4%	25 5% 96%	4 4% 15%	6 4% 23%	4 4% 15%	8 6% 31%	4 4% 15%
Mean	2.51	2.35	2.67	2.86	2.57	2.23	2.51	2.39	2.73	2.07	2.63	2.86	2.35	2.33	2.27	2.82
Chi Square		11.09 .050		20.63 .024			16.05 .098			31.14 .001		30.56 .061				

Prepared by RBI Strategies and Research

Table 4b: Based on everything you have heard about this issue so far, do you think the new power line to the Sonoita/ Elgin/ Patagonia area should be allowed to be built or not?

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
Build	323 54%	139 53% 43%	60 52% 19%	18 60% 6%	79 63% 24%	27 41% 8%	54 43% 17%	57 50% 18%	63 53% 20%	82 58% 25%	74 54% 23%	69 51% 21%	80 53% 25%	100 56% 31%	205 56% 63%	118 51% 37%
Lean build	61 10%	27 10% 44%	16 14% 26%	1 3% 2%	8 6% 13%	9 14% 15%	16 13% 26%	16 14% 26%	6 5% 10%	17 12% 28%	16 12% 26%	13 10% 21%	17 11% 28%	15 8% 25%	36 10% 59%	23 10% 38%
Lean not build	13 2%	4 2% 31%	4 3% 31%	0 0% 0%	3 2% 23%	2 3% 15%	2 2% 15%	3 3% 23%	3 3% 23%	2 1% 15%	3 2% 23%	2 1% 15%	5 3% 38%	3 2% 23%	9 2% 69%	4 2% 31%
Not build	47 8%	17 6% 36%	5 4% 11%	1 3% 2%	20 16% 43%	4 6% 9%	8 6% 17%	7 6% 15%	8 7% 17%	11 8% 23%	13 10% 28%	9 7% 19%	12 8% 26%	13 7% 28%	24 7% 51%	23 10% 49%
Hard undecided	130 22%	60 23% 46%	26 23% 20%	9 30% 7%	14 11% 11%	21 32% 16%	32 26% 25%	27 23% 21%	33 28% 25%	28 20% 22%	25 18% 19%	31 23% 24%	29 19% 22%	45 25% 35%	71 19% 55%	57 25% 44%
REF	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	26 4%	17 6% 65%	4 3% 15%	1 3% 4%	1 1% 4%	3 5% 12%	13 10% 50%	5 4% 19%	5 4% 19%	2 1% 8%	5 4% 19%	11 8% 42%	7 5% 27%	3 2% 12%	20 5% 77%	6 3% 23%
Mean	2.51	2.62	2.45	2.53	2.09	2.92	3.00	2.57	2.68	2.25	2.40	2.73	2.47	2.44	2.45	2.58
Chi Square		43.56 .002					22.28 .101				13.53 .562				7.57 .182	

Table 4c: Based on everything you have heard about this issue so far, do you think the new power line to the Sonoita/ Elgin/ Patagonia area should be allowed to be built or not?

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
Build	323 54%	119 50% 37%	174 60% 54%	30 42% 9%	292 56% 90%	30 38% 9%	323 84% 100%	0 0% 0%	0 0% 0%	312 64% 97%	6 10% 2%	5 10% 2%	106 53% 33%	138 59% 43%	45 54% 14%	29 48% 9%
Lean build	61 10%	31 13% 51%	26 9% 43%	4 6% 7%	57 11% 93%	3 4% 5%	61 16% 100%	0 0% 0%	0 0% 0%	54 11% 89%	3 5% 5%	4 8% 7%	22 11% 36%	24 10% 39%	6 7% 10%	6 10% 10%
Lean not build	13 2%	5 2% 38%	6 2% 46%	2 3% 15%	9 2% 69%	4 5% 31%	0 0% 0%	13 22% 100%	0 0% 0%	3 1% 23%	6 10% 46%	4 8% 31%	4 2% 31%	3 1% 23%	5 6% 38%	0 0% 0%
Not build	47 8%	16 7% 34%	26 9% 55%	5 7% 11%	32 6% 68%	14 18% 30%	0 0% 0%	47 78% 100%	0 0% 0%	9 2% 19%	31 49% 66%	7 14% 15%	13 6% 28%	12 5% 26%	8 10% 17%	9 15% 19%
Hard undecided	130 22%	56 24% 43%	49 17% 38%	25 35% 19%	105 20% 81%	25 32% 19%	0 0% 0%	0 0% 0%	130 83% 100%	90 19% 69%	16 25% 12%	24 47% 18%	45 22% 35%	45 19% 35%	19 23% 15%	14 23% 11%
REF	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	26 4%	11 5% 42%	10 3% 38%	5 7% 19%	22 4% 85%	3 4% 12%	0 0% 0%	0 0% 0%	26 17% 100%	18 4% 69%	1 2% 4%	7 14% 27%	11 5% 42%	12 5% 46%	1 1% 4%	2 3% 8%
Mean	2.51	2.59	2.28	3.15	2.40	3.16	1.16	3.78	5.33	2.14	3.83	4.35	2.57	2.36	2.45	2.68
Chi Square		20.47 .025			27.25 .001		1000+ .001			274.11 .001			21.13 .133			

Table 5.1: Basic Performance

Keeping blinks and momentary outages to a minimum

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
V Poor	16 3%	5 2% 31%	11 4% 69%	2 2% 13%	10 5% 63%	4 2% 25%	12 3% 75%	2 2% 13%	2 4% 13%	14 11% 88%	2 0% 13%	3 3% 19%	5 4% 31%	1 1% 6%	2 2% 13%	5 5% 31%
Fair	35 6%	10 3% 29%	24 8% 69%	7 6% 20%	10 5% 29%	16 6% 46%	25 6% 71%	4 4% 11%	6 12% 17%	16 13% 46%	18 4% 51%	7 7% 20%	7 5% 20%	6 5% 17%	7 5% 20%	8 7% 23%
Avg	100 17%	45 15% 45%	55 18% 55%	17 14% 17%	42 19% 42%	40 16% 40%	76 17% 76%	15 16% 15%	9 18% 9%	37 29% 37%	63 13% 63%	21 20% 21%	22 15% 22%	15 13% 15%	24 19% 24%	18 16% 18%
Good	203 34%	121 40% 60%	82 27% 40%	41 34% 20%	78 35% 38%	83 33% 41%	157 35% 77%	31 32% 15%	15 29% 7%	38 30% 19%	165 35% 81%	36 34% 18%	45 32% 22%	35 31% 17%	47 37% 23%	40 36% 20%
Exclnt	229 38%	109 36% 48%	120 40% 52%	54 45% 24%	76 34% 33%	94 38% 41%	169 37% 74%	42 44% 18%	18 35% 8%	20 16% 9%	209 44% 91%	38 36% 17%	58 41% 25%	52 46% 23%	46 36% 20%	35 32% 15%
Unsure	12 2%	7 2% 58%	5 2% 42%	0 0% 0%	4 2% 33%	8 3% 67%	10 2% 83%	2 2% 17%	0 0% 0%	2 2% 17%	10 2% 83%	1 1% 8%	3 2% 25%	3 3% 25%	1 1% 8%	4 4% 33%
DK	5 1%	3 1% 60%	2 1% 40%	0 0% 0%	1 0% 20%	3 1% 60%	4 1% 80%	0 0% 0%	1 2% 20%	0 0% 0%	5 1% 100%	0 0% 0%	2 1% 40%	1 1% 20%	1 1% 20%	1 1% 20%
Mean	4.08	4.17	4.00	4.14	3.98	4.14	4.09	4.18	3.88	3.31	4.29	3.96	4.13	4.27	4.05	3.97
Chi Square		17.57 .007		14.87 .249			8.28 .763			94.19 .001		15.67 .900				

Table 5.1b: Basic Performance

Keeping blinks and momentary outages to a minimum

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
V Poor	16 3%	0 0% 0%	1 1% 6%	1 3% 6%	14 11% 88%	0 0% 0%	0 0% 0%	0 0% 0%	2 2% 13%	1 1% 6%	4 3% 25%	1 1% 6%	4 3% 25%	7 4% 44%	9 2% 56%	7 3% 44%
Fair	35 6%	11 4% 31%	4 3% 11%	1 3% 3%	16 13% 46%	3 5% 9%	4 3% 11%	5 4% 14%	7 6% 20%	6 4% 17%	5 4% 14%	10 7% 29%	8 5% 23%	12 7% 34%	23 6% 66%	12 5% 34%
Avg	100 17%	31 12% 31%	18 16% 18%	3 10% 3%	37 30% 37%	11 17% 11%	15 12% 15%	18 16% 18%	17 14% 17%	24 17% 24%	25 18% 25%	16 12% 16%	28 19% 28%	31 17% 31%	53 15% 53%	46 20% 46%
Good	203 34%	91 34% 45%	40 35% 20%	9 30% 4%	37 30% 18%	26 39% 13%	39 31% 19%	44 38% 22%	41 35% 20%	51 36% 25%	38 28% 19%	40 30% 20%	49 33% 24%	76 42% 37%	133 36% 66%	70 30% 34%
Exclnt	229 38%	124 47% 54%	47 41% 21%	15 50% 7%	19 15% 8%	24 36% 10%	60 48% 26%	46 40% 20%	48 41% 21%	57 40% 25%	56 41% 24%	65 48% 28%	57 38% 25%	51 28% 22%	137 38% 60%	89 39% 39%
Unsure	12 2%	4 2% 33%	3 3% 25%	1 3% 8%	2 2% 17%	2 3% 17%	4 3% 33%	1 1% 8%	3 3% 25%	2 1% 17%	6 4% 50%	2 1% 17%	3 2% 25%	1 1% 8%	8 2% 67%	4 2% 33%
DK	5 1%	3 1% 60%	2 2% 40%	0 0% 0%	0 0% 0%	0 0% 0%	3 2% 60%	1 1% 20%	0 0% 0%	1 1% 20%	2 1% 40%	1 1% 20%	1 1% 20%	1 1% 20%	2 1% 40%	3 1% 60%
Mean	4.08	4.33	4.26	4.30	3.30	4.17	4.43	4.20	4.14	4.18	4.20	4.24	4.07	3.89	4.09	4.06
Chi Square		104.87 .001					14.09 .723				28.65 .053				5.64 .465	

Table 5.1c: Basic Performance

Keeping blinks and momentary outages to a minimum

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
V Poor	16 3%	6 3% 38%	7 2% 44%	3 4% 19%	8 2% 50%	6 8% 38%	8 2% 50%	6 10% 38%	2 1% 13%	7 1% 44%	7 11% 44%	2 4% 13%	5 2% 31%	4 2% 25%	1 1% 6%	6 10% 38%
Fair	35 6%	16 7% 46%	13 4% 37%	6 8% 17%	23 4% 66%	10 13% 29%	17 4% 49%	6 10% 17%	12 8% 34%	23 5% 66%	6 10% 17%	6 12% 17%	17 8% 49%	7 3% 20%	5 6% 14%	5 8% 14%
Avg	100 17%	44 18% 44%	46 16% 46%	10 14% 10%	77 15% 77%	23 29% 23%	54 14% 54%	19 32% 19%	27 17% 27%	71 15% 71%	18 29% 18%	11 22% 11%	31 15% 31%	35 15% 35%	16 19% 16%	12 20% 12%
Good	203 34%	82 34% 40%	95 33% 47%	26 37% 13%	180 35% 89%	23 29% 11%	124 32% 61%	14 23% 7%	65 42% 32%	166 34% 82%	22 35% 11%	15 29% 7%	68 34% 33%	77 33% 38%	28 33% 14%	22 37% 11%
Exclnt	229 38%	87 37% 38%	117 40% 51%	25 35% 11%	216 42% 94%	13 16% 6%	171 45% 75%	12 20% 5%	46 29% 20%	207 43% 90%	7 11% 3%	15 29% 7%	75 37% 33%	102 44% 45%	32 38% 14%	14 23% 6%
Unsure	12 2%	2 1% 17%	10 3% 83%	0 0% 0%	10 2% 83%	2 3% 17%	7 2% 58%	3 5% 25%	2 1% 17%	8 2% 67%	3 5% 25%	1 2% 8%	3 1% 25%	6 3% 50%	2 2% 17%	1 2% 8%
DK	5 1%	1 0% 20%	3 1% 60%	1 1% 20%	3 1% 60%	2 3% 40%	3 1% 60%	0 0% 0%	2 1% 40%	4 1% 80%	0 0% 0%	1 2% 20%	2 1% 40%	3 1% 60%	0 0% 0%	0 0% 0%
Mean	4.08	4.00	4.18	3.96	4.19	3.52	4.21	3.48	3.99	4.20	3.40	3.82	4.03	4.26	4.08	3.60
Chi Square		11.59 .479			42.59 .001		48.87 .001			52.72 .001			28.47 .055			

Table 5.2: Basic Performance

Restoring power quickly after an outage

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
V Poor	13 2%	6 2% 46%	7 2% 54%	2 2% 15%	6 3% 46%	5 2% 38%	10 2% 77%	1 1% 8%	2 4% 15%	6 5% 46%	7 1% 54%	1 1% 8%	3 2% 23%	2 2% 15%	2 2% 15%	5 5% 38%
Fair	30 5%	11 4% 37%	18 6% 60%	7 6% 23%	14 6% 47%	7 3% 23%	16 4% 53%	8 8% 27%	6 12% 20%	13 10% 43%	16 3% 53%	8 8% 27%	6 4% 20%	0 0% 0%	6 5% 20%	10 9% 33%
Avg	82 14%	36 12% 44%	46 15% 56%	15 12% 18%	30 14% 37%	35 14% 43%	62 14% 76%	11 11% 13%	9 18% 11%	25 20% 30%	57 12% 70%	15 14% 18%	17 12% 21%	16 14% 20%	16 13% 20%	18 16% 22%
Good	217 36%	120 40% 55%	97 32% 45%	38 31% 18%	82 37% 38%	95 38% 44%	173 38% 80%	28 29% 13%	16 31% 7%	57 45% 26%	160 34% 74%	41 39% 19%	56 39% 26%	37 33% 17%	45 35% 21%	38 34% 18%
Exclnt	231 39%	110 37% 48%	121 40% 52%	50 41% 22%	81 37% 35%	96 39% 42%	169 37% 73%	44 46% 19%	18 35% 8%	25 20% 11%	206 44% 89%	38 36% 16%	54 38% 23%	51 45% 22%	49 38% 21%	39 35% 17%
Unsure	17 3%	13 4% 76%	4 1% 24%	5 4% 29%	5 2% 29%	7 3% 41%	16 4% 94%	1 1% 6%	0 0% 0%	1 1% 6%	16 3% 94%	0 0% 0%	4 3% 24%	4 4% 24%	8 6% 47%	1 1% 6%
DK	10 2%	4 1% 40%	6 2% 60%	4 3% 40%	3 1% 30%	3 1% 30%	7 2% 70%	3 3% 30%	0 0% 0%	0 0% 0%	10 2% 100%	3 3% 30%	2 1% 20%	3 3% 30%	2 2% 20%	0 0% 0%
Mean	4.19	4.24	4.15	4.31	4.11	4.22	4.22	4.26	3.82	3.67	4.33	4.12	4.21	4.41	4.29	3.89
Chi Square		11.11 .085		8.88 .713			20.19 .064			42.07 .001		31.93 .129				

Table 5.2b: Basic Performance

Restoring power quickly after an outage

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
V Poor	13 2%	4 2% 31%	2 2% 15%	0 0% 0%	7 6% 54%	0 0% 0%	0 0% 0%	3 3% 23%	1 1% 8%	3 2% 23%	4 3% 31%	0 0% 0%	3 2% 23%	6 3% 46%	6 2% 46%	7 3% 54%
Fair	30 5%	7 3% 23%	5 4% 17%	2 7% 7%	13 10% 43%	3 5% 10%	5 4% 17%	4 3% 13%	6 5% 20%	5 4% 17%	5 4% 17%	8 6% 27%	7 5% 23%	10 6% 33%	16 4% 53%	13 6% 43%
Avg	82 14%	32 12% 39%	8 7% 10%	3 10% 4%	24 19% 29%	15 23% 18%	9 7% 11%	14 12% 17%	19 16% 23%	22 15% 27%	18 13% 22%	13 10% 16%	22 15% 27%	29 16% 35%	47 13% 57%	35 15% 43%
Good	217 36%	81 31% 37%	45 39% 21%	10 33% 5%	55 44% 25%	26 39% 12%	34 27% 16%	42 37% 19%	46 39% 21%	51 36% 24%	45 33% 21%	47 35% 22%	56 37% 26%	69 39% 32%	140 38% 65%	76 33% 35%
Exclnt	231 39%	122 46% 53%	51 44% 22%	13 43% 6%	25 20% 11%	20 30% 9%	60 48% 26%	46 40% 20%	44 37% 19%	60 42% 26%	54 40% 23%	56 41% 24%	59 39% 26%	62 35% 27%	136 37% 59%	93 40% 40%
Unsure	17 3%	12 5% 71%	1 1% 6%	2 7% 12%	1 1% 6%	1 2% 6%	10 8% 59%	4 3% 24%	1 1% 6%	1 1% 6%	7 5% 41%	6 4% 35%	3 2% 18%	1 1% 6%	13 4% 76%	4 2% 24%
DK	10 2%	6 2% 60%	3 3% 30%	0 0% 0%	0 0% 0%	1 2% 10%	7 6% 70%	2 2% 20%	1 1% 10%	0 0% 0%	3 2% 30%	5 4% 50%	0 0% 0%	2 1% 20%	7 2% 70%	3 1% 30%
Mean	4.19	4.40	4.33	4.33	3.65	4.06	4.66	4.25	4.13	4.15	4.27	4.40	4.13	4.02	4.24	4.12
Chi Square		65.57 .001					39.37 .003				23.64 .167				5.71 .457	

Table 5.2c: Basic Performance

Restoring power quickly after an outage

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
V Poor	13 2%	4 2% 31%	7 2% 54%	2 3% 15%	4 1% 31%	8 10% 62%	3 1% 23%	7 12% 54%	3 2% 23%	3 1% 23%	4 6% 31%	6 12% 46%	3 1% 23%	4 2% 31%	3 4% 23%	3 5% 23%
Fair	30 5%	15 6% 50%	10 3% 33%	5 7% 17%	22 4% 73%	6 8% 20%	11 3% 37%	6 10% 20%	13 8% 43%	18 4% 60%	7 11% 23%	5 10% 17%	10 5% 33%	8 3% 27%	1 1% 3%	8 13% 27%
Avg	82 14%	37 16% 45%	37 13% 45%	8 11% 10%	63 12% 77%	18 23% 22%	46 12% 56%	13 22% 16%	23 15% 28%	57 12% 70%	17 27% 21%	8 16% 10%	23 11% 28%	32 14% 39%	16 19% 20%	7 12% 9%
Good	217 36%	81 34% 37%	107 37% 49%	29 41% 13%	187 36% 86%	30 38% 14%	138 36% 64%	19 32% 9%	60 38% 28%	179 37% 82%	23 37% 11%	15 29% 7%	81 40% 37%	70 30% 32%	31 37% 14%	27 45% 12%
Exclnt	231 39%	85 36% 37%	120 41% 52%	26 37% 11%	218 42% 94%	13 16% 6%	171 45% 74%	12 20% 5%	48 31% 21%	208 43% 90%	9 14% 4%	14 27% 6%	77 38% 33%	103 44% 45%	30 36% 13%	15 25% 6%
Unsure	17 3%	9 4% 53%	7 2% 41%	1 1% 6%	14 3% 82%	3 4% 18%	9 2% 53%	2 3% 12%	6 4% 35%	14 3% 82%	2 3% 12%	1 2% 6%	4 2% 24%	11 5% 65%	2 2% 12%	0 0% 0%
DK	10 2%	7 3% 70%	3 1% 30%	0 0% 0%	9 2% 90%	1 1% 10%	6 2% 60%	1 2% 10%	3 2% 30%	7 1% 70%	1 2% 10%	2 4% 20%	3 1% 30%	6 3% 60%	1 1% 10%	0 0% 0%
Mean	4.19	4.19	4.22	4.06	4.30	3.59	4.34	3.55	4.07	4.32	3.57	3.73	4.21	4.35	4.12	3.72
Chi Square		11.93 .451			49.19 .001		55.13 .001			66.64 .001			35.59 .008			

Table 5.3: Basic Performance

Communicating with you and keeping you informed

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
V Poor	36 6%	14 5% 39%	22 7% 61%	9 7% 25%	16 7% 44%	11 4% 31%	27 6% 75%	5 5% 14%	4 8% 11%	13 10% 36%	23 5% 64%	5 5% 14%	11 8% 31%	7 6% 19%	5 4% 14%	8 7% 22%
Fair	46 8%	25 8% 54%	21 7% 46%	7 6% 15%	20 9% 43%	19 8% 41%	41 9% 89%	2 2% 4%	3 6% 7%	8 6% 17%	38 8% 83%	6 6% 13%	13 9% 28%	5 4% 11%	10 8% 22%	12 11% 26%
Avg	96 16%	47 16% 49%	48 16% 50%	26 21% 27%	37 17% 39%	30 12% 31%	75 17% 78%	13 14% 14%	8 16% 8%	13 10% 14%	82 17% 85%	21 20% 22%	20 14% 21%	14 12% 15%	21 16% 22%	20 18% 21%
Good	191 32%	104 35% 54%	87 29% 46%	41 34% 21%	68 31% 36%	80 32% 42%	139 31% 73%	35 36% 18%	17 33% 9%	38 30% 20%	153 32% 80%	40 38% 21%	41 29% 21%	33 29% 17%	50 39% 26%	27 24% 14%
Exclnt	217 36%	102 34% 47%	115 38% 53%	34 28% 16%	76 34% 35%	103 42% 47%	160 35% 74%	39 41% 18%	18 35% 8%	54 43% 25%	163 35% 75%	32 30% 15%	57 40% 26%	51 45% 24%	39 30% 18%	38 34% 18%
Unsure	6 1%	6 2% 100%	0 0% 0%	1 1% 17%	2 1% 33%	3 1% 50%	5 1% 83%	1 1% 17%	0 0% 0%	0 0% 0%	6 1% 100%	0 0% 0%	0 0% 0%	2 2% 33%	3 2% 50%	1 1% 17%
DK	8 1%	2 1% 25%	6 2% 75%	3 2% 38%	2 1% 25%	2 1% 25%	6 1% 75%	1 1% 13%	1 2% 13%	1 1% 13%	7 1% 88%	2 2% 25%	0 0% 0%	1 1% 13%	0 0% 0%	5 5% 63%
Mean	3.93	3.94	3.92	3.82	3.82	4.06	3.89	4.13	3.90	3.91	3.93	3.91	3.85	4.12	3.91	3.88
Chi Square		12.43 .053		14.71 .258			8.36 .756			12.34 .055		37.84 .036				

Table 5.3b: Basic Performance

Communicating with you and keeping you informed

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
V Poor	36 6%	13 5% 36%	5 4% 14%	2 7% 6%	13 10% 36%	3 5% 8%	4 3% 11%	6 5% 17%	7 6% 19%	8 6% 22%	6 4% 17%	7 5% 19%	9 6% 25%	14 8% 39%	17 5% 47%	19 8% 53%
Fair	46 8%	14 5% 30%	12 10% 26%	4 13% 9%	8 6% 17%	8 12% 17%	10 8% 22%	9 8% 20%	9 8% 20%	12 8% 26%	8 6% 17%	11 8% 24%	10 7% 22%	17 9% 37%	31 8% 67%	15 6% 33%
Avg	96 16%	49 19% 51%	21 18% 22%	4 13% 4%	12 10% 13%	10 15% 10%	22 18% 23%	19 17% 20%	25 21% 26%	23 16% 24%	18 13% 19%	16 12% 17%	30 20% 31%	32 18% 33%	62 17% 65%	32 14% 33%
Good	191 32%	96 36% 50%	25 22% 13%	8 27% 4%	38 30% 20%	24 36% 13%	44 35% 23%	43 37% 23%	36 31% 19%	41 29% 21%	43 32% 23%	39 29% 20%	46 31% 24%	63 35% 33%	112 31% 59%	79 34% 41%
Exclnt	217 36%	83 31% 38%	50 43% 23%	11 37% 5%	52 42% 24%	21 32% 10%	40 32% 18%	36 31% 17%	38 32% 18%	55 39% 25%	57 42% 26%	59 44% 27%	50 33% 23%	51 28% 24%	133 36% 61%	82 35% 38%
Unsure	6 1%	4 2% 67%	1 1% 17%	1 3% 17%	0 0% 0%	0 0% 0%	2 2% 33%	1 1% 17%	2 2% 33%	1 1% 17%	1 1% 17%	2 1% 33%	2 1% 33%	1 1% 17%	4 1% 67%	2 1% 33%
DK	8 1%	5 2% 63%	1 1% 13%	0 0% 0%	2 2% 25%	0 0% 0%	3 2% 38%	1 1% 13%	1 1% 13%	2 1% 25%	3 2% 38%	1 1% 13%	3 2% 38%	1 1% 13%	6 2% 75%	2 1% 25%
Mean	3.93	3.96	3.96	3.83	3.93	3.79	3.99	3.88	3.84	3.94	4.12	4.05	3.91	3.71	3.96	3.88
Chi Square		33.69 .090					7.72 .983				18.33 .434				5.89 .436	

Table 5.3c: Basic Performance

Communicating with you and keeping you informed

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
V Poor	36 6%	15 6% 42%	17 6% 47%	4 6% 11%	20 4% 56%	15 19% 42%	10 3% 28%	16 27% 44%	10 6% 28%	14 3% 39%	13 21% 36%	9 18% 25%	7 3% 19%	10 4% 28%	11 13% 31%	6 10% 17%
Fair	46 8%	18 8% 39%	24 8% 52%	4 6% 9%	32 6% 70%	14 18% 30%	23 6% 50%	4 7% 9%	19 12% 41%	31 6% 67%	7 11% 15%	8 16% 17%	17 8% 37%	14 6% 30%	10 12% 22%	3 5% 7%
Avg	96 16%	45 19% 47%	34 12% 35%	17 24% 18%	77 15% 80%	18 23% 19%	52 14% 54%	13 22% 14%	31 20% 32%	81 17% 84%	11 17% 11%	4 8% 4%	35 17% 36%	29 12% 30%	12 14% 13%	12 20% 13%
Good	191 32%	83 35% 43%	88 30% 46%	20 28% 10%	167 32% 87%	24 30% 13%	123 32% 64%	15 25% 8%	53 34% 28%	154 32% 81%	20 32% 10%	17 33% 9%	64 32% 34%	80 34% 42%	23 27% 12%	20 33% 10%
Exclnt	217 36%	70 29% 32%	121 42% 56%	26 37% 12%	210 41% 97%	5 6% 2%	171 45% 79%	11 18% 5%	35 22% 16%	199 41% 92%	10 16% 5%	8 16% 4%	72 36% 33%	94 40% 43%	27 32% 12%	19 32% 9%
Unsure	6 1%	3 1% 50%	3 1% 50%	0 0% 0%	4 1% 67%	2 3% 33%	1 0% 17%	1 2% 17%	4 3% 67%	2 0% 33%	1 2% 17%	3 6% 50%	3 1% 50%	3 1% 50%	0 0% 0%	0 0% 0%
DK	8 1%	4 2% 50%	4 1% 50%	0 0% 0%	7 1% 88%	1 1% 13%	4 1% 50%	0 0% 0%	4 3% 50%	5 1% 63%	1 2% 13%	2 4% 25%	3 1% 38%	4 2% 50%	1 1% 13%	0 0% 0%
Mean	3.93	3.84	4.02	3.85	4.07	3.00	4.15	3.07	3.72	4.07	3.22	3.47	3.99	4.11	3.58	3.72
Chi Square		16.65 .163			65.68 .001		90.83 .001			83.73 .001			24.28 .146			

Table 5.4: Basic Performance

Handling customer questions and complaints

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
V Poor	19 3%	8 3% 42%	11 4% 58%	5 4% 26%	8 4% 42%	6 2% 32%	14 3% 74%	3 3% 16%	2 4% 11%	8 6% 42%	11 2% 58%	1 1% 5%	2 1% 11%	4 4% 21%	7 5% 37%	5 5% 26%
Fair	25 4%	14 5% 56%	11 4% 44%	3 2% 12%	14 6% 56%	8 3% 32%	21 5% 84%	2 2% 8%	2 4% 8%	7 6% 28%	18 4% 72%	5 5% 20%	9 6% 36%	4 4% 16%	3 2% 12%	4 4% 16%
Avg	83 14%	42 14% 51%	41 14% 49%	18 15% 22%	36 16% 43%	27 11% 33%	64 14% 77%	9 9% 11%	10 20% 12%	21 17% 25%	62 13% 75%	12 11% 14%	22 15% 27%	15 13% 18%	19 15% 23%	15 14% 18%
Good	146 24%	80 27% 55%	65 22% 45%	33 27% 23%	54 24% 37%	58 23% 40%	105 23% 72%	30 31% 21%	11 22% 8%	26 20% 18%	119 25% 82%	26 25% 18%	41 29% 28%	32 28% 22%	26 20% 18%	21 19% 14%
Exclnt	201 34%	101 34% 50%	100 33% 50%	36 30% 18%	69 31% 34%	90 36% 45%	153 34% 76%	33 34% 16%	15 29% 7%	44 35% 22%	157 33% 78%	33 31% 16%	42 30% 21%	42 37% 21%	48 38% 24%	36 32% 18%
Unsure	66 11%	26 9% 39%	40 13% 61%	12 10% 18%	21 10% 32%	32 13% 48%	52 11% 79%	9 9% 14%	5 10% 8%	10 8% 15%	56 12% 85%	17 16% 26%	14 10% 21%	4 4% 6%	15 12% 23%	16 14% 24%
DK	60 10%	29 10% 48%	31 10% 52%	14 12% 23%	19 9% 32%	27 11% 45%	44 10% 73%	10 10% 17%	6 12% 10%	11 9% 18%	49 10% 82%	12 11% 20%	12 8% 20%	12 11% 20%	10 8% 17%	14 13% 23%
Mean	4.54	4.49	4.59	4.52	4.36	4.70	4.53	4.61	4.45	4.30	4.60	4.74	4.42	4.45	4.48	4.65
Chi Square		5.44 .489		11.52 .485			7.17 .846			9.22 .161		27.22 .294				

Table 5.4b: Basic Performance

Handling customer questions and complaints

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
V Poor	19 3%	9 3% 47%	2 2% 11%	0 0% 0%	8 6% 42%	0 0% 0%	4 3% 21%	1 1% 5%	5 4% 26%	3 2% 16%	4 3% 21%	5 4% 26%	0 0% 0%	10 6% 53%	7 2% 37%	11 5% 58%
Fair	25 4%	5 2% 20%	7 6% 28%	2 7% 8%	7 6% 28%	4 6% 16%	3 2% 12%	4 3% 16%	5 4% 20%	7 5% 28%	1 1% 4%	5 4% 20%	8 5% 32%	11 6% 44%	11 3% 44%	14 6% 56%
Avg	83 14%	35 13% 42%	17 15% 20%	3 10% 4%	21 17% 25%	7 11% 8%	19 15% 23%	16 14% 19%	13 11% 16%	19 13% 23%	18 13% 22%	15 11% 18%	25 17% 30%	25 14% 30%	50 14% 60%	32 14% 39%
Good	146 24%	65 25% 45%	32 28% 22%	7 23% 5%	26 21% 18%	16 24% 11%	27 22% 18%	37 32% 25%	31 26% 21%	30 21% 21%	39 29% 27%	26 19% 18%	35 23% 24%	46 26% 32%	96 26% 66%	49 21% 34%
Exclnt	201 34%	88 33% 44%	35 30% 17%	12 40% 6%	43 34% 21%	23 35% 11%	40 32% 20%	30 26% 15%	41 35% 20%	52 .37% 26%	49 36% 24%	53 39% 26%	49 33% 24%	50 28% 25%	118 32% 59%	82 35% 41%
Unsure	66 11%	35 13% 53%	8 7% 12%	4 13% 6%	9 7% 14%	10 15% 15%	15 12% 23%	16 14% 24%	13 11% 20%	17 12% 26%	12 9% 18%	21 16% 32%	17 11% 26%	16 9% 24%	41 11% 62%	25 11% 38%
DK	60 10%	27 10% 45%	14 12% 23%	2 7% 3%	11 9% 18%	6 9% 10%	17 14% 28%	11 10% 18%	10 8% 17%	14 10% 23%	13 10% 22%	10 7% 17%	16 11% 27%	21 12% 35%	42 12% 70%	18 8% 30%
Mean	4.54	4.63	4.49	4.63	4.28	4.70	4.67	4.59	4.50	4.61	4.59	4.63	4.60	4.38	4.64	4.40
Chi Square		24.52 .432					13.33 .772				27.26 .074				10.81 .094	

Table 5.4c: Basic Performance

Handling customer questions and complaints

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
V Poor	19 3%	11 5% 58%	7 2% 37%	1 1% 5%	4 1% 21%	14 18% 74%	5 1% 26%	10 17% 53%	4 3% 21%	10 2% 53%	8 13% 42%	1 2% 5%	4 2% 21%	5 2% 26%	5 6% 26%	3 5% 16%
Fair	25 4%	13 5% 52%	10 3% 40%	2 3% 8%	15 3% 60%	10 13% 40%	10 3% 40%	5 8% 20%	10 6% 40%	16 3% 64%	6 10% 24%	3 6% 12%	10 5% 40%	8 3% 32%	3 4% 12%	1 2% 4%
Avg	83 14%	38 16% 46%	35 12% 42%	10 14% 12%	59 11% 71%	24 30% 29%	47 12% 57%	9 15% 11%	27 17% 33%	64 13% 77%	10 16% 12%	9 18% 11%	27 13% 33%	33 14% 40%	11 13% 13%	10 17% 12%
Good	146 24%	61 26% 42%	71 24% 49%	14 20% 10%	134 26% 92%	11 14% 8%	99 26% 68%	13 22% 9%	34 22% 23%	119 24% 82%	17 27% 12%	10 20% 7%	53 26% 36%	55 24% 38%	17 20% 12%	14 23% 10%
Exclnt	201 34%	69 29% 34%	104 36% 52%	28 39% 14%	194 38% 97%	6 8% 3%	151 39% 75%	9 15% 4%	41 26% 20%	183 38% 91%	10 16% 5%	8 16% 4%	78 39% 39%	70 30% 35%	28 33% 14%	22 37% 11%
Unsure	66 11%	24 10% 36%	33 11% 50%	9 13% 14%	59 11% 89%	7 9% 11%	37 10% 56%	9 15% 14%	20 13% 30%	49 10% 74%	8 13% 12%	9 18% 14%	12 6% 18%	37 16% 56%	10 12% 15%	6 10% 9%
DK	60 10%	22 9% 37%	31 11% 52%	7 10% 12%	52 10% 87%	7 9% 12%	35 9% 58%	5 8% 8%	20 13% 33%	45 9% 75%	4 6% 7%	11 22% 18%	17 8% 28%	26 11% 43%	10 12% 17%	4 7% 7%
Mean	4.54	4.36	4.64	4.70	4.71	3.43	4.65	3.88	4.53	4.60	3.87	4.80	4.47	4.68	4.55	4.42
Chi Square		10.00 .616			121.28 .001		64.75 .001			51.02 .001			21.37 .261			

Table 5.5: Basic Performance

Working to keep rates low.

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
V Poor	57 10%	26 9% 46%	31 10% 54%	15 12% 26%	18 8% 32%	23 9% 40%	43 9% 75%	6 6% 11%	8 16% 14%	16 13% 28%	41 9% 72%	12 11% 21%	19 13% 33%	6 5% 11%	8 6% 14%	12 11% 21%
Fair	74 12%	33 11% 45%	41 14% 55%	15 12% 20%	35 16% 47%	22 9% 30%	51 11% 69%	14 15% 19%	9 18% 12%	15 12% 20%	59 13% 80%	14 13% 19%	14 10% 19%	14 12% 19%	11 9% 15%	21 19% 28%
Avg	148 25%	83 28% 56%	65 22% 44%	28 23% 19%	57 26% 39%	61 25% 41%	122 27% 82%	17 18% 11%	9 18% 6%	35 28% 24%	113 24% 76%	21 20% 14%	39 27% 26%	26 23% 18%	39 30% 26%	23 21% 16%
Good	151 25%	71 24% 47%	80 27% 53%	34 28% 23%	52 24% 34%	64 26% 42%	112 25% 74%	27 28% 18%	12 24% 8%	31 24% 21%	120 25% 79%	29 27% 19%	34 24% 23%	30 27% 20%	33 26% 22%	25 23% 17%
Exclnt	115 19%	59 20% 51%	55 18% 48%	22 18% 19%	42 19% 37%	48 19% 42%	81 18% 70%	26 27% 23%	8 16% 7%	18 14% 16%	96 20% 83%	20 19% 17%	25 18% 22%	28 25% 24%	26 20% 23%	16 14% 14%
Unsure	34 6%	17 6% 50%	17 6% 50%	5 4% 15%	12 5% 35%	17 7% 50%	27 6% 79%	3 3% 9%	4 8% 12%	6 5% 18%	28 6% 82%	7 7% 21%	7 5% 21%	5 4% 15%	8 6% 24%	7 6% 21%
DK	21 4%	11 4% 52%	10 3% 48%	2 2% 10%	5 2% 24%	13 5% 62%	17 4% 81%	3 3% 14%	1 2% 5%	6 5% 29%	15 3% 71%	3 3% 14%	4 3% 19%	4 4% 19%	3 2% 14%	7 6% 33%
Mean	3.63	3.66	3.60	3.46	3.55	3.79	3.63	3.77	3.37	3.49	3.67	3.60	3.49	3.81	3.73	3.55
Chi Square		4.22 .648		12.64 .395			15.29 .226			5.16 .524		24.71 .422				

Table 5.5b: Basic Performance

Working to keep rates low.

	Total	DISTRICT					CON DATE				BILL				Central Air and Heating?	
		Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
V Poor	57 10%	20 8% 35%	14 12% 25%	1 3% 2%	17 14% 30%	5 8% 9%	9 7% 16%	11 10% 19%	10 8% 18%	15 11% 26%	13 10% 23%	5 4% 9%	13 9% 23%	26 15% 46%	30 8% 53%	26 11% 46%
Fair	74 12%	30 11% 41%	11 10% 15%	8 27% 11%	15 12% 20%	10 15% 14%	19 15% 26%	12 10% 16%	14 12% 19%	15 11% 20%	12 9% 16%	19 14% 26%	18 12% 24%	25 14% 34%	43 12% 58%	31 13% 42%
Avg	148 25%	64 24% 43%	28 24% 19%	8 27% 5%	33 26% 22%	15 23% 10%	33 26% 22%	29 25% 20%	39 33% 26%	26 18% 18%	29 21% 20%	31 23% 21%	36 24% 24%	52 29% 35%	101 28% 68%	46 20% 31%
Good	151 25%	68 26% 45%	31 27% 21%	5 17% 3%	30 24% 20%	17 26% 11%	25 20% 17%	36 31% 24%	26 22% 17%	36 25% 24%	36 26% 24%	34 25% 23%	45 30% 30%	36 20% 24%	97 27% 64%	54 23% 36%
Exclnt	115 19%	56 21% 49%	23 20% 20%	7 23% 6%	18 14% 16%	11 17% 10%	27 22% 23%	18 16% 16%	20 17% 17%	36 25% 31%	34 25% 30%	33 24% 29%	28 19% 24%	20 11% 17%	62 17% 54%	52 23% 45%
Unsure	34 6%	20 8% 59%	4 3% 12%	0 0% 0%	6 5% 18%	4 6% 12%	8 6% 24%	7 6% 21%	6 5% 18%	7 5% 21%	7 5% 21%	12 9% 35%	7 5% 21%	8 4% 24%	21 6% 62%	12 5% 35%
DK	21 4%	6 2% 29%	4 3% 19%	1 3% 5%	6 5% 29%	4 6% 19%	4 3% 19%	2 2% 10%	3 3% 14%	7 5% 33%	5 4% 24%	1 1% 5%	3 2% 14%	12 7% 57%	11 3% 52%	10 4% 48%
Mean	3.63	3.73	3.57	3.43	3.47	3.71	3.66	3.58	3.53	3.79	3.79	3.82	3.60	3.40	3.62	3.65
Chi Square		23.48 .492					17.96 .458				40.01 .002				8.75 .188	

Table 5.5c: Basic Performance

Working to keep rates low.

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
V Poor	57 10%	25 11% 44%	25 9% 44%	7 10% 12%	36 7% 63%	20 25% 35%	28 7% 49%	11 18% 19%	18 12% 32%	34 7% 60%	13 21% 23%	10 20% 18%	18 9% 32%	18 8% 32%	10 12% 18%	8 13% 14%
Fair	74 12%	34 14% 46%	26 9% 35%	14 20% 19%	47 9% 64%	27 34% 36%	31 8% 42%	11 18% 15%	32 21% 43%	52 11% 70%	15 24% 20%	7 14% 9%	32 16% 43%	19 8% 26%	10 12% 14%	8 13% 11%
Avg	148 25%	68 29% 46%	67 23% 45%	13 18% 9%	133 26% 90%	15 19% 10%	92 24% 62%	17 28% 11%	39 25% 26%	118 24% 80%	17 27% 11%	13 25% 9%	43 21% 29%	68 29% 46%	21 25% 14%	11 18% 7%
Good	151 25%	52 22% 34%	79 27% 52%	20 28% 13%	140 27% 93%	9 11% 6%	111 29% 74%	11 18% 7%	29 19% 19%	132 27% 87%	9 14% 6%	10 20% 7%	58 29% 38%	59 25% 39%	16 19% 11%	16 27% 11%
Exclnt	115 19%	44 18% 38%	61 21% 53%	10 14% 9%	114 22% 99%	0 0% 0%	89 23% 77%	7 12% 6%	19 12% 17%	106 22% 92%	6 10% 5%	3 6% 3%	31 15% 27%	51 22% 44%	18 21% 16%	12 20% 10%
Unsure	34 6%	8 3% 24%	21 7% 62%	5 7% 15%	28 5% 82%	6 8% 18%	21 5% 62%	1 2% 3%	12 8% 35%	27 6% 79%	1 2% 3%	6 12% 18%	7 3% 21%	15 6% 44%	7 8% 21%	4 7% 12%
DK	21 4%	7 3% 33%	12 4% 57%	2 3% 10%	19 4% 90%	2 3% 10%	12 3% 57%	2 3% 10%	7 4% 33%	17 3% 81%	2 3% 10%	2 4% 10%	12 6% 57%	4 2% 19%	2 2% 10%	1 2% 5%
Mean	3.63	3.45	3.81	3.49	3.79	2.59	3.82	3.05	3.40	3.77	2.86	3.29	3.60	3.71	3.61	3.53
Chi Square		17.65 .127			85.54 .001		42.19 .001			44.09 .001			26.37 .092			

Table 5.6: Basic Performance

Being good stewards of the environment.

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
V Poor	22 4%	13 4% 59%	9 3% 41%	4 3% 18%	12 5% 55%	5 2% 23%	15 3% 68%	3 3% 14%	4 8% 18%	15 12% 68%	7 1% 32%	3 3% 14%	6 4% 27%	1 1% 5%	7 5% 32%	5 5% 23%
Fair	30 5%	8 3% 27%	22 7% 73%	3 2% 10%	10 5% 33%	16 6% 53%	27 6% 90%	2 2% 7%	1 2% 3%	8 6% 27%	22 5% 73%	7 7% 23%	7 5% 23%	5 4% 17%	5 4% 17%	6 5% 20%
Avg	100 17%	55 18% 55%	45 15% 45%	23 19% 23%	35 16% 35%	41 17% 41%	78 17% 78%	12 13% 12%	10 20% 10%	20 16% 20%	80 17% 80%	14 13% 14%	25 18% 25%	19 17% 19%	22 17% 22%	20 18% 20%
Good	175 29%	96 32% 55%	78 26% 45%	39 32% 22%	63 29% 36%	71 29% 41%	131 29% 75%	35 36% 20%	9 18% 5%	35 28% 20%	139 29% 79%	28 26% 16%	43 30% 25%	32 28% 18%	37 29% 21%	35 32% 20%
Exclnt	164 27%	83 28% 51%	81 27% 49%	24 20% 15%	62 28% 38%	75 30% 46%	122 27% 74%	30 31% 18%	12 24% 7%	29 23% 18%	135 29% 82%	29 27% 18%	37 26% 23%	38 34% 23%	35 27% 21%	25 23% 15%
Unsure	66 11%	27 9% 41%	39 13% 59%	19 16% 29%	28 13% 42%	18 7% 27%	49 11% 74%	10 10% 15%	7 14% 11%	12 9% 18%	54 11% 82%	14 13% 21%	18 13% 27%	8 7% 12%	16 13% 24%	10 9% 15%
DK	43 7%	18 6% 42%	25 8% 58%	9 7% 21%	11 5% 26%	22 9% 51%	31 7% 72%	4 4% 9%	8 16% 19%	8 6% 19%	35 7% 81%	11 10% 26%	6 4% 14%	10 9% 23%	6 5% 14%	10 9% 23%
Mean	4.33	4.27	4.39	4.40	4.27	4.36	4.30	4.39	4.51	3.97	4.43	4.50	4.24	4.46	4.25	4.25
Chi Square		13.47 .036		19.45 .078			19.16 .085			31.56 .001		17.62 .821				

Table 5.6b: Basic Performance

Being good stewards of the environment.

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
V Poor	22 4%	3 1% 14%	4 3% 18%	0 0% 0%	15 12% 68%	0 0% 0%	2 2% 9%	2 2% 9%	3 3% 14%	4 3% 18%	6 4% 27%	5 4% 23%	4 3% 18%	7 4% 32%	7 2% 32%	14 6% 64%
Fair	30 5%	13 5% 43%	4 3% 13%	1 3% 3%	8 6% 27%	4 6% 13%	3 2% 10%	3 3% 10%	10 8% 33%	9 6% 30%	9 7% 30%	7 5% 23%	7 5% 23%	7 4% 23%	15 4% 50%	15 6% 50%
Avg	100 17%	44 17% 44%	21 18% 21%	6 20% 6%	18 14% 18%	11 17% 11%	21 17% 21%	22 19% 22%	25 21% 25%	18 13% 18%	23 17% 23%	18 13% 18%	22 15% 22%	37 21% 37%	69 19% 69%	30 13% 30%
Good	175 29%	78 30% 45%	34 30% 19%	8 27% 5%	35 28% 20%	20 30% 11%	40 32% 23%	34 30% 19%	36 31% 21%	34 24% 19%	37 27% 21%	37 27% 21%	44 29% 25%	57 32% 33%	110 30% 63%	65 28% 37%
Exclnt	164 27%	72 27% 44%	34 30% 21%	9 30% 5%	28 22% 17%	21 32% 13%	32 26% 20%	30 26% 18%	22 19% 13%	55 39% 34%	38 28% 23%	41 30% 25%	49 33% 30%	36 20% 22%	103 28% 63%	61 26% 37%
Unsure	66 11%	33 13% 50%	11 10% 17%	4 13% 6%	12 10% 18%	6 9% 9%	18 14% 27%	16 14% 24%	13 11% 20%	11 8% 17%	14 10% 21%	16 12% 24%	16 11% 24%	20 11% 30%	35 10% 53%	29 13% 44%
DK	43 7%	21 8% 49%	7 6% 16%	2 7% 5%	9 7% 21%	4 6% 9%	9 7% 21%	8 7% 19%	9 8% 21%	11 8% 26%	9 7% 21%	11 8% 26%	8 5% 19%	15 8% 35%	26 7% 60%	17 7% 40%
Mean	4.33	4.46	4.31	4.50	4.00	4.39	4.50	4.45	4.18	4.44	4.25	4.44	4.38	4.27	4.36	4.29
Chi Square		37.86 .036					25.08 .123				12.50 .820				13.00 .043	

Table 5.6c: Basic Performance

Being good stewards of the environment.

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
V Poor	22 4%	12 5% 55%	8 3% 36%	2 3% 9%	10 2% 45%	11 14% 50%	1 0% 5%	15 25% 68%	6 4% 27%	5 1% 23%	16 25% 73%	1 2% 5%	6 3% 27%	3 1% 14%	4 5% 18%	6 10% 27%
Fair	30 5%	10 4% 33%	16 5% 53%	4 6% 13%	21 4% 70%	8 10% 27%	15 4% 50%	5 8% 17%	10 6% 33%	19 4% 63%	6 10% 20%	5 10% 17%	12 6% 40%	11 5% 37%	3 4% 10%	3 5% 10%
Avg	100 17%	42 18% 42%	42 14% 42%	16 23% 16%	80 15% 80%	20 25% 20%	62 16% 62%	11 18% 11%	27 17% 27%	80 16% 80%	12 19% 12%	8 16% 8%	36 18% 36%	40 17% 40%	13 15% 13%	7 12% 7%
Good	175 29%	76 32% 43%	79 27% 45%	20 28% 11%	156 30% 89%	18 23% 10%	124 32% 71%	10 17% 6%	41 26% 23%	152 31% 87%	11 17% 6%	12 24% 7%	62 31% 35%	70 30% 40%	20 24% 11%	18 30% 10%
Exclnt	164 27%	52 22% 32%	99 34% 60%	13 18% 8%	160 31% 98%	4 5% 2%	139 36% 85%	7 12% 4%	18 12% 11%	156 32% 95%	2 3% 1%	6 12% 4%	54 27% 33%	68 29% 41%	24 29% 15%	15 25% 9%
Unsure	66 11%	26 11% 39%	27 9% 41%	13 18% 20%	56 11% 85%	10 13% 15%	27 7% 41%	5 8% 8%	34 22% 52%	46 9% 70%	9 14% 14%	11 22% 17%	15 7% 23%	25 11% 38%	14 17% 21%	8 13% 12%
DK	43 7%	20 8% 47%	20 7% 47%	3 4% 7%	34 7% 79%	8 10% 19%	16 4% 37%	7 12% 16%	20 13% 47%	28 6% 65%	7 11% 16%	8 16% 19%	16 8% 37%	17 7% 40%	6 7% 14%	3 5% 7%
Mean	4.33	4.28	4.40	4.25	4.43	3.73	4.38	3.53	4.52	4.41	3.51	4.61	4.27	4.42	4.46	4.15
Chi Square		21.20 .048			56.50 .001		161.21 .001			138.08 .001			20.83 .288			

Table 5.7: Basic Performance

Keeping longer power outages to a minimum.

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
V Poor	10 2%	3 1% 30%	7 2% 70%	2 2% 20%	5 2% 50%	3 1% 30%	9 2% 90%	0 0% 0%	1 2% 10%	8 6% 80%	2 0% 20%	2 2% 20%	3 2% 30%	0 0% 0%	2 2% 20%	3 3% 30%
Fair	24 4%	6 2% 25%	18 6% 75%	4 3% 17%	7 3% 29%	12 5% 50%	18 4% 75%	4 4% 17%	2 4% 8%	11 9% 46%	13 3% 54%	5 5% 21%	6 4% 25%	1 1% 4%	5 4% 21%	7 6% 29%
Avg	81 14%	34 11% 42%	47 16% 58%	12 10% 15%	37 17% 46%	30 12% 37%	59 13% 73%	10 10% 12%	12 24% 15%	31 24% 38%	50 11% 62%	15 14% 19%	17 12% 21%	10 9% 12%	21 16% 26%	18 16% 22%
Good	206 34%	117 39% 57%	88 29% 43%	45 37% 22%	75 34% 36%	84 34% 41%	158 35% 77%	34 35% 17%	14 27% 7%	45 35% 22%	160 34% 78%	30 28% 15%	57 40% 28%	39 35% 19%	41 32% 20%	39 35% 19%
Exclnt	250 42%	122 41% 49%	128 43% 51%	50 41% 20%	90 41% 36%	106 43% 42%	185 41% 74%	44 46% 18%	21 41% 8%	29 23% 12%	221 47% 88%	47 44% 19%	54 38% 22%	57 50% 23%	53 41% 21%	39 35% 16%
Unsure	20 3%	12 4% 60%	8 3% 40%	4 3% 20%	7 3% 35%	8 3% 40%	17 4% 85%	2 2% 10%	1 2% 5%	3 2% 15%	17 4% 85%	5 5% 25%	2 1% 10%	4 4% 20%	6 5% 30%	3 3% 15%
DK	9 2%	6 2% 67%	3 1% 33%	4 3% 44%	0 0% 0%	5 2% 56%	7 2% 78%	2 2% 22%	0 0% 0%	0 0% 0%	9 2% 100%	2 2% 22%	3 2% 33%	2 2% 22%	0 0% 0%	2 2% 22%
Mean	4.26	4.36	4.16	4.36	4.17	4.30	4.26	4.38	4.08	3.67	4.42	4.30	4.20	4.52	4.22	4.09
Chi Square		15.73 .015		11.70 .470			9.68 .644			60.28 .001		22.82 .531				

Table 5.7b: Basic Performance

Keeping longer power outages to a minimum.

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
V Poor	10 2%	0 0% 0%	2 2% 20%	0 0% 0%	8 6% 80%	0 0% 0%	0 0% 0%	0 0% 0%	2 2% 20%	2 1% 20%	4 3% 40%	0 0% 0%	2 1% 20%	4 2% 40%	4 1% 40%	6 3% 60%
Fair	24 4%	5 2% 21%	5 4% 21%	0 0% 0%	10 8% 42%	4 6% 17%	2 2% 8%	4 3% 17%	4 3% 17%	5 4% 21%	5 4% 21%	9 7% 38%	5 3% 21%	5 3% 21%	15 4% 63%	9 4% 38%
Avg	81 14%	29 11% 36%	8 7% 10%	3 10% 4%	31 25% 38%	10 15% 12%	15 12% 19%	13 11% 16%	14 12% 17%	14 10% 17%	14 10% 17%	9 7% 11%	28 19% 35%	30 17% 37%	48 13% 59%	32 14% 40%
Good	206 34%	89 34% 43%	35 30% 17%	13 43% 6%	44 35% 21%	25 38% 12%	40 32% 19%	42 37% 20%	47 40% 23%	44 31% 21%	42 31% 20%	42 31% 20%	50 33% 24%	72 40% 35%	126 35% 61%	79 34% 38%
Exclnt	250 42%	127 48% 51%	59 51% 24%	13 43% 5%	28 22% 11%	23 35% 9%	57 46% 23%	51 44% 20%	48 41% 19%	70 49% 28%	61 45% 24%	66 49% 26%	59 39% 24%	64 36% 26%	155 42% 62%	93 40% 37%
Unsure	20 3%	9 3% 45%	4 3% 20%	1 3% 5%	3 2% 15%	3 5% 15%	6 5% 30%	3 3% 15%	3 3% 15%	5 4% 25%	6 4% 30%	6 4% 30%	6 4% 30%	2 1% 10%	12 3% 60%	8 3% 40%
DK	9 2%	5 2% 56%	2 2% 22%	0 0% 0%	1 1% 11%	1 2% 11%	5 4% 56%	2 2% 22%	0 0% 0%	2 1% 22%	4 3% 44%	3 2% 33%	0 0% 0%	2 1% 22%	5 1% 56%	4 2% 44%
Mean	4.26	4.46	4.43	4.40	3.70	4.21	4.52	4.37	4.22	4.39	4.36	4.44	4.18	4.12	4.28	4.23
Chi Square		70.19 .001					14.92 .667				32.40 .020				2.27 .893	

Table 5.7c: Basic Performance

Keeping longer power outages to a minimum.

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
V Poor	10 2%	3 1% 30%	5 2% 50%	2 3% 20%	4 1% 40%	5 6% 50%	4 1% 40%	4 7% 40%	2 1% 20%	4 1% 40%	5 8% 50%	1 2% 10%	1 0% 10%	2 1% 20%	2 2% 20%	5 8% 50%
Fair	24 4%	9 4% 38%	13 4% 54%	2 3% 8%	14 3% 58%	9 11% 38%	11 3% 46%	7 12% 29%	6 4% 25%	13 3% 54%	5 8% 21%	6 12% 25%	7 3% 29%	9 4% 38%	5 6% 21%	1 2% 4%
Avg	81 14%	41 17% 51%	30 10% 37%	10 14% 12%	60 12% 74%	20 25% 25%	39 10% 48%	15 25% 19%	27 17% 33%	50 10% 62%	19 30% 23%	12 24% 15%	30 15% 37%	25 11% 31%	10 12% 12%	7 12% 9%
Good	206 34%	80 34% 39%	96 33% 47%	30 42% 15%	174 34% 84%	31 39% 15%	132 34% 64%	16 27% 8%	58 37% 28%	172 35% 83%	22 35% 11%	12 24% 6%	74 37% 36%	73 31% 35%	35 42% 17%	21 35% 10%
Exclnt	250 42%	94 39% 38%	132 45% 53%	24 34% 10%	241 47% 96%	9 11% 4%	190 49% 76%	13 22% 5%	47 30% 19%	232 48% 93%	6 10% 2%	12 24% 5%	79 39% 32%	114 49% 46%	29 35% 12%	22 37% 9%
Unsure	20 3%	7 3% 35%	10 3% 50%	3 4% 15%	16 3% 80%	4 5% 20%	4 1% 20%	5 8% 25%	11 7% 55%	10 2% 50%	6 10% 30%	4 8% 20%	6 3% 30%	6 3% 30%	3 4% 15%	4 7% 20%
DK	9 2%	4 2% 44%	5 2% 56%	0 0% 0%	8 2% 89%	1 1% 11%	4 1% 44%	0 0% 0%	5 3% 56%	5 1% 56%	0 0% 0%	4 8% 44%	4 2% 44%	5 2% 56%	0 0% 0%	0 0% 0%
Mean	4.26	4.22	4.33	4.14	4.38	3.58	4.36	3.70	4.25	4.37	3.59	4.10	4.28	4.39	4.11	4.10
Chi Square		11.16 .515			58.71 .001		70.08 .001			103.60 .001			33.70 .014			

Table 6: STATEMENT A OR STATEMENT B -- Opponents say that the new line will hurt their property values because it will interfere with their view of the mountains. The cooperative says that it has owned the right-of-way to build that line for 28 years and that was public record when property owners bought their property.

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300	299	121	221	248	453	96	51	127	472	106	142	113	128	111
		50%	50%	20%	37%	41%	76%	16%	9%	21%	79%	18%	24%	19%	21%	19%
Coop	434	222	212	93	150	187	331	72	31	85	349	75	111	84	95	69
	72%	74%	71%	77%	68%	75%	73%	75%	61%	67%	74%	71%	78%	74%	74%	62%
		51%	49%	21%	35%	43%	76%	17%	7%	20%	80%	17%	26%	19%	22%	16%
Lean Coop	43	23	20	6	21	15	33	4	6	5	38	10	9	9	6	9
	7%	8%	7%	5%	10%	6%	7%	4%	12%	4%	8%	9%	6%	8%	5%	8%
		53%	47%	14%	49%	35%	77%	9%	14%	12%	88%	23%	21%	21%	14%	21%
Lean opponents	12	5	7	2	6	4	10	2	0	0	12	1	3	2	3	3
	2%	2%	2%	2%	3%	2%	2%	2%	0%	0%	3%	1%	2%	2%	2%	3%
		42%	58%	17%	50%	33%	83%	17%	0%	0%	100%	8%	25%	17%	25%	25%
Opponents	64	28	35	11	25	25	49	11	4	23	40	9	14	12	14	15
	11%	9%	12%	9%	11%	10%	11%	11%	8%	18%	8%	8%	10%	11%	11%	14%
		44%	55%	17%	39%	39%	77%	17%	6%	36%	63%	14%	22%	19%	22%	23%
Undecided	42	19	23	9	17	14	25	7	10	11	31	9	3	6	10	14
	7%	6%	8%	7%	8%	6%	6%	7%	20%	9%	7%	8%	2%	5%	8%	13%
		45%	55%	21%	40%	33%	60%	17%	24%	26%	74%	21%	7%	14%	24%	33%
REF	1	1	0	0	0	1	1	0	0	0	1	0	1	0	0	0
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%
		100%	0%	0%	0%	100%	100%	0%	0%	0%	100%	0%	100%	0%	0%	0%
DK	4	2	2	0	2	2	4	0	0	3	1	2	1	0	0	1
	1%	1%	1%	0%	1%	1%	1%	0%	0%	2%	0%	2%	1%	0%	0%	1%
		50%	50%	0%	50%	50%	100%	0%	0%	75%	25%	50%	25%	0%	0%	25%
Mean	1.76	1.70	1.81	1.65	1.85	1.69	1.73	1.72	2.14	2.07	1.67	1.82	1.56	1.65	1.73	2.10
Chi Square		2.93		8.65			19.99			22.93		25.09				
		.818		.732			.067			.001		.401				

Table 6b: STATEMENT A OR STATEMENT B -- Opponents say that the new line will hurt their property values because it will interfere with their view of the mountains. The cooperative says that it has owned the right-of-way to build that line for 28 years and that was public record when property owners bought their property.

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
Coop	434 72%	194 73% 45%	81 70% 19%	25 83% 6%	83 66% 19%	51 77% 12%	94 75% 22%	81 70% 19%	86 73% 20%	103 73% 24%	97 71% 22%	98 73% 23%	107 71% 25%	132 74% 30%	265 73% 61%	166 72% 38%
Lean Coop	43 7%	23 9% 53%	10 9% 23%	0 0% 0%	5 4% 12%	5 8% 12%	9 7% 21%	14 12% 33%	8 7% 19%	8 6% 19%	7 5% 16%	15 11% 35%	9 6% 21%	12 7% 28%	32 9% 74%	11 5% 26%
Lean opponents	12 2%	7 3% 58%	2 2% 17%	1 3% 8%	0 0% 0%	2 3% 17%	0 0% 0%	4 3% 33%	2 2% 17%	6 4% 50%	1 1% 8%	2 1% 17%	4 3% 33%	5 3% 42%	9 2% 75%	3 1% 25%
Opponents	64 11%	19 7% 30%	13 11% 20%	2 7% 3%	23 18% 36%	7 11% 11%	13 10% 20%	8 7% 13%	15 13% 23%	11 8% 17%	17 13% 27%	12 9% 19%	16 11% 25%	19 11% 30%	30 8% 47%	34 15% 53%
Undecided	42 7%	19 7% 45%	9 8% 21%	2 7% 5%	11 9% 26%	1 2% 2%	9 7% 21%	7 6% 17%	6 5% 14%	13 9% 31%	14 10% 33%	8 6% 19%	11 7% 26%	9 5% 21%	24 7% 57%	17 7% 40%
REF	1 0%	1 0% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 100%	0 0% 0%	0 0% 0%	1 1% 100%	0 0% 0%	1 0% 100%	0 0% 0%
DK	4 1%	1 0% 25%	0 0% 0%	0 0% 0%	3 2% 75%	0 0% 0%	0 0% 0%	1 1% 25%	1 1% 25%	0 0% 0%	0 0% 0%	0 0% 0%	2 1% 50%	2 1% 50%	4 1% 100%	0 0% 0%
Mean	1.76	1.69	1.77	1.53	2.09	1.52	1.67	1.70	1.74	1.77	1.85	1.64	1.84	1.71	1.73	1.81
Chi Square		32.99 .104					19.02 .390				16.83 .535				12.97 .044	

Table 6c: STATEMENT A OR STATEMENT B -- Opponents say that the new line will hurt their property values because it will interfere with their view of the mountains. The cooperative says that it has owned the right-of-way to build that line for 28 years and that was public record when property owners bought their property.

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
Coop	434 72%	167 70% 38%	219 75% 50%	48 68% 11%	392 76% 90%	41 52% 9%	334 87% 77%	12 20% 3%	88 56% 20%	413 85% 95%	9 14% 2%	12 24% 3%	149 74% 34%	178 76% 41%	56 67% 13%	39 65% 9%
Lean Coop	43 7%	20 8% 47%	18 6% 42%	5 7% 12%	35 7% 81%	8 10% 19%	17 4% 40%	5 8% 12%	21 13% 49%	30 6% 70%	3 5% 7%	10 20% 23%	16 8% 37%	16 7% 37%	4 5% 9%	5 8% 12%
Lean opponents	12 2%	5 2% 42%	6 2% 50%	1 1% 8%	11 2% 92%	1 1% 8%	2 1% 17%	2 3% 17%	8 5% 67%	7 1% 58%	1 2% 8%	4 8% 33%	4 2% 33%	3 1% 25%	4 5% 33%	0 0% 0%
Opponents	64 11%	24 10% 38%	30 10% 47%	10 14% 16%	40 8% 63%	22 28% 34%	10 3% 16%	34 57% 53%	20 13% 31%	16 3% 25%	39 62% 61%	9 18% 14%	17 8% 27%	15 6% 23%	14 17% 22%	13 22% 20%
Undecided	42 7%	20 8% 48%	15 5% 36%	7 10% 17%	34 7% 81%	7 9% 17%	19 5% 45%	7 12% 17%	16 10% 38%	18 4% 43%	9 14% 21%	15 29% 36%	13 6% 31%	20 9% 48%	6 7% 14%	2 3% 5%
REF	1 0%	0 0% 0%	1 0% 100%	0 0% 0%	1 0% 100%	0 0% 0%	1 0% 100%	0 0% 0%	0 0% 0%	0 0% 0%	1 2% 100%	0 0% 0%	0 0% 0%	1 0% 100%	0 0% 0%	0 0% 0%
DK	4 1%	2 1% 50%	2 1% 50%	0 0% 0%	4 1% 100%	0 0% 0%	1 0% 25%	0 0% 0%	3 2% 75%	2 0% 50%	1 2% 25%	1 2% 25%	2 1% 50%	1 0% 25%	0 0% 0%	1 2% 25%
Mean	1.76	1.82	1.68	1.92	1.66	2.32	1.36	3.32	2.15	1.36	3.68	3.18	1.69	1.68	1.93	1.97
Chi Square		7.21 .844			34.65 .001		219.95 .001			320.76 .001			28.06 .061			

Prepared by RBI Strategies and Research

Table 7: STATEMENT A OR STATEMENT B -- Opponents say that putting the new line in the view of the mountains is unfair to them because one of the primary reasons they bought their property was the view of the mountain. The cooperative says that the path they chose for the new line is the path that will affect the fewest number of people, a statement with which an independent study on the matter has agreed.

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
Coop	435 73%	224 75% 51%	211 71% 49%	90 74% 21%	150 68% 34%	190 77% 44%	328 72% 75%	73 76% 17%	34 67% 8%	84 66% 19%	351 74% 81%	75 71% 17%	109 77% 25%	83 73% 19%	97 76% 22%	71 64% 16%
Lean Coop	37 6%	19 6% 51%	18 6% 49%	5 4% 14%	18 8% 49%	14 6% 38%	28 6% 76%	4 4% 11%	5 10% 14%	7 6% 19%	30 6% 81%	8 8% 22%	10 7% 27%	6 5% 16%	7 5% 19%	6 5% 16%
Lean opponents	15 3%	10 3% 67%	5 2% 33%	3 2% 20%	7 3% 47%	5 2% 33%	11 2% 73%	4 4% 27%	0 0% 0%	3 2% 20%	12 3% 80%	0 0% 0%	4 3% 27%	5 4% 33%	2 2% 13%	4 4% 27%
Opponents	65 11%	29 10% 45%	36 12% 55%	11 9% 17%	27 12% 42%	25 10% 38%	55 12% 85%	6 6% 9%	4 8% 6%	21 17% 32%	44 9% 68%	9 8% 14%	17 12% 26%	13 12% 20%	8 6% 12%	18 16% 28%
Undecided	44 7%	16 5% 36%	27 9% 61%	10 8% 23%	18 8% 41%	13 5% 30%	27 6% 61%	9 9% 20%	8 16% 18%	10 8% 23%	33 7% 75%	12 11% 27%	2 1% 5%	6 5% 14%	13 10% 30%	11 10% 25%
REF	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	4 1%	2 1% 50%	2 1% 50%	2 2% 50%	1 0% 25%	1 0% 25%	4 1% 100%	0 0% 0%	0 0% 0%	2 2% 50%	2 0% 50%	2 2% 50%	0 0% 0%	0 0% 0%	1 1% 25%	1 1% 25%
Mean	1.77	1.67	1.86	1.79	1.86	1.63	1.77	1.69	1.96	2.01	1.70	1.90	1.54	1.70	1.73	2.06
Chi Square		5.65 .342		8.95 .537			15.33 .120			7.95 .159		30.45 .063				

Table 7b: STATEMENT A OR STATEMENT B -- Opponents say that putting the new line in the view of the mountains is unfair to them because one of the primary reasons they bought their property was the view of the mountain. The cooperative says that the path they chose for the new line is the path that will affect the fewest number of people, a statement with which an independent study on the matter has agreed.

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
Coop	435 73%	200 76% 46%	80 70% 18%	25 83% 6%	83 66% 19%	47 71% 11%	93 74% 21%	80 70% 18%	88 75% 20%	107 75% 25%	96 71% 22%	97 72% 22%	111 74% 26%	131 73% 30%	267 73% 61%	165 71% 38%
Lean Coop	37 6%	13 5% 35%	9 8% 24%	1 3% 3%	6 5% 16%	8 12% 22%	6 5% 16%	9 8% 24%	7 6% 19%	9 6% 24%	5 4% 14%	11 8% 30%	7 5% 19%	14 8% 38%	27 7% 73%	10 4% 27%
Lean opponents	15 3%	9 3% 60%	2 2% 13%	1 3% 7%	3 2% 20%	0 0% 0%	2 2% 13%	3 3% 20%	2 2% 13%	5 4% 33%	2 1% 13%	3 2% 20%	5 3% 33%	5 3% 33%	12 3% 80%	3 1% 20%
Opponents	65 11%	19 7% 29%	16 14% 25%	3 10% 5%	20 16% 31%	7 11% 11%	12 10% 18%	14 12% 22%	13 11% 20%	10 7% 15%	21 15% 32%	9 7% 14%	16 11% 25%	19 11% 29%	33 9% 51%	32 14% 49%
Undecided	44 7%	22 8% 50%	7 6% 16%	0 0% 0%	11 9% 25%	4 6% 9%	10 8% 23%	9 8% 20%	7 6% 16%	11 8% 25%	12 9% 27%	15 11% 34%	9 6% 20%	8 4% 18%	22 6% 50%	21 9% 48%
REF	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	4 1%	1 0% 25%	1 1% 25%	0 0% 0%	2 2% 50%	0 0% 0%	2 2% 50%	0 0% 0%	1 1% 25%	0 0% 0%	0 0% 0%	0 0% 0%	2 1% 50%	2 1% 50%	4 1% 100%	0 0% 0%
Mean	1.77	1.69	1.83	1.40	2.02	1.68	1.78	1.81	1.71	1.65	1.88	1.77	1.75	1.70	1.72	1.85
Chi Square		23.60 .260					8.73 .891				18.40 .242				11.80 .038	

Prepared by RBI Strategies and Research

Table 7c: STATEMENT A OR STATEMENT B -- Opponents say that putting the new line in the view of the mountains is unfair to them because one of the primary reasons they bought their property was the view of the mountain. The cooperative says that the path they chose for the new line is the path that will affect the fewest number of people, a statement with which an independent study on the matter has agreed.

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
Coop	435 73%	173 73% 40%	218 75% 50%	44 62% 10%	390 75% 90%	44 56% 10%	337 88% 77%	16 27% 4%	82 53% 19%	409 84% 94%	14 22% 3%	12 24% 3%	150 75% 34%	183 78% 42%	54 64% 12%	36 60% 8%
Lean Coop	37 6%	16 7% 43%	14 5% 38%	7 10% 19%	32 6% 86%	5 6% 14%	17 4% 46%	2 3% 5%	18 12% 49%	30 6% 81%	1 2% 3%	6 12% 16%	15 7% 41%	16 7% 43%	1 1% 3%	5 8% 14%
Lean opponents	15 3%	6 3% 40%	9 3% 60%	0 0% 0%	11 2% 73%	4 5% 27%	4 1% 27%	3 5% 20%	8 5% 53%	9 2% 60%	2 3% 13%	4 8% 27%	5 2% 33%	3 1% 20%	6 7% 40%	0 0% 0%
Opponents	65 11%	23 10% 35%	32 11% 49%	10 14% 15%	45 9% 69%	19 24% 29%	7 2% 11%	32 53% 49%	26 17% 40%	16 3% 25%	39 62% 60%	10 20% 15%	19 9% 29%	14 6% 22%	14 17% 22%	13 22% 20%
Undecided	44 7%	17 7% 39%	17 6% 39%	10 14% 23%	35 7% 80%	7 9% 16%	18 5% 41%	7 12% 16%	19 12% 43%	19 4% 43%	6 10% 14%	19 37% 43%	10 5% 23%	17 7% 39%	9 11% 20%	5 8% 11%
REF	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	4 1%	3 1% 75%	1 0% 25%	0 0% 0%	4 1% 100%	0 0% 0%	1 0% 25%	0 0% 0%	3 2% 75%	3 1% 75%	1 2% 25%	0 0% 0%	2 1% 50%	1 0% 25%	0 0% 0%	1 2% 25%
Mean	1.77	1.77	1.69	2.08	1.68	2.24	1.32	3.20	2.32	1.39	3.41	3.35	1.67	1.59	2.08	2.17
Chi Square		14.56 .149			22.08 .001		206.27 .001			311.86 .001			38.00 .001			

Prepared by RBI Strategies and Research

Table 8: STATEMENT A OR STATEMENT B -- Opponents say that alternative energy sources, like wind or solar power, could take care of much of the problem. They want the cooperative to build enough alternative energy sources in the area to reduce the need for a new line and say that would be positive for the environment as well. The cooperative says that renewable energy would not solve the reliability and power quality problems caused by having only one line into the area, would not provide enough electricity when it is needed, would be only a short term fix and would be far more expensive, a statement with which an independent study on the matter has agreed.

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300	299	121	221	248	453	96	51	127	472	106	142	113	128	111
		50%	50%	20%	37%	41%	76%	16%	9%	21%	79%	18%	24%	19%	21%	19%
Coop	416	224	192	81	157	174	319	66	31	86	330	59	99	86	101	71
	69%	75%	64%	67%	71%	70%	70%	69%	61%	68%	70%	56%	70%	76%	79%	64%
		54%	46%	19%	38%	42%	77%	16%	7%	21%	79%	14%	24%	21%	24%	17%
Lean Coop	47	21	26	9	16	22	33	11	3	7	40	8	14	8	7	10
	8%	7%	9%	7%	7%	9%	7%	11%	6%	6%	8%	8%	10%	7%	5%	9%
		45%	55%	19%	34%	47%	70%	23%	6%	15%	85%	17%	30%	17%	15%	21%
Lean opponents	17	10	7	3	8	6	12	4	1	2	15	7	2	2	2	4
	3%	3%	2%	2%	4%	2%	3%	4%	2%	2%	3%	7%	1%	2%	2%	4%
		59%	41%	18%	47%	35%	71%	24%	6%	12%	88%	41%	12%	12%	12%	24%
Opponents	73	29	43	17	24	28	55	8	10	24	48	16	22	11	9	15
	12%	10%	14%	14%	11%	11%	12%	8%	20%	19%	10%	15%	15%	10%	7%	14%
		40%	59%	23%	33%	38%	75%	11%	14%	33%	66%	22%	30%	15%	12%	21%
Undecided	41	14	27	9	13	17	28	7	6	6	35	14	4	5	7	11
	7%	5%	9%	7%	6%	7%	6%	7%	12%	5%	7%	13%	3%	4%	5%	10%
		34%	66%	22%	32%	41%	68%	17%	15%	15%	85%	34%	10%	12%	17%	27%
REF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DK	6	2	4	2	3	1	6	0	0	2	4	2	1	1	2	0
	1%	1%	1%	2%	1%	0%	1%	0%	0%	2%	1%	2%	1%	1%	2%	0%
		33%	67%	33%	50%	17%	100%	0%	0%	33%	67%	33%	17%	17%	33%	0%
Mean	1.83	1.65	2.01	1.94	1.79	1.77	1.82	1.74	2.16	1.94	1.80	2.30	1.75	1.63	1.61	1.96
Chi Square		11.03		4.03			11.00			10.03		35.97				
		.051		.946			.358			.075		.015				

Table 8b: STATEMENT A OR STATEMENT B -- Opponents say that alternative energy sources, like wind or solar power, could take care of much of the problem. They want the cooperative to build enough alternative energy sources in the area to reduce the need for a new line and say that would be positive for the environment as well. The cooperative says that renewable energy would not solve the reliability and power quality problems caused by having only one line into the area, would not provide enough electricity when it is needed, would be only a short term fix and would be far more expensive, a statement with which an independent study on the matter has agreed.

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264	115	30	125	66	125	115	118	142	136	135	150	179	365	231
		44%	19%	5%	21%	11%	21%	19%	20%	24%	23%	23%	25%	30%	61%	39%
Coop	416	178	81	25	85	47	87	82	79	100	95	95	98	128	254	159
	69%	67%	70%	83%	68%	71%	70%	71%	67%	70%	70%	70%	65%	72%	70%	69%
		43%	19%	6%	20%	11%	21%	20%	19%	24%	23%	23%	24%	31%	61%	38%
Lean Coop	47	23	10	3	6	5	11	8	9	13	6	13	13	15	33	14
	8%	9%	9%	10%	5%	8%	9%	7%	8%	9%	4%	10%	9%	8%	9%	6%
		49%	21%	6%	13%	11%	23%	17%	19%	28%	13%	28%	28%	32%	70%	30%
Lean opponents	17	7	7	0	2	1	2	4	5	5	4	4	6	3	10	7
	3%	3%	6%	0%	2%	2%	2%	3%	4%	4%	3%	3%	4%	2%	3%	3%
		41%	41%	0%	12%	6%	12%	24%	29%	29%	24%	24%	35%	18%	59%	41%
Opponents	73	34	9	1	23	6	12	13	17	12	22	13	20	18	38	34
	12%	13%	8%	3%	18%	9%	10%	11%	14%	8%	16%	10%	13%	10%	10%	15%
		47%	12%	1%	32%	8%	16%	18%	23%	16%	30%	18%	27%	25%	52%	47%
Undecided	41	19	8	1	7	6	11	7	8	11	8	10	11	12	25	16
	7%	7%	7%	3%	6%	9%	9%	6%	7%	8%	6%	7%	7%	7%	7%	7%
		46%	20%	2%	17%	15%	27%	17%	20%	27%	20%	24%	27%	29%	61%	39%
REF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DK	6	3	0	0	2	1	2	1	0	1	1	0	2	3	5	1
	1%	1%	0%	0%	2%	2%	2%	1%	0%	1%	1%	0%	1%	2%	1%	0%
		50%	0%	0%	33%	17%	33%	17%	0%	17%	17%	0%	33%	50%	83%	17%
Mean	1.83	1.88	1.72	1.33	1.95	1.83	1.86	1.77	1.86	1.77	1.87	1.74	1.94	1.79	1.81	1.87
Chi Square		21.16 .388					7.12 .954				10.93 .757				5.05 .409	

Table 8c: STATEMENT A OR STATEMENT B -- Opponents say that alternative energy sources, like wind or solar power, could take care of much of the problem. They want the cooperative to build enough alternative energy sources in the area to reduce the need for a new line and say that would be positive for the environment as well. The cooperative says that renewable energy would not solve the reliability and power quality problems caused by having only one line into the area, would not provide enough electricity when it is needed, would be only a short term fix and would be far more expensive, a statement with which an independent study on the matter has agreed.

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
Coop	416 69%	162 68% 39%	204 70% 49%	50 70% 12%	378 73% 91%	38 48% 9%	323 84% 78%	15 25% 4%	78 50% 19%	392 81% 94%	11 17% 3%	13 25% 3%	139 69% 33%	167 71% 40%	58 69% 14%	39 65% 9%
Lean Coop	47 8%	19 8% 40%	22 8% 47%	6 8% 13%	38 7% 81%	9 11% 19%	23 6% 49%	3 5% 6%	21 13% 45%	39 8% 83%	2 3% 4%	6 12% 13%	18 9% 38%	18 8% 38%	7 8% 15%	2 3% 4%
Lean opponents	17 3%	8 3% 47%	8 3% 47%	1 1% 6%	12 2% 71%	5 6% 29%	2 1% 12%	5 8% 29%	10 6% 59%	8 2% 47%	6 10% 35%	3 6% 18%	5 2% 29%	7 3% 41%	2 2% 12%	3 5% 18%
Opponents	73 12%	29 12% 40%	35 12% 48%	9 13% 12%	49 9% 67%	20 25% 27%	20 5% 27%	30 50% 41%	23 15% 32%	22 5% 30%	40 63% 55%	11 22% 15%	22 11% 30%	24 10% 33%	11 13% 15%	10 17% 14%
Undecided	41 7%	14 6% 34%	22 8% 54%	5 7% 12%	35 7% 85%	6 8% 15%	13 3% 32%	7 12% 17%	21 13% 51%	22 5% 54%	3 5% 7%	16 31% 39%	13 6% 32%	17 7% 41%	6 7% 15%	5 8% 12%
REF	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	6 1%	6 3% 100%	0 0% 0%	0 0% 0%	5 1% 83%	1 1% 17%	3 1% 50%	0 0% 0%	3 2% 50%	3 1% 50%	1 2% 17%	2 4% 33%	4 2% 67%	1 0% 17%	0 0% 0%	1 2% 17%
Mean	1.83	1.90	1.79	1.77	1.73	2.38	1.41	3.18	2.36	1.47	3.41	3.37	1.85	1.76	1.81	2.07
Chi Square		10.60 .389			26.40 .001		174.40 .001			282.23 .001			9.20 .867			

Table 9: STATEMENT A OR STATEMENT B -- Opponents of the Sonoita/ Elgin/ Patagonia line asked the Arizona Corporate Commission, which regulates electric utilities, to order Sulphur Springs Valley Electric Cooperative to conduct an independent, third party study of the alternatives to building a new feeder line, including wind and solar power. That study has just been completed and found that the proposed new feeder line is the most realistic, affordable and long term way to solve the reliability and power quality problems. Opponents are expected to criticize the study or ask for more studies of the various alternatives. The cooperative says that further delays will significantly increase costs to put in the new line to the Sonoita/ Elgin/ Patagonia area and that such cost increases are unfair to all other ratepayers who have to pay for the new line.

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
Coop	461 77%	247 82% 54%	214 72% 46%	90 74% 20%	169 76% 37%	197 79% 43%	351 77% 76%	78 81% 17%	32 63% 7%	92 72% 20%	369 78% 80%	69 65% 15%	113 80% 25%	88 78% 19%	112 88% 24%	79 71% 17%
Lean Coop	34 6%	12 4% 35%	22 7% 65%	11 9% 32%	13 6% 38%	10 4% 29%	26 6% 76%	5 5% 15%	3 6% 9%	4 3% 12%	30 6% 88%	5 5% 15%	10 7% 29%	9 8% 26%	5 4% 15%	5 5% 15%
Lean opponents	12 2%	6 2% 50%	6 2% 50%	1 1% 8%	4 2% 33%	7 3% 58%	10 2% 83%	1 1% 8%	1 2% 8%	2 2% 17%	10 2% 83%	3 3% 25%	3 2% 25%	1 1% 8%	2 2% 17%	3 3% 25%
Opponents	62 10%	28 9% 45%	33 11% 53%	9 7% 15%	27 12% 44%	22 9% 35%	45 10% 73%	6 6% 10%	11 22% 18%	19 15% 31%	42 9% 68%	17 16% 27%	12 8% 19%	9 8% 15%	7 5% 11%	17 15% 27%
Undecided	25 4%	6 2% 24%	19 6% 76%	8 7% 32%	6 3% 24%	10 4% 40%	16 4% 64%	5 5% 20%	4 8% 16%	5 4% 20%	20 4% 80%	11 10% 44%	1 1% 4%	4 4% 16%	2 2% 8%	7 6% 28%
REF	1 0%	1 0% 100%	0 0% 0%	0 0% 0%	0 0% 0%	1 0% 100%	1 0% 100%	0 0% 0%	0 0% 0%	0 0% 0%	1 0% 100%	0 0% 0%	1 1% 100%	0 0% 0%	0 0% 0%	0 0% 0%
DK	5 1%	0 0% 0%	5 2% 100%	2 2% 40%	2 1% 40%	1 0% 20%	4 1% 80%	1 1% 20%	0 0% 0%	5 4% 100%	0 0% 0%	1 1% 20%	2 1% 40%	2 2% 40%	0 0% 0%	0 0% 0%
Mean	1.63	1.46	1.80	1.69	1.62	1.57	1.60	1.53	2.06	1.91	1.55	2.06	1.51	1.58	1.30	1.81
Chi Square		18.47 .005		13.63 .325			13.17 .357			24.87 .001		42.88 .010				

Table 9b: STATEMENT A OR STATEMENT B -- Opponents of the Sonoita/ Elgin/ Patagonia line asked the Arizona Corporate Commission, which regulates electric utilities, to order Sulphur Springs Valley Electric Cooperative to conduct an independent, third party study of the alternatives to building a new feeder line, including wind and solar power. That study has just been completed and found that the proposed new feeder line is the most realistic, affordable and long term way to solve the reliability and power quality problems. Opponents are expected to criticize the study or ask for more studies of the various alternatives. The cooperative says that further delays will significantly increase costs to put in the new line to the Sonoita/ Elgin/ Patagonia area and that such cost increases are unfair to all other ratepayers who have to pay for the new line.

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
Coop	461 77%	207 78% 45%	88 77% 19%	25 83% 5%	90 72% 20%	51 77% 11%	95 76% 21%	93 81% 20%	87 74% 19%	110 77% 24%	100 74% 22%	106 79% 23%	114 76% 25%	141 79% 31%	289 79% 63%	170 74% 37%
Lean Coop	34 6%	18 7% 53%	5 4% 15%	2 7% 6%	5 4% 15%	4 6% 12%	9 7% 26%	3 3% 9%	11 9% 32%	8 6% 24%	8 6% 24%	8 6% 24%	5 3% 15%	13 7% 38%	23 6% 68%	11 5% 32%
Lean opponents	12 2%	5 2% 42%	5 4% 42%	0 0% 0%	2 2% 17%	0 0% 0%	1 . 1% 8%	4 3% 33%	2 2% 17%	4 3% 33%	4 3% 33%	1 1% 8%	4 3% 33%	3 2% 25%	9 2% 75%	3 1% 25%
Opponents	62 10%	21 8% 34%	13 11% 21%	3 10% 5%	18 14% 29%	7 11% 11%	14 11% 23%	11 10% 18%	10 8% 16%	13 9% 21%	20 15% 32%	11 8% 18%	18 12% 29%	13 7% 21%	31 8% 50%	30 13% 48%
Undecided	25 4%	12 5% 48%	4 3% 16%	0 0% 0%	5 4% 20%	4 6% 16%	5 4% 20%	4 3% 16%	7 6% 28%	6 4% 24%	4 3% 16%	9 7% 36%	7 5% 28%	5 3% 20%	11 3% 44%	14 6% 56%
REF	1 0%	1 0% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 100%	0 0% 0%	0 0% 0%	1 1% 100%	0 0% 0%	1 0% 100%	0 0% 0%
DK	5 1%	0 0% 0%	0 0% 0%	0 0% 0%	5 4% 100%	0 0% 0%	1 1% 20%	0 0% 0%	1 1% 20%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 20%	4 2% 80%	1 0% 20%	3 1% 60%
Mean	1.63	1.55	1.61	1.37	1.90	1.62	1.63	1.52	1.67	1.59	1.68	1.59	1.71	1.57	1.52	1.78
Chi Square		33.37 .096					13.35 .771				22.84 .197				10.89 .092	

Prepared by RBI Strategies and Research

Table 9c: STATEMENT A OR STATEMENT B -- Opponents of the Sonoita/ Elgin/ Patagonia line asked the Arizona Corporate Commission, which regulates electric utilities, to order Sulphur Springs Valley Electric Cooperative to conduct an independent, third party study of the alternatives to building a new feeder line, including wind and solar power. That study has just been completed and found that the proposed new feeder line is the most realistic, affordable and long term way to solve the reliability and power quality problems. Opponents are expected to criticize the study or ask for more studies of the various alternatives. The cooperative says that further delays will significantly increase costs to put in the new line to the Sonoita/ Elgin/ Patagonia area and that such cost increases are unfair to all other ratepayers who have to pay for the new line.

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propan e	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
Coop	461 77%	180 76% 39%	234 80% 51%	47 66% 10%	415 80% 90%	45 57% 10%	347 90% 75%	16 27% 3%	98 63% 21%	434 89% 94%	7 11% 2%	20 39% 4%	159 79% 34%	189 81% 41%	62 74% 13%	39 65% 8%
Lean Coop	34 6%	15 6% 44%	10 3% 29%	9 13% 26%	24 5% 71%	10 13% 29%	11 3% 32%	3 5% 9%	20 13% 59%	23 5% 68%	3 5% 9%	8 16% 24%	14 7% 41%	13 6% 38%	3 4% 9%	3 5% 9%
Lean opponents	12 2%	5 2% 42%	7 2% 58%	0 0% 0%	8 2% 67%	4 5% 33%	5 1% 42%	5 8% 42%	2 1% 17%	7 1% 58%	2 3% 17%	3 6% 25%	6 3% 50%	4 2% 33%	2 2% 17%	0 0% 0%
Opponents	62 10%	23 10% 37%	27 9% 44%	12 17% 19%	44 9% 71%	16 20% 26%	13 3% 21%	30 50% 48%	19 12% 31%	12 2% 19%	43 68% 69%	7 14% 11%	18 9% 29%	16 7% 26%	11 13% 18%	10 17% 16%
Undecided	25 4%	11 5% 44%	11 4% 44%	3 4% 12%	22 4% 88%	2 3% 8%	5 1% 20%	4 7% 16%	16 10% 64%	9 2% 36%	4 6% 16%	12 24% 48%	3 1% 12%	11 5% 44%	5 6% 20%	5 8% 20%
REF	1 0%	0 0% 0%	1 0% 100%	0 0% 0%	1 0% 100%	0 0% 0%	1 0% 100%	0 0% 0%	0 0% 0%	0 0% 0%	1 2% 100%	0 0% 0%	0 0% 0%	1 0% 100%	0 0% 0%	0 0% 0%
DK	5 1%	4 2% 80%	1 0% 20%	0 0% 0%	3 1% 60%	2 3% 40%	2 1% 40%	2 3% 40%	1 1% 20%	1 0% 20%	3 5% 60%	1 2% 20%	1 0% 20%	0 0% 0%	1 1% 20%	3 5% 60%
Mean	1.63	1.68	1.55	1.80	1.55	2.09	1.25	3.18	1.97	1.24	3.78	2.75	1.49	1.50	1.79	2.18
Chi Square		20.27 .062			29.91 .001		203.36 .001			379.87 .001			34.06 .012			

A Survey of Sulphur Springs Valley Electric Cooperative Members

Table 10: Sometimes, over the course of a survey like this one, with more information, people change their minds. Do you think the new power line to the Sonoita/ Elgin/ Patagonia area should be allowed to be built or not?

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
Strong build	394 66%	220 73% 56%	174 58% 44%	77 64% 20%	141 64% 36%	173 70% 44%	302 67% 77%	63 66% 16%	29 57% 7%	80 63% 20%	314 67% 80%	60 57% 15%	97 68% 25%	79 70% 20%	97 76% 25%	61 55% 15%
SW build	74 12%	28 9% 38%	46 15% 62%	19 16% 26%	27 12% 36%	26 10% 35%	54 12% 73%	12 13% 16%	8 16% 11%	9 7% 12%	65 14% 88%	18 17% 24%	19 13% 26%	15 13% 20%	9 7% 12%	13 12% 18%
Lean build	18 3%	8 3% 44%	10 3% 56%	7 6% 39%	8 4% 44%	3 1% 17%	12 3% 67%	5 5% 28%	1 2% 6%	3 2% 17%	15 3% 83%	1 1% 6%	2 1% 11%	5 4% 28%	6 5% 33%	4 4% 22%
Lean not build	7 1%	4 1% 57%	2 1% 29%	1 1% 14%	2 1% 29%	2 1% 29%	5 1% 71%	1 1% 14%	1 2% 14%	3 2% 43%	3 1% 43%	2 2% 29%	2 1% 29%	1 1% 14%	1 1% 14%	1 1% 14%
SW not build	7 1%	2 1% 29%	5 2% 71%	3 2% 43%	2 1% 29%	2 1% 29%	3 1% 43%	2 2% 29%	2 4% 29%	3 2% 43%	4 1% 57%	2 2% 29%	3 2% 43%	0 0% 0%	0 0% 0%	2 2% 29%
Strong not build	49 8%	20 7% 41%	29 10% 59%	6 5% 12%	23 10% 47%	18 7% 37%	36 8% 73%	6 6% 12%	7 14% 14%	23 18% 47%	26 6% 53%	12 11% 24%	11 8% 22%	5 4% 10%	7 5% 14%	14 13% 29%
Undecided	49 8%	17 6% 35%	32 11% 65%	7 6% 14%	17 8% 35%	24 10% 49%	39 9% 80%	7 7% 14%	3 6% 6%	6 5% 12%	43 9% 88%	11 10% 22%	8 6% 16%	8 7% 16%	7 5% 14%	15 14% 31%
REF	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	2 0%	1 0% 50%	1 0% 50%	1 1% 50%	1 0% 50%	0 0% 0%	2 0% 100%	0 0% 0%	0 0% 0%	0 0% 0%	2 0% 100%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 50%	1 1% 50%

Table 10: Sometimes, over the course of a survey like this one, with more information, people change their minds. Do you think the new power line to the Sonoita/ Elgin/ Patagonia area should be allowed to be built or not?

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
Mean	2.19	1.91	2.46	2.06	2.28	2.13	2.18	2.09	2.45	2.47	2.11	2.51	2.01	1.89	1.85	2.80
Chi Square		18.17 .011		17.28 .242			11.99 .607			31.29 .001		38.22 .094				

Prepared by RBI Strategies and Research

Table 10b: Sometimes, over the course of a survey like this one, with more information, people change their minds. Do you think the new power line to the Sonoita/ Elgin/ Patagonia area should be allowed to be built or not?

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
Strong build	394 66%	180 68% 46%	74 64% 19%	23 77% 6%	78 62% 20%	39 59% 10%	83 66% 21%	72 63% 18%	78 66% 20%	94 66% 24%	88 65% 22%	90 67% 23%	95 63% 24%	121 68% 31%	244 67% 62%	148 64% 38%
SW build	74 12%	33 13% 45%	16 14% 22%	4 13% 5%	9 7% 12%	12 18% 16%	21 17% 28%	15 13% 20%	15 13% 20%	17 12% 23%	13 10% 18%	20 15% 27%	18 12% 24%	23 13% 31%	46 13% 62%	27 12% 36%
Lean build	18 3%	11 4% 61%	3 3% 17%	0 0% 0%	3 2% 17%	1 2% 6%	4 3% 22%	4 3% 22%	4 3% 22%	4 3% 22%	4 3% 22%	4 3% 22%	4 3% 22%	6 3% 33%	13 4% 72%	5 2% 28%
Lean not build	7 1%	2 1% 29%	2 2% 29%	0 0% 0%	3 2% 43%	0 0% 0%	2 2% 29%	1 1% 14%	0 0% 0%	1 1% 14%	1 1% 14%	1 1% 14%	1 1% 14%	4 2% 57%	4 1% 57%	3 1% 43%
SW not build	7 1%	2 1% 29%	2 2% 29%	0 0% 0%	3 2% 43%	0 0% 0%	1 1% 14%	1 1% 14%	1 1% 14%	1 1% 14%	3 2% 43%	2 1% 29%	2 1% 29%	0 0% 0%	3 1% 43%	4 2% 57%
Strong not build	49 8%	12 5% 24%	8 7% 16%	1 3% 2%	22 18% 45%	6 9% 12%	5 4% 10%	8 7% 16%	11 9% 22%	11 8% 22%	13 10% 27%	5 4% 10%	16 11% 33%	15 8% 31%	24 7% 49%	24 10% 49%
Undecided	49 8%	22 8% 45%	10 9% 20%	2 7% 4%	7 6% 14%	8 12% 16%	9 7% 18%	12 10% 24%	9 8% 18%	14 10% 29%	14 10% 29%	13 10% 27%	13 9% 27%	9 5% 18%	29 8% 59%	20 9% 41%
REF	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	2 0%	2 1% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	2 2% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 50%	1 1% 50%	2 1% 100%	0 0% 0%
Mean	2.19	2.05	2.18	1.70	2.50	2.39	1.94	2.37	2.15	2.20	2.36	2.05	2.35	2.03	2.11	2.31
Chi Square		39.88 .068					13.99 .870				17.73 .666				6.13 .524	

Table 10c: Sometimes, over the course of a survey like this one, with more information, people change their minds. Do you think the new power line to the Sonoita/ Elgin/ Patagonia area should be allowed to be built or not?

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
Strong build	394 66%	153 64% 39%	200 69% 51%	41 58% 10%	359 69% 91%	34 43% 9%	321 84% 81%	9 15% 2%	64 41% 16%	394 81% 100%	0 0% 0%	0 0% 0%	135 67% 34%	162 69% 41%	51 61% 13%	36 60% 9%
SW build	74 12%	32 13% 43%	30 10% 41%	12 17% 16%	60 12% 81%	14 18% 19%	40 10% 54%	2 3% 3%	32 21% 43%	74 15% 100%	0 0% 0%	0 0% 0%	27 13% 36%	29 12% 39%	9 11% 12%	7 12% 9%
Lean build	18 3%	12 5% 67%	3 1% 17%	3 4% 17%	15 3% 83%	3 4% 17%	5 1% 28%	1 2% 6%	12 8% 67%	18 4% 100%	0 0% 0%	0 0% 0%	8 4% 44%	7 3% 39%	2 2% 11%	0 0% 0%
Lean not build	7 1%	4 2% 57%	3 1% 43%	0 0% 0%	5 1% 71%	1 1% 14%	3 1% 43%	1 2% 14%	3 2% 43%	0 0% 0%	7 11% 100%	0 0% 0%	2 1% 29%	2 1% 29%	0 0% 0%	3 5% 43%
SW not build	7 1%	2 1% 29%	3 1% 43%	2 3% 29%	4 1% 57%	2 3% 29%	2 1% 29%	2 3% 29%	3 2% 43%	0 0% 0%	7 11% 100%	0 0% 0%	1 0% 14%	4 2% 57%	0 0% 0%	1 2% 14%
Strong not build	49 8%	17 7% 35%	24 8% 49%	8 11% 16%	34 7% 69%	14 18% 29%	4 1% 8%	34 57% 69%	11 7% 22%	0 0% 0%	49 78% 100%	0 0% 0%	11 5% 22%	11 5% 22%	10 12% 20%	10 17% 20%
Undecided	49 8%	17 7% 35%	28 10% 57%	4 6% 8%	39 8% 80%	10 13% 20%	8 2% 16%	11 18% 22%	30 19% 61%	0 0% 0%	0 0% 0%	49 96% 100%	17 8% 35%	18 8% 37%	11 13% 22%	3 5% 6%
REF	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	2 0%	1 0% 50%	0 0% 0%	1 1% 50%	1 0% 50%	1 1% 50%	1 0% 50%	0 0% 0%	1 1% 50%	0 0% 0%	0 0% 0%	2 4% 100%	0 0% 0%	1 0% 50%	1 1% 50%	0 0% 0%
Mean	2.19	2.14	2.19	2.38	2.03	3.14	1.37	5.18	3.05	1.23	5.67	7.08	2.04	2.01	2.63	2.47
Chi Square		20.57 .113			26.75 .001		337.66 .001			1000+ .001			33.86 .037			

Table 11: What is the primary way you heat your home -- do you heat your home with electric heat, natural gas, propane, wood, solar, or something else?

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
Electric heat	201 34%	106 35% 53%	95 32% 47%	46 38% 23%	75 34% 37%	77 31% 38%	149 33% 74%	33 34% 16%	19 37% 9%	49 39% 24%	152 32% 76%	32 30% 16%	46 32% 23%	43 38% 21%	41 32% 20%	39 35% 19%
Natural gas	234 39%	111 37% 47%	123 41% 53%	48 40% 21%	76 34% 32%	107 43% 46%	180 40% 77%	35 36% 15%	19 37% 8%	21 17% 9%	213 45% 91%	36 34% 15%	56 39% 24%	44 39% 19%	55 43% 24%	43 39% 18%
Propane	84 14%	43 14% 51%	41 14% 49%	9 7% 11%	34 15% 40%	40 16% 48%	65 14% 77%	14 15% 17%	5 10% 6%	24 19% 29%	60 13% 71%	13 12% 15%	20 14% 24%	12 11% 14%	20 16% 24%	19 17% 23%
Wood	60 10%	30 10% 50%	29 10% 48%	11 9% 18%	31 14% 52%	16 6% 27%	44 10% 73%	11 11% 18%	5 10% 8%	29 23% 48%	30 6% 50%	17 16% 28%	15 11% 25%	12 11% 20%	10 8% 17%	6 5% 10%
Solar	2 0%	2 1% 100%	0 0% 0%	1 1% 50%	0 0% 0%	1 0% 50%	1 0% 50%	1 1% 50%	0 0% 0%	1 1% 50%	1 0% 50%	0 0% 0%	1 1% 50%	1 1% 50%	0 0% 0%	0 0% 0%
Something else	13 2%	6 2% 46%	7 2% 54%	3 2% 23%	4 2% 31%	6 2% 46%	12 3% 92%	0 0% 0%	1 2% 8%	1 1% 8%	12 3% 92%	6 6% 46%	3 2% 23%	1 1% 8%	1 1% 8%	2 2% 15%
REF	2 0%	2 1% 100%	0 0% 0%	1 1% 50%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	2 4% 100%	0 0% 0%	2 0% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	2 2% 100%
DK	4 1%	0 0% 0%	4 1% 100%	2 2% 50%	1 0% 25%	1 0% 25%	2 0% 50%	2 2% 50%	0 0% 0%	2 2% 50%	2 0% 50%	2 2% 50%	1 1% 25%	0 0% 0%	1 1% 25%	0 0% 0%
Mean	2.16	2.12	2.19	2.14	2.19	2.11	2.15	2.19	2.20	2.41	2.09	2.48	2.18	2.00	2.07	2.09
Chi Square		9.36 .228		23.09 .059			30.96 .006			57.41 .001		35.06 .168				

Prepared by RBI Strategies and Research

Table 11b: What is the primary way you heat your home -- do you heat your home with electric heat, natural gas, propane, wood, solar, or something else?

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
Electric heat	201 34%	77 29% 38%	42 37% 21%	12 40% 6%	47 38% 23%	23 35% 11%	48 38% 24%	40 35% 20%	31 26% 15%	38 27% 19%	38 28% 19%	28 21% 14%	44 29% 22%	91 51% 45%	138 38% 69%	63 27% 31%
Natural gas	234 39%	148 56% 63%	38 33% 16%	10 33% 4%	22 18% 9%	16 24% 7%	52 42% 22%	53 46% 23%	54 46% 23%	61 43% 26%	64 47% 27%	72 53% 31%	60 40% 26%	38 21% 16%	148 41% 63%	85 37% 36%
Propane	84 14%	23 9% 27%	21 18% 25%	4 13% 5%	23 18% 27%	13 20% 15%	9 7% 11%	15 13% 18%	21 18% 25%	24 17% 29%	21 15% 25%	15 11% 18%	25 17% 30%	23 13% 27%	46 13% 55%	37 16% 44%
Wood	60 10%	8 3% 13%	8 7% 13%	3 10% 5%	29 23% 48%	12 18% 20%	8 6% 13%	3 3% 5%	10 8% 17%	14 10% 23%	8 6% 13%	17 13% 28%	14 9% 23%	21 12% 35%	21 6% 35%	39 17% 65%
Solar	2 0%	1 0% 50%	0 0% 0%	0 0% 0%	1 1% 50%	0 0% 0%	1 1% 50%	0 0% 0%	0 0% 0%	1 1% 50%	1 1% 50%	0 0% 0%	0 0% 0%	1 1% 50%	1 0% 50%	1 0% 50%
Something else	13 2%	4 2% 31%	5 4% 38%	1 3% 8%	1 1% 8%	2 3% 15%	5 4% 38%	3 3% 23%	2 2% 15%	3 2% 23%	2 1% 15%	1 1% 8%	5 3% 38%	5 3% 38%	7 2% 54%	6 3% 46%
REF	2 0%	1 0% 50%	1 1% 50%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 50%	0 0% 0%	0 0% 0%	1 1% 50%	2 1% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	4 1%	2 1% 50%	0 0% 0%	0 0% 0%	2 2% 50%	0 0% 0%	1 1% 25%	1 1% 25%	0 0% 0%	0 0% 0%	0 0% 0%	2 1% 50%	2 1% 50%	0 0% 0%	4 1% 100%	0 0% 0%
Mean	2.16	1.99	2.17	2.07	2.42	2.33	2.09	1.99	2.15	2.24	2.15	2.27	2.27	1.98	2.01	2.34
Chi Square		103.20 .001					23.47 .319				70.31 .001				26.69 .001	

A Survey of Sulphur Springs Valley Electric Cooperative Members

Table 11c: What is the primary way you heat your home -- do you heat your home with electric heat, natural gas, propane, wood, solar, or something else?

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
Electric heat	201 34%	79 33% 39%	92 32% 46%	30 42% 15%	171 33% 85%	30 38% 15%	128 33% 64%	17 28% 8%	56 36% 28%	170 35% 85%	14 22% 7%	17 33% 8%	201 100% 100%	0 0% 0%	0 0% 0%	0 0% 0%
Natural gas	234 39%	97 41% 41%	115 40% 49%	22 31% 9%	209 40% 89%	23 29% 10%	162 42% 69%	15 25% 6%	57 37% 24%	198 41% 85%	17 27% 7%	19 37% 8%	0 0% 0%	234 100% 100%	0 0% 0%	0 0% 0%
Propane	84 14%	25 11% 30%	52 18% 62%	7 10% 8%	70 14% 83%	13 16% 15%	51 13% 61%	13 22% 15%	20 13% 24%	62 13% 74%	10 16% 12%	12 24% 14%	0 0% 0%	0 0% 0%	84 100% 100%	0 0% 0%
Wood	60 10%	28 12% 47%	25 9% 42%	7 10% 12%	52 10% 87%	7 9% 12%	35 9% 58%	9 15% 15%	16 10% 27%	43 9% 72%	14 22% 23%	3 6% 5%	0 0% 0%	0 0% 0%	0 0% 0%	60 100% 100%
Solar	2 0%	1 0% 50%	1 0% 50%	0 0% 0%	1 0% 50%	1 1% 50%	0 0% 0%	2 3% 100%	0 0% 0%	1 0% 50%	1 2% 50%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
Something else	13 2%	6 3% 46%	5 2% 38%	2 3% 15%	11 2% 85%	2 3% 15%	4 1% 31%	3 5% 23%	6 4% 46%	8 2% 62%	5 8% 38%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
REF	2 0%	1 0% 50%	0 0% 0%	1 1% 50%	1 0% 50%	1 1% 50%	1 0% 50%	0 0% 0%	1 1% 50%	1 0% 50%	1 2% 50%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	4 1%	1 0% 25%	1 0% 25%	2 3% 50%	2 0% 50%	2 3% 50%	3 1% 75%	1 2% 25%	0 0% 0%	3 1% 75%	1 2% 25%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
Mean	2.16	2.17	2.13	2.23	2.13	2.32	2.08	2.63	2.16	2.07	2.92	2.02	1.00	2.00	3.00	4.00
Chi Square		20.62 .112			12.70 .080		36.85 .001			39.69 .001			1000+ .001			

Prepared by RBI Strategies and Research

Table 12: About how many years old is your electric heating system?

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	202	106 52%	95 47%	46 23%	75 37%	77 38%	149 74%	34 17%	19 9%	49 24%	152 75%	32 16%	47 23%	43 21%	41 20%	39 19%
Several months	9 4%	8 8% 89%	1 1% 11%	2 4% 22%	5 7% 56%	2 3% 22%	5 3% 56%	2 6% 22%	2 11% 22%	2 4% 22%	7 5% 78%	2 6% 22%	3 6% 33%	2 5% 22%	2 5% 22%	0 0% 0%
About a year	20 10%	10 9% 50%	10 11% 50%	2 4% 10%	11 15% 55%	6 8% 30%	16 11% 80%	3 9% 15%	1 5% 5%	6 12% 30%	14 9% 70%	2 6% 10%	4 9% 20%	5 12% 25%	4 10% 20%	5 13% 25%
Between a year and 3 years	43 21%	25 24% 58%	18 19% 42%	12 26% 28%	13 17% 30%	18 23% 42%	36 24% 84%	5 15% 12%	2 11% 5%	9 18% 21%	34 22% 79%	2 6% 5%	13 28% 30%	9 21% 21%	10 24% 23%	9 23% 21%
Older than 4 years	102 50%	50 47% 49%	52 55% 51%	18 39% 18%	37 49% 36%	45 58% 44%	75 50% 74%	17 50% 17%	10 53% 10%	31 63% 30%	71 47% 70%	20 63% 20%	21 45% 21%	22 51% 22%	20 49% 20%	19 49% 19%
Unsure	23 11%	11 10% 48%	12 13% 52%	10 22% 43%	7 9% 30%	6 8% 26%	16 11% 70%	4 12% 17%	3 16% 13%	1 2% 4%	22 14% 96%	6 19% 26%	5 11% 22%	5 12% 22%	3 7% 13%	4 10% 17%
REF	1 0%	0 0% 0%	1 1% 100%	0 0% 0%	1 1% 100%	0 0% 0%	0 0% 0%	1 3% 100%	0 0% 0%	0 0% 0%	1 1% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	1 3% 100%
DK	4 2%	2 2% 50%	1 1% 25%	2 4% 50%	1 1% 25%	0 0% 0%	1 1% 25%	2 6% 50%	1 5% 25%	0 0% 0%	3 2% 75%	0 0% 0%	1 2% 25%	0 0% 0%	2 5% 50%	1 3% 25%
Mean	3.64	3.51	3.75	3.87	3.49	3.61	3.57	3.85	3.79	3.47	3.67	3.81	3.53	3.53	3.63	3.74
Chi Square		7.42 .284		18.93 .090			15.27 .227			8.94 .177		18.86 .760				

Table 12b: About how many years old is your electric heating system?

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	202	77 38%	43 21%	12 6%	47 23%	23 11%	49 24%	40 20%	31 15%	38 19%	38 19%	28 14%	44 22%	92 46%	138 68%	64 32%
Several months	9 4%	1 1% 11%	2 5% 22%	2 17% 22%	2 4% 22%	2 9% 22%	1 2% 11%	2 5% 22%	1 3% 11%	3 8% 33%	2 5% 22%	0 0% 0%	3 7% 33%	4 4% 44%	6 4% 67%	3 5% 33%
About a year	20 10%	7 9% 35%	3 7% 15%	0 0% 0%	6 13% 30%	4 17% 20%	4 8% 20%	1 3% 5%	3 10% 15%	7 18% 35%	2 5% 10%	4 14% 20%	3 7% 15%	11 12% 55%	14 10% 70%	6 9% 30%
Between a year and 3 years	43 21%	18 23% 42%	11 26% 26%	3 25% 7%	8 17% 19%	3 13% 7%	9 18% 21%	12 30% 28%	4 13% 9%	10 26% 23%	7 18% 16%	5 18% 12%	10 23% 23%	21 23% 49%	32 23% 74%	11 17% 26%
Older than 4 years	102 50%	37 48% 36%	20 47% 20%	5 42% 5%	30 64% 29%	10 43% 10%	18 37% 18%	20 50% 20%	21 68% 21%	15 39% 15%	21 55% 21%	14 50% 14%	23 52% 23%	44 48% 43%	68 49% 67%	34 53% 33%
Unsure	23 11%	11 14% 48%	5 12% 22%	2 17% 9%	1 2% 4%	4 17% 17%	14 29% 61%	4 10% 17%	2 6% 9%	2 5% 9%	6 16% 26%	4 14% 17%	5 11% 22%	8 9% 35%	16 12% 70%	7 11% 30%
REF	1 0%	0 0% 0%	1 2% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	1 3% 100%	0 0% 0%	1 4% 100%	0 0% 0%	0 0% 0%	0 0% 0%	1 2% 100%
DK	4 2%	3 4% 75%	1 2% 25%	0 0% 0%	0 0% 0%	0 0% 0%	3 6% 75%	1 3% 25%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	4 4% 100%	2 1% 50%	2 3% 50%
Mean	3.64	3.81	3.70	3.42	3.47	3.43	4.06	3.68	3.65	3.24	3.71	3.75	3.55	3.62	3.59	3.73
Chi Square		25.92 .357					33.23 .016				17.25 .506				3.70 .717	

Prepared by RBI Strategies and Research

Table 12c: About how many years old is your electric heating system?

A Survey of Sulphur Springs Valley Electric Cooperative Members

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
Base	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
	202	80	92	30	171	30	129	17	56	170	15	17	201	0	0	1
Several months	9	2	5	2	7	2	5	2	2	5	3	1	9	0	0	0
	4%	3%	5%	7%	4%	7%	4%	12%	4%	3%	20%	6%	4%	0%	0%	0%
About a year		22%	56%	22%	78%	22%	56%	22%	22%	56%	33%	11%	100%	0%	0%	0%
	20	7	10	3	19	1	16	0	4	18	2	0	20	0	0	0
Between a year and 3 years	10%	9%	11%	10%	11%	3%	12%	0%	7%	11%	13%	0%	10%	0%	0%	0%
		35%	50%	15%	95%	5%	80%	0%	20%	90%	10%	0%	100%	0%	0%	0%
	43	16	21	6	39	4	29	2	12	37	1	5	43	0	0	0
Older than 4 years	21%	20%	23%	20%	23%	13%	22%	12%	21%	22%	7%	29%	21%	0%	0%	0%
		37%	49%	14%	91%	9%	67%	5%	28%	86%	2%	12%	100%	0%	0%	0%
	102	43	49	10	84	18	63	11	28	85	8	9	102	0	0	0
Unsure	50%	54%	53%	33%	49%	60%	49%	65%	50%	50%	53%	53%	51%	0%	0%	0%
		42%	48%	10%	82%	18%	62%	11%	27%	83%	8%	9%	100%	0%	0%	0%
	23	10	6	7	19	4	14	2	7	21	0	2	23	0	0	0
REF	11%	13%	7%	23%	11%	13%	11%	12%	13%	12%	0%	12%	11%	0%	0%	0%
		43%	26%	30%	83%	17%	61%	9%	30%	91%	0%	9%	100%	0%	0%	0%
	1	0	1	0	1	0	0	0	1	1	0	0	1	0	0	0
DK	0%	0%	1%	0%	1%	0%	0%	0%	2%	1%	0%	0%	0%	0%	0%	0%
		0%	100%	0%	100%	0%	0%	0%	100%	100%	0%	0%	100%	0%	0%	0%
	4	2	0	2	2	1	2	0	3	1	0	0	0	0	0	1
Mean	2%	3%	0%	7%	1%	3%	2%	0%	4%	7%	0%	3%	0%	0%	0%	100%
		50%	0%	50%	50%	25%	50%	0%	50%	25%	0%	75%	0%	0%	0%	25%
Chi Square	3.64	3.75	3.48	3.83	3.58	3.83	3.57	3.65	3.80	3.67	3.27	3.65	3.62	0.00	0.00	7.00
		15.87			4.68		10.60			17.21			49.75			
		.197			.585		.563			.142			.001			

Prepared by RBI Strategies and Research

Table 13: Do you have a central air conditioning and heating system?

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
Yes	365 61%	197 66% 54%	168 56% 46%	72 60% 20%	138 62% 38%	150 60% 41%	286 63% 78%	48 50% 13%	31 61% 8%	69 54% 19%	296 63% 81%	51 48% 14%	80 56% 22%	67 59% 18%	98 77% 27%	69 62% 19%
No	231 39%	101 34% 44%	129 43% 56%	46 38% 20%	83 38% 36%	98 40% 42%	166 37% 72%	47 49% 20%	18 35% 8%	57 45% 25%	173 37% 75%	55 52% 24%	61 43% 26%	45 40% 19%	30 23% 13%	40 36% 17%
Unsure	1 0%	0 0% 0%	1 0% 100%	1 1% 100%	0 0% 0%	0 0% 0%	1 0% 100%	0 0% 0%	0 0% 0%	0 0% 0%	1 0% 100%	0 0% 0%	0 0% 0%	1 1% 100%	0 0% 0%	0 0% 0%
REF	2 0%	2 1% 100%	0 0% 0%	1 1% 50%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	2 4% 100%	0 0% 0%	2 0% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	2 2% 100%
DK	1 0%	0 0% 0%	1 0% 100%	1 1% 100%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 100%	0 0% 0%	1 1% 100%	0 0% 0%	0 0% 0%	1 1% 100%	0 0% 0%	0 0% 0%	0 0% 0%
Mean	1.41	1.36	1.45	1.45	1.38	1.40	1.37	1.53	1.47	1.48	1.38	1.52	1.46	1.42	1.23	1.41
Chi Square		9.71 .046		11.88 .156			32.62 .001			7.44 .114		38.36 .001				

Prepared by RBI Strategies and Research

Table 13b: Do you have a central air conditioning and heating system?

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
Yes	365 61%	170 64% 47%	72 63% 20%	19 63% 5%	66 53% 18%	38 58% 10%	79 63% 22%	85 74% 23%	80 68% 22%	65 46% 18%	78 57% 21%	80 59% 22%	98 65% 27%	109 61% 30%	365 100% 100%	0 0% 0%
No	231 39%	93 35% 40%	41 36% 18%	11 37% 5%	58 46% 25%	28 42% 12%	43 34% 19%	30 26% 13%	38 32% 16%	76 54% 33%	56 41% 24%	54 40% 23%	52 35% 23%	69 39% 30%	0 0% 0%	231 100% 100%
Unsure	1 0%	0 0% 0%	1 1% 100%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
REF	2 0%	1 0% 50%	1 1% 50%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 50%	0 0% 0%	0 0% 0%	1 1% 50%	2 1% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	1 0%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 100%	0 0% 0%	1 1% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 100%	0 0% 0%	0 0% 0%
Mean	1.41	1.36	1.40	1.37	1.50	1.42	1.42	1.26	1.32	1.56	1.46	1.41	1.35	1.41	1.00	2.00
Chi Square		15.14 .515					32.07 .001				14.35 .279				596.00 .001	

Prepared by RBI Strategies and Research

Table 13c: Do you have a central air conditioning and heating system?

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
Yes	365 61%	149 63% 41%	176 60% 48%	40 56% 11%	321 62% 88%	43 54% 12%	241 63% 66%	33 55% 9%	91 58% 25%	303 62% 83%	31 49% 8%	31 61% 8%	138 69% 38%	148 63% 41%	46 55% 13%	21 35% 6%
No	231 39%	87 37% 38%	115 40% 50%	29 41% 13%	193 37% 84%	35 44% 15%	141 37% 61%	27 45% 12%	63 40% 27%	180 37% 78%	31 49% 13%	20 39% 9%	63 31% 27%	85 36% 37%	37 44% 16%	39 65% 17%
Unsure	1 0%	0 0% 0%	0 0% 0%	1 1% 100%	1 0% 100%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 100%	1 0% 100%	0 0% 0%	0 0% 0%	0 0% 0%	1 0% 100%	0 0% 0%	0 0% 0%
REF	2 0%	1 0% 50%	0 0% 0%	1 1% 50%	1 0% 50%	1 1% 50%	1 0% 50%	0 0% 0%	1 1% 50%	1 0% 50%	1 2% 50%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
DK	1 0%	1 0% 100%	0 0% 0%	0 0% 0%	1 0% 100%	0 0% 0%	1 0% 100%	0 0% 0%	0 0% 0%	1 0% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 100%	0 0% 0%
Mean	1.41	1.39	1.40	1.48	1.39	1.48	1.39	1.45	1.44	1.39	1.54	1.39	1.31	1.37	1.49	1.65
Chi Square		13.24 .104			4.18 .382		5.96 .651			7.58 .475			31.18 .002			

Table 18: Is your home in this area a seasonal residence or your primary residence?

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	599	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	95 16%	51 9%	127 21%	472 79%	106 18%	141 24%	113 19%	128 21%	111 19%
Primary	559 93%	276 92% 49%	283 95% 51%	119 98% 21%	210 95% 38%	226 91% 40%	420 93% 75%	94 99% 17%	45 88% 8%	118 93% 21%	441 93% 79%	103 97% 18%	129 91% 23%	105 93% 19%	120 94% 21%	102 92% 18%
Seasonal	33 6%	20 7% 61%	13 4% 39%	1 1% 3%	11 5% 33%	19 8% 58%	29 6% 88%	1 1% 3%	3 6% 9%	8 6% 24%	25 5% 76%	1 1% 3%	12 9% 36%	7 6% 21%	8 6% 24%	5 5% 15%
Both	4 1%	2 1% 50%	2 1% 50%	1 1% 25%	0 0% 0%	3 1% 75%	4 1% 100%	0 0% 0%	0 0% 0%	1 1% 25%	3 1% 75%	2 2% 50%	0 0% 0%	1 1% 25%	0 0% 0%	1 1% 25%
REF	3 1%	2 1% 67%	1 0% 33%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	3 6% 100%	0 0% 0%	3 1% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	3 3% 100%
DK	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
Mean	1.08	1.10	1.07	1.02	1.05	1.10	1.08	1.01	1.24	1.08	1.08	1.05	1.09	1.08	1.06	1.14
Chi Square		1.90 .593		10.34 .111			38.10 .001			1.03 .795		24.51 .017				

Table 18b: Is your home in this area a seasonal residence or your primary residence?

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	599	264 44%	114 19%	30 5%	125 21%	66 11%	124 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	178 30%	365 61%	230 38%
Primary	559 93%	248 94% 44%	104 91% 19%	29 97% 5%	116 93% 21%	62 94% 11%	110 89% 20%	105 91% 19%	114 97% 20%	137 96% 25%	114 84% 20%	125 93% 22%	143 95% 26%	177 99% 32%	342 94% 61%	214 93% 38%
Seasonal	33 6%	13 5% 39%	7 6% 21%	1 3% 3%	8 6% 24%	4 6% 12%	12 10% 36%	9 8% 27%	3 3% 9%	3 2% 9%	17 13% 52%	8 6% 24%	7 5% 21%	1 1% 3%	20 5% 61%	13 6% 39%
Both	4 1%	1 0% 25%	2 2% 50%	0 0% 0%	1 1% 25%	0 0% 0%	1 1% 25%	1 1% 25%	0 0% 0%	1 1% 25%	3 2% 75%	1 1% 25%	0 0% 0%	0 0% 0%	2 1% 50%	2 1% 50%
REF	3 1%	2 1% 67%	1 1% 33%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 33%	0 0% 0%	1 1% 33%	1 1% 33%	2 1% 67%	1 1% 33%	0 0% 0%	0 0% 0%	1 0% 33%	1 0% 33%
DK	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
Mean	1.08	1.08	1.12	1.03	1.08	1.06	1.14	1.10	1.05	1.06	1.21	1.10	1.05	1.01	1.07	1.09
Chi Square		5.62 .934					12.56 .183				33.68 .001				0.34 .952	

Prepared by RBI Strategies and Research

Table 18c: Is your home in this area a seasonal residence or your primary residence?

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	599	237 40%	291 49%	71 12%	517 86%	79 13%	383 64%	60 10%	156 26%	486 81%	62 10%	51 9%	201 34%	234 39%	84 14%	59 10%
Primary	559 93%	228 96% 41%	266 91% 48%	65 92% 12%	484 94% 87%	72 91% 13%	355 93% 64%	58 97% 10%	146 94% 26%	455 94% 81%	57 92% 10%	47 92% 8%	187 93% 33%	218 93% 39%	78 93% 14%	57 97% 10%
Seasonal	33 6%	7 3% 21%	23 8% 70%	3 4% 9%	27 5% 82%	6 8% 18%	23 6% 70%	2 3% 6%	8 5% 24%	26 5% 79%	4 6% 12%	3 6% 9%	12 6% 36%	14 6% 42%	5 6% 15%	2 3% 6%
Both	4 1%	2 1% 50%	2 1% 50%	0 0% 0%	4 1% 100%	0 0% 0%	4 1% 100%	0 0% 0%	0 0% 0%	4 1% 100%	0 0% 0%	0 0% 0%	1 0% 25%	1 0% 25%	1 1% 25%	0 0% 0%
REF	3 1%	0 0% 0%	0 0% 0%	3 4% 100%	2 0% 67%	1 1% 33%	1 0% 33%	0 0% 0%	2 1% 67%	1 0% 33%	1 2% 33%	1 2% 33%	1 0% 33%	1 0% 33%	0 0% 0%	0 0% 0%
DK	0 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
Mean	1.08	1.05	1.09	1.17	1.08	1.11	1.09	1.03	1.09	1.08	1.11	1.12	1.08	1.08	1.08	1.03
Chi Square		29.30 .001			2.40 .493		5.71 .456			5.64 .465			2.44 .982			

Prepared by RBI Strategies and Research

Table 19: Age

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	599	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	95 16%	51 9%	127 21%	472 79%	106 18%	141 24%	113 19%	128 21%	111 19%
18-34	71 12%	34 11% 48%	37 12% 52%	71 59% 100%	0 0% 0%	0 0% 0%	47 10% 66%	20 21% 28%	4 8% 6%	6 5% 8%	65 14% 92%	16 15% 23%	19 13% 27%	16 14% 23%	13 10% 18%	7 6% 10%
35-44	50 8%	29 10% 58%	21 7% 42%	50 41% 100%	0 0% 0%	0 0% 0%	32 7% 64%	13 14% 26%	5 10% 10%	9 7% 18%	41 9% 82%	3 3% 6%	13 9% 26%	16 14% 32%	15 12% 30%	3 3% 6%
45-54	93 16%	48 16% 52%	45 15% 48%	0 0% 0%	93 42% 100%	0 0% 0%	68 15% 73%	18 19% 19%	7 14% 8%	24 19% 26%	69 15% 74%	10 9% 11%	20 14% 22%	16 14% 17%	33 26% 35%	14 13% 15%
55-64	128 21%	58 19% 45%	70 23% 55%	0 0% 0%	128 58% 100%	0 0% 0%	103 23% 80%	14 15% 11%	11 22% 9%	36 28% 28%	92 19% 72%	21 20% 16%	30 21% 23%	22 19% 17%	38 30% 30%	17 15% 13%
65+	248 41%	127 42% 51%	121 40% 49%	0 0% 0%	0 0% 0%	248 100% 100%	201 44% 81%	29 31% 12%	18 35% 7%	49 39% 20%	199 42% 80%	56 53% 23%	59 42% 24%	42 37% 17%	29 23% 12%	62 56% 25%
REF	6 1%	2 1% 33%	4 1% 67%	0 0% 0%	0 0% 0%	0 0% 0%	2 0% 33%	1 1% 17%	3 6% 50%	1 1% 17%	5 1% 83%	0 0% 0%	0 0% 0%	1 1% 17%	0 0% 0%	5 5% 83%
DK	3 1%	2 1% 67%	1 0% 33%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	3 6% 100%	2 2% 67%	1 0% 33%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	3 3% 100%
Mean	3.77	3.76	3.78	1.41	3.58	5.00	3.85	3.23	4.08	3.98	3.72	3.92	3.69	3.54	3.43	4.36
Chi Square		3.77 .707		1000+ .001			65.75 .001			16.16 .013		88.83 .001				

Table 19b: Age

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	599	264	114	30	125	66	124	115	118	142	136	135	150	178	365	230
		44%	19%	5%	21%	11%	21%	19%	20%	24%	23%	23%	25%	30%	61%	38%
18-34	71	45	14	4	6	2	42	17	7	0	13	22	16	20	44	24
	12%	17%	12%	13%	5%	3%	34%	15%	6%	0%	10%	16%	11%	11%	12%	10%
		63%	20%	6%	8%	3%	59%	24%	10%	0%	18%	31%	23%	28%	62%	34%
35-44	50	27	8	3	9	3	21	13	8	2	6	7	16	21	28	22
	8%	10%	7%	10%	7%	5%	17%	11%	7%	1%	4%	5%	11%	12%	8%	10%
		54%	16%	6%	18%	6%	42%	26%	16%	4%	12%	14%	32%	42%	56%	44%
45-54	93	47	10	5	23	8	20	20	19	13	17	15	25	36	62	31
	16%	18%	9%	17%	18%	12%	16%	17%	16%	9%	13%	11%	17%	20%	17%	13%
		51%	11%	5%	25%	9%	22%	22%	20%	14%	18%	16%	27%	39%	67%	33%
55-64	128	40	32	3	36	17	21	24	22	33	28	32	28	40	76	52
	21%	15%	28%	10%	29%	26%	17%	21%	19%	23%	21%	24%	19%	22%	21%	23%
		31%	25%	2%	28%	13%	16%	19%	17%	26%	22%	25%	22%	31%	59%	41%
65+	248	102	49	15	48	34	19	40	59	93	68	57	63	60	150	98
	41%	39%	43%	50%	38%	52%	15%	35%	50%	65%	50%	42%	42%	34%	41%	43%
		41%	20%	6%	19%	14%	8%	16%	24%	38%	27%	23%	25%	24%	60%	40%
REF	6	2	1	0	1	2	1	0	3	1	3	1	1	1	3	2
	1%	1%	1%	0%	1%	3%	1%	0%	3%	1%	2%	1%	1%	1%	1%	1%
		33%	17%	0%	17%	33%	17%	0%	50%	17%	50%	17%	17%	17%	50%	33%
DK	3	1	0	0	2	0	0	1	0	0	1	1	1	0	2	1
	1%	0%	0%	0%	2%	0%	0%	1%	0%	0%	1%	1%	1%	0%	1%	0%
		33%	0%	0%	67%	0%	0%	33%	0%	0%	33%	33%	33%	0%	67%	33%
Mean	3.77	3.52	3.85	3.73	3.98	4.27	2.65	3.53	4.08	4.55	4.07	3.76	3.75	3.57	3.76	3.82
Chi Square		47.06 .003					138.61 .001				25.74 .106				2.36 .883	

Table 19c: Age

	Total	Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
		Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	599	237 40%	291 49%	71 12%	517 86%	79 13%	383 64%	60 10%	156 26%	486 81%	62 10%	51 9%	201 34%	234 39%	84 14%	59 10%
18-34	71 12%	51 22% 72%	0 0% 0%	20 28% 28%	59 11% 83%	12 15% 17%	37 10% 52%	4 7% 6%	30 19% 42%	60 12% 85%	8 13% 11%	3 6% 4%	27 13% 38%	29 12% 41%	5 6% 7%	4 7% 6%
35-44	50 8%	39 16% 78%	2 1% 4%	9 13% 18%	41 8% 82%	9 11% 18%	34 9% 68%	4 7% 8%	12 8% 24%	43 9% 86%	2 3% 4%	5 10% 10%	19 9% 38%	19 8% 38%	4 5% 8%	7 12% 14%
45-54	93 16%	67 28% 72%	16 5% 17%	10 14% 11%	80 15% 86%	13 16% 14%	55 14% 59%	8 13% 9%	30 19% 32%	76 16% 82%	7 11% 8%	10 20% 11%	34 17% 37%	37 16% 40%	8 10% 9%	10 17% 11%
55-64	128 21%	54 23% 42%	59 20% 46%	15 21% 12%	114 22% 89%	13 16% 10%	79 21% 62%	19 32% 15%	30 19% 23%	100 21% 78%	20 32% 16%	8 16% 6%	41 20% 32%	39 17% 30%	26 31% 20%	21 36% 16%
65+	248 41%	26 11% 10%	212 73% 85%	10 14% 4%	215 42% 87%	31 39% 13%	174 45% 70%	25 42% 10%	49 31% 20%	202 42% 81%	22 35% 9%	24 47% 10%	77 38% 31%	107 46% 43%	40 48% 16%	16 27% 6%
REF	6 1%	0 0% 0%	1 0% 17%	5 7% 83%	5 1% 83%	1 1% 17%	1 0% 17%	0 0% 0%	5 3% 83%	2 0% 33%	3 5% 50%	1 2% 17%	2 1% 33%	2 1% 33%	1 1% 17%	0 0% 0%
DK	3 1%	0 0% 0%	1 0% 33%	2 3% 67%	3 1% 100%	0 0% 0%	3 1% 100%	0 0% 0%	0 0% 0%	3 1% 100%	0 0% 0%	0 0% 0%	1 0% 33%	1 0% 33%	0 0% 0%	1 2% 33%
Mean	3.77	2.85	4.68	3.13	3.80	3.57	3.87	3.95	3.46	3.74	3.89	3.94	3.66	3.79	4.13	3.71
Chi Square		327.72 .001			3.46 .749		33.02 .001			22.43 .033			28.18 .059			

Table 22: What was your approximate household income for 2008 before taxes?

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
Under 25k	106 18%	34 11% 32%	72 24% 68%	19 16% 18%	31 14% 29%	56 23% 53%	75 17% 71%	20 21% 19%	11 22% 10%	19 15% 18%	87 18% 82%	106 100% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%
25k-50k	142 24%	71 24% 50%	70 23% 49%	32 26% 23%	50 23% 35%	59 24% 42%	109 24% 77%	26 27% 18%	7 14% 5%	27 21% 19%	114 24% 80%	0 0% 0%	142 100% 100%	0 0% 0%	0 0% 0%	0 0% 0%
50k-75k	113 19%	62 21% 55%	51 17% 45%	32 26% 28%	38 17% 34%	42 17% 37%	88 19% 78%	17 18% 15%	8 16% 7%	21 17% 19%	92 19% 81%	0 0% 0%	0 0% 0%	113 100% 100%	0 0% 0%	0 0% 0%
75k-100k	61 10%	34 11% 56%	27 9% 44%	10 8% 16%	40 18% 66%	11 4% 18%	47 10% 77%	10 10% 16%	4 8% 7%	15 12% 25%	46 10% 75%	0 0% 0%	0 0% 0%	0 0% 0%	61 48% 100%	0 0% 0%
100k-150k	44 7%	27 9% 61%	17 6% 39%	14 12% 32%	22 10% 50%	8 3% 18%	35 8% 80%	5 5% 11%	4 8% 9%	12 9% 27%	32 7% 73%	0 0% 0%	0 0% 0%	0 0% 0%	44 34% 100%	0 0% 0%
150k+	23 4%	17 6% 74%	6 2% 26%	4 3% 17%	9 4% 39%	10 4% 43%	18 4% 78%	4 4% 17%	1 2% 4%	7 6% 30%	16 3% 70%	0 0% 0%	0 0% 0%	0 0% 0%	23 18% 100%	0 0% 0%
DK	111 19%	55 18% 50%	56 19% 50%	10 8% 9%	31 14% 28%	62 25% 56%	81 18% 73%	14 15% 13%	16 31% 14%	26 20% 23%	85 18% 77%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	111 100% 100%
Mean	3.51	3.73	3.30	3.17	3.56	3.54	3.52	3.23	3.98	3.78	3.44	1.00	2.00	3.00	4.70	7.00
Chi Square		23.04 .001		57.99 .001			11.33 .501			4.39 .624		1000+ .001				

Table 22b: What was your approximate household income for 2008 before taxes?

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
Under 25k	106 18%	36 14% 34%	26 23% 25%	7 23% 7%	19 15% 18%	18 27% 17%	23 18% 22%	21 18% 20%	19 16% 18%	32 23% 30%	26 19% 25%	31 23% 29%	27 18% 25%	22 12% 21%	51 14% 48%	55 24% 52%
25k-50k	142 24%	60 23% 42%	35 30% 25%	6 20% 4%	25 20% 18%	16 24% 11%	34 27% 24%	32 28% 23%	24 20% 17%	31 22% 22%	34 25% 24%	28 21% 20%	36 24% 25%	44 25% 31%	80 22% 56%	61 26% 43%
50k-75k	113 19%	51 19% 45%	19 17% 17%	7 23% 6%	21 17% 19%	15 23% 13%	29 23% 26%	18 16% 16%	24 20% 21%	23 16% 20%	28 21% 25%	23 17% 20%	26 17% 23%	36 20% 32%	67 18% 59%	45 19% 40%
75k-100k	61 10%	33 13% 54%	8 7% 13%	2 7% 3%	15 12% 25%	3 5% 5%	13 10% 21%	14 12% 23%	11 9% 18%	12 8% 20%	8 6% 13%	14 10% 23%	16 11% 26%	23 13% 38%	43 12% 70%	18 8% 30%
100k-150k	44 7%	23 9% 52%	5 4% 11%	3 10% 7%	12 10% 27%	1 2% 2%	6 5% 14%	10 9% 23%	11 9% 25%	7 5% 16%	6 4% 14%	7 5% 16%	18 12% 41%	13 7% 30%	34 9% 77%	10 4% 23%
150k+	23 4%	12 5% 52%	2 2% 9%	0 0% 0%	7 6% 30%	2 3% 9%	7 6% 30%	4 3% 17%	3 3% 13%	4 3% 17%	8 6% 35%	7 5% 30%	4 3% 17%	4 2% 17%	21 6% 91%	2 1% 9%
DK	111 19%	49 19% 44%	20 17% 18%	5 17% 5%	26 21% 23%	11 17% 10%	13 10% 12%	16 14% 14%	26 22% 23%	33 23% 30%	26 19% 23%	25 19% 23%	23 15% 21%	37 21% 33%	69 19% 62%	40 17% 36%
Mean	3.51	3.68	3.15	3.27	3.81	3.05	3.14	3.31	3.71	3.53	3.46	3.44	3.44	3.68	3.73	3.14
Chi Square		29.40 .206					20.80 .289				22.50 .210				24.91 .001	

Table 22c: What was your approximate household income for 2008 before taxes?

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propan e	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
Under 25k	106 18%	22 9% 21%	65 22% 61%	19 27% 18%	96 19% 91%	10 13% 9%	56 15% 53%	16 27% 15%	34 22% 32%	79 16% 75%	16 25% 15%	11 22% 10%	32 16% 30%	36 15% 34%	13 15% 12%	17 28% 16%
25k-50k	142 24%	57 24% 40%	74 25% 52%	11 15% 8%	122 24% 86%	18 23% 13%	99 26% 70%	13 22% 9%	30 19% 21%	118 24% 83%	16 25% 11%	8 16% 6%	46 23% 32%	56 24% 39%	20 24% 14%	15 25% 11%
50k-75k	113 19%	54 23% 48%	49 17% 43%	10 14% 9%	99 19% 88%	14 18% 12%	77 20% 68%	10 17% 9%	26 17% 23%	99 20% 88%	6 10% 5%	8 16% 7%	43 21% 38%	44 19% 39%	12 14% 11%	12 20% 11%
75k-100k	61 10%	39 16% 64%	18 6% 30%	4 6% 7%	51 10% 84%	10 13% 16%	45 12% 74%	4 7% 7%	12 8% 20%	53 11% 87%	4 6% 7%	4 8% 7%	19 9% 31%	27 12% 44%	9 11% 15%	4 7% 7%
100k-150k	44 7%	26 11% 59%	12 4% 27%	6 8% 14%	40 8% 91%	4 5% 9%	29 8% 66%	5 8% 11%	10 6% 23%	37 8% 84%	4 6% 9%	3 6% 7%	15 7% 34%	16 7% 36%	9 11% 20%	4 7% 9%
150k+	23 4%	13 5% 57%	8 3% 35%	2 3% 9%	19 4% 83%	4 5% 17%	16 4% 70%	1 2% 4%	6 4% 26%	22 5% 96%	0 0% 0%	1 2% 4%	7 3% 30%	12 5% 52%	2 2% 9%	2 3% 9%
DK	111 19%	27 11% 24%	65 22% 59%	19 27% 17%	90 17% 81%	19 24% 17%	62 16% 56%	11 18% 10%	38 24% 34%	78 16% 70%	17 27% 15%	16 31% 14%	39 19% 35%	43 18% 39%	19 23% 17%	6 10% 5%
Mean	3.51	3.58	3.42	3.69	3.45	3.86	3.49	3.27	3.67	3.47	3.51	3.92	3.58	3.59	3.75	2.88
Chi Square		59.89 .001			4.62 .593		17.04 .148			22.23 .035			14.19 .717			

Table 23: What is the highest level of education you have completed?

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
Less than high school	30 5%	16 5% 53%	13 4% 43%	5 4% 17%	7 3% 23%	16 6% 53%	19 4% 63%	8 8% 27%	3 6% 10%	4 3% 13%	25 5% 83%	16 15% 53%	4 3% 13%	2 2% 7%	2 2% 7%	6 5% 20%
High school graduate	102 17%	52 17% 51%	50 17% 49%	22 18% 22%	36 16% 35%	44 18% 43%	81 18% 79%	14 15% 14%	7 14% 7%	14 11% 14%	88 19% 86%	25 24% 25%	32 23% 31%	23 20% 23%	11 9% 11%	11 10% 11%
Some college	163 27%	67 22% 41%	96 32% 59%	37 31% 23%	57 26% 35%	67 27% 41%	113 25% 69%	38 40% 23%	12 24% 7%	27 21% 17%	136 29% 83%	34 32% 21%	38 27% 23%	34 30% 21%	29 23% 18%	28 25% 17%
College grad	142 24%	67 22% 47%	75 25% 53%	29 24% 20%	57 26% 40%	55 22% 39%	119 26% 84%	16 17% 11%	7 14% 5%	35 28% 25%	107 23% 75%	15 14% 11%	29 20% 20%	29 26% 20%	38 30% 27%	31 28% 22%
Graduate school or advanced degree	139 23%	84 28% 60%	55 18% 40%	25 21% 18%	56 25% 40%	57 23% 41%	109 24% 78%	17 18% 12%	13 25% 9%	42 33% 30%	97 21% 70%	15 14% 11%	33 23% 24%	21 19% 15%	47 37% 34%	23 21% 17%
Technical/ junior college	14 2%	8 3% 57%	6 2% 43%	2 2% 14%	6 3% 43%	6 2% 43%	8 2% 57%	2 2% 14%	4 8% 29%	2 2% 14%	12 3% 86%	1 1% 7%	6 4% 43%	4 4% 29%	1 1% 7%	2 2% 14%
DK	10 2%	6 2% 60%	4 1% 40%	1 1% 10%	2 1% 20%	3 1% 30%	4 1% 40%	1 1% 10%	5 10% 50%	3 2% 30%	7 1% 70%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	10 9% 100%
Mean	3.57	3.66	3.48	3.47	3.66	3.50	3.57	3.31	4.02	3.91	3.48	2.92	3.51	3.50	3.94	3.90
Chi Square		12.69 .048		5.60 .935			46.54 .001			15.10 .020		117.54 .001				

Table 23b: What is the highest level of education you have completed?

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
Less than high school	30 5%	12 5% 40%	5 4% 17%	4 13% 13%	4 3% 13%	5 8% 17%	6 5% 20%	5 4% 17%	5 4% 17%	11 8% 37%	3 2% 10%	11 8% 37%	6 4% 20%	10 6% 33%	14 4% 47%	16 7% 53%
High school graduate	102 17%	36 14% 35%	31 27% 30%	6 20% 6%	14 11% 14%	15 23% 15%	25 20% 25%	22 19% 22%	24 20% 24%	20 14% 20%	30 22% 29%	24 18% 24%	15 10% 15%	33 18% 32%	60 16% 59%	41 18% 40%
Some college	163 27%	80 30% 49%	30 26% 18%	8 27% 5%	26 21% 16%	19 29% 12%	34 27% 21%	29 25% 18%	32 27% 20%	45 32% 28%	31 23% 19%	38 28% 23%	45 30% 28%	49 27% 30%	92 25% 56%	70 30% 43%
College grad	142 24%	57 22% 40%	27 23% 19%	6 20% 4%	36 29% 25%	16 24% 11%	32 26% 23%	27 23% 19%	24 20% 17%	30 21% 21%	29 21% 20%	29 21% 20%	46 31% 32%	38 21% 27%	98 27% 69%	44 19% 31%
Graduate school or advanced degree	139 23%	65 25% 47%	17 15% 12%	6 20% 4%	41 33% 29%	10 15% 7%	24 19% 17%	28 24% 20%	28 24% 20%	28 20% 20%	38 28% 27%	27 20% 19%	29 19% 21%	45 25% 32%	88 24% 63%	50 22% 36%
Technical/ junior college	14 2%	9 3% 64%	3 3% 21%	0 0% 0%	1 1% 7%	1 2% 7%	2 2% 14%	3 3% 21%	1 1% 7%	7 5% 50%	1 1% 7%	4 3% 29%	7 5% 50%	2 1% 14%	8 2% 57%	6 3% 43%
DK	10 2%	5 2% 50%	2 2% 20%	0 0% 0%	3 2% 30%	0 0% 0%	2 2% 20%	1 1% 10%	4 3% 40%	1 1% 10%	4 3% 40%	2 1% 20%	2 1% 20%	2 1% 20%	5 1% 50%	4 2% 40%
Mean	3.57	3.66	3.32	3.13	3.89	3.21	3.46	3.56	3.55	3.49	3.65	3.42	3.71	3.50	3.63	3.45
Chi Square		39.70 .023					15.48 .629				28.76 .051				8.39 .211	

Table 23c: What is the highest level of education you have completed?

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
Less than high school	30 5%	6 3% 20%	17 6% 57%	7 10% 23%	26 5% 87%	3 4% 10%	16 4% 53%	2 3% 7%	12 8% 40%	22 5% 73%	3 5% 10%	5 10% 17%	10 5% 33%	9 4% 30%	6 7% 20%	4 7% 13%
High school graduate	102 17%	38 16% 37%	51 18% 50%	13 18% 13%	92 18% 90%	10 13% 10%	60 16% 59%	10 17% 10%	32 21% 31%	87 18% 85%	5 8% 5%	10 20% 10%	30 15% 29%	39 17% 38%	17 20% 17%	12 20% 12%
Some college	163 27%	57 24% 35%	85 29% 52%	21 30% 13%	141 27% 87%	20 25% 12%	109 28% 67%	15 25% 9%	39 25% 24%	138 28% 85%	14 22% 9%	11 22% 7%	57 28% 35%	70 30% 43%	16 19% 10%	13 22% 8%
College grad	142 24%	60 25% 42%	68 23% 48%	14 20% 10%	126 24% 89%	15 19% 11%	94 24% 66%	9 15% 6%	39 25% 27%	116 24% 82%	12 19% 8%	14 27% 10%	50 25% 35%	60 26% 42%	16 19% 11%	13 22% 9%
Graduate school or advanced degree	139 23%	65 27% 47%	64 22% 46%	10 14% 7%	110 21% 79%	29 37% 21%	91 24% 65%	22 37% 16%	26 17% 19%	104 21% 75%	25 40% 18%	10 20% 7%	45 22% 32%	45 19% 32%	28 33% 20%	17 28% 12%
Technical/ junior college	14 2%	8 3% 57%	5 2% 36%	1 1% 7%	13 3% 93%	1 1% 7%	9 2% 64%	1 2% 7%	4 3% 29%	13 3% 93%	1 2% 7%	0 0% 0%	6 3% 43%	5 2% 36%	1 1% 7%	1 2% 7%
DK	10 2%	4 2% 40%	1 0% 10%	5 7% 50%	9 2% 90%	1 1% 10%	5 1% 50%	1 2% 10%	4 3% 40%	6 1% 60%	3 5% 30%	1 2% 10%	3 1% 30%	6 3% 60%	0 0% 0%	0 0% 0%
Mean	3.57	3.76	3.45	3.42	3.54	3.81	3.60	3.77	3.40	3.53	4.05	3.35	3.60	3.56	3.55	3.50
Chi Square		30.83 .002			9.75 .136		16.23 .181			22.50 .032			18.69 .411			

Table 24: Are you currently a student, unemployed, employed, retired or a homemaker?

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
Full time	200 33%	122 41% 61%	77 26% 39%	76 63% 38%	109 49% 55%	14 6% 7%	139 31% 70%	46 48% 23%	15 29% 8%	47 37% 24%	152 32% 76%	10 9% 5%	49 35% 25%	48 42% 24%	69 54% 35%	24 22% 12%
Part time	38 6%	9 3% 24%	29 10% 76%	14 12% 37%	12 5% 32%	12 5% 32%	29 6% 76%	7 7% 18%	2 4% 5%	9 7% 24%	29 6% 76%	12 11% 32%	8 6% 21%	6 5% 16%	9 7% 24%	3 3% 8%
Unemployed	23 4%	12 4% 52%	11 4% 48%	10 8% 43%	12 5% 52%	0 0% 0%	20 4% 87%	1 1% 4%	2 4% 9%	5 4% 22%	18 4% 78%	7 7% 30%	4 3% 17%	4 4% 17%	4 3% 17%	4 4% 17%
Student	7 1%	1 0% 14%	6 2% 86%	4 3% 57%	1 0% 14%	1 0% 14%	6 1% 86%	0 0% 0%	1 2% 14%	1 1% 14%	6 1% 86%	3 3% 43%	1 1% 14%	0 0% 0%	2 2% 29%	1 1% 14%
Retired	291 49%	146 49% 50%	145 48% 50%	2 2% 1%	75 34% 26%	212 85% 73%	235 52% 81%	33 34% 11%	23 45% 8%	57 45% 20%	234 50% 80%	65 61% 22%	74 52% 25%	49 43% 17%	38 30% 13%	65 59% 22%
Homemaker	36 6%	6 2% 17%	30 10% 83%	15 12% 42%	11 5% 31%	9 4% 25%	24 5% 67%	9 9% 25%	3 6% 8%	6 5% 17%	30 6% 83%	9 8% 25%	6 4% 17%	6 5% 17%	6 5% 17%	9 8% 25%
REF	3 1%	2 1% 67%	1 0% 33%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	3 6% 100%	0 0% 0%	3 1% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	3 3% 100%
DK	2 0%	2 1% 100%	0 0% 0%	0 0% 0%	1 0% 50%	0 0% 0%	0 0% 0%	0 0% 0%	2 4% 100%	2 2% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	2 2% 100%
Mean	3.47	3.25	3.69	2.07	2.81	4.66	3.53	2.94	3.90	3.31	3.51	4.21	3.43	3.12	2.60	4.16
Chi Square		42.65 .001		281.78 .001			72.92 .001			10.18 .179		97.18 .001				

Prepared by RBI Strategies and Research

A Survey of Sulphur Springs Valley Electric Cooperative Members

Table 24b: Are you currently a student, unemployed, employed, retired or a homemaker?

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
Full time	200 33%	104 39% 52%	26 23% 13%	11 37% 6%	46 37% 23%	13 20% 7%	63 50% 32%	43 37% 22%	35 30% 18%	23 16% 12%	34 25% 17%	44 33% 22%	52 35% 26%	70 39% 35%	129 35% 65%	69 30% 35%
Part time	38 6%	14 5% 37%	8 7% 21%	2 7% 5%	9 7% 24%	5 8% 13%	10 8% 26%	7 6% 18%	5 4% 13%	8 6% 21%	8 6% 21%	10 7% 26%	9 6% 24%	11 6% 29%	20 5% 53%	18 8% 47%
Unemployed	23 4%	12 5% 52%	5 4% 22%	0 0% 0%	5 4% 22%	1 2% 4%	8 6% 35%	6 5% 26%	2 2% 9%	3 2% 13%	3 2% 13%	8 6% 35%	5 3% 22%	7 4% 30%	12 3% 52%	11 5% 48%
Student	7 1%	3 1% 43%	2 2% 29%	0 0% 0%	1 1% 14%	1 2% 14%	4 3% 57%	2 2% 29%	1 1% 14%	0 0% 0%	2 1% 29%	2 1% 29%	2 1% 29%	1 1% 14%	3 1% 43%	4 2% 57%
Retired	291 49%	117 44% 40%	64 56% 22%	14 47% 5%	56 45% 19%	40 61% 14%	28 22% 10%	52 45% 18%	64 54% 22%	103 73% 35%	81 60% 28%	60 44% 21%	76 51% 26%	74 41% 25%	176 48% 60%	115 50% 40%
Homemaker	36 6%	12 5% 33%	9 8% 25%	3 10% 8%	6 5% 17%	6 9% 17%	11 9% 31%	5 4% 14%	10 8% 28%	4 3% 11%	6 4% 17%	10 7% 28%	5 3% 14%	15 8% 42%	22 6% 61%	13 6% 36%
REF	3 1%	2 1% 67%	1 1% 33%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 33%	0 0% 0%	1 1% 33%	1 1% 33%	2 1% 67%	1 1% 33%	0 0% 0%	0 0% 0%	1 0% 33%	1 0% 33%
DK	2 0%	0 0% 0%	0 0% 0%	0 0% 0%	2 2% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 50%	1 1% 50%	2 1% 100%	0 0% 0%
Mean	3.47	3.22	3.88	3.43	3.32	4.03	2.69	3.24	3.75	4.18	3.84	3.43	3.41	3.27	3.43	3.52
Chi Square		32.96 .237					78.29 .001				24.91 .251				5.74 .571	

Prepared by RBI Strategies and Research

Table 24c: Are you currently a student, unemployed, employed, retired or a homemaker?

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
Full time	200 33%	200 84% 100%	0 0% 0%	0 0% 0%	167 32% 84%	31 39% 16%	125 33% 63%	18 30% 9%	57 37% 29%	167 34% 84%	19 30% 10%	14 27% 7%	66 33% 33%	81 35% 41%	22 26% 11%	23 38% 12%
Part time	38 6%	38 16% 100%	0 0% 0%	0 0% 0%	34 7% 89%	4 5% 11%	25 7% 66%	3 5% 8%	10 6% 26%	30 6% 79%	4 6% 11%	4 8% 11%	13 6% 34%	16 7% 42%	3 4% 8%	5 8% 13%
Unemployed	23 4%	0 0% 0%	0 0% 0%	23 32% 100%	18 3% 78%	5 6% 22%	13 3% 57%	2 3% 9%	8 5% 35%	19 4% 83%	3 5% 13%	1 2% 4%	12 6% 52%	8 3% 35%	0 0% 0%	1 2% 4%
Student	7 1%	0 0% 0%	0 0% 0%	7 10% 100%	7 1% 100%	0 0% 0%	1 0% 14%	2 3% 29%	4 3% 57%	4 1% 57%	3 5% 43%	0 0% 0%	3 1% 43%	1 0% 14%	2 2% 29%	0 0% 0%
Retired	291 49%	0 0% 0%	291 100% 100%	0 0% 0%	258 50% 89%	31 39% 11%	200 52% 69%	32 53% 11%	59 38% 20%	233 48% 80%	30 48% 10%	28 55% 10%	92 46% 32%	115 49% 40%	52 62% 18%	25 42% 9%
Homemaker	36 6%	0 0% 0%	0 0% 0%	36 51% 100%	29 6% 81%	7 9% 19%	17 4% 47%	3 5% 8%	16 10% 44%	30 6% 83%	3 5% 8%	3 6% 8%	12 6% 33%	12 5% 33%	5 6% 14%	6 10% 17%
REF	3 1%	0 0% 0%	0 0% 0%	3 4% 100%	2 0% 67%	1 1% 33%	1 0% 33%	0 0% 0%	2 1% 67%	1 0% 33%	1 2% 33%	1 2% 33%	1 0% 33%	1 0% 33%	0 0% 0%	0 0% 0%
DK	2 0%	0 0% 0%	0 0% 0%	2 3% 100%	2 0% 100%	0 0% 0%	2 1% 100%	0 0% 0%	0 0% 0%	2 0% 100%	0 0% 0%	0 0% 0%	2 1% 100%	0 0% 0%	0 0% 0%	0 0% 0%
Mean	3.47	1.16	5.00	4.93	3.50	3.27	3.50	3.60	3.35	3.43	3.54	3.73	3.46	3.40	3.88	3.28
Chi Square		1000+ .001			7.91 .340		24.73 .037			15.40 .352			23.68 .309			

Table 25: Race/ Ethnicity

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
White non-Hispanic	453 76%	219 73% 48%	234 78% 52%	79 65% 17%	171 77% 38%	201 81% 44%	453 100% 100%	0 0% 0%	0 0% 0%	95 75% 21%	358 76% 79%	75 71% 17%	109 77% 24%	88 78% 19%	100 78% 22%	81 73% 18%
Hispanic/ Latino	96 16%	48 16% 50%	47 16% 49%	33 27% 34%	32 14% 33%	29 12% 30%	0 0% 0%	96 100% 100%	0 0% 0%	23 18% 24%	72 15% 75%	20 19% 21%	26 18% 27%	17 15% 18%	19 15% 20%	14 13% 15%
Black non-Hispanic	7 1%	4 1% 57%	3 1% 43%	3 2% 43%	1 0% 14%	3 1% 43%	0 0% 0%	0 0% 0%	7 14% 100%	0 0% 0%	7 1% 100%	1 1% 14%	2 1% 29%	2 2% 29%	2 2% 29%	0 0% 0%
Asian	7 1%	3 1% 43%	4 1% 57%	2 2% 29%	2 1% 29%	2 1% 29%	0 0% 0%	0 0% 0%	7 14% 100%	0 0% 0%	7 1% 100%	1 1% 14%	2 1% 29%	1 1% 14%	1 1% 14%	2 2% 29%
Other	19 3%	14 5% 74%	5 2% 26%	2 2% 11%	9 4% 47%	8 3% 42%	0 0% 0%	0 0% 0%	19 37% 100%	3 2% 16%	16 3% 84%	8 8% 42%	1 1% 5%	5 4% 26%	5 4% 26%	0 0% 0%
REF	11 2%	7 2% 64%	4 1% 36%	1 1% 9%	3 1% 27%	4 2% 36%	0 0% 0%	0 0% 0%	11 22% 100%	2 2% 18%	9 2% 82%	0 0% 0%	2 1% 18%	0 0% 0%	1 1% 9%	8 7% 73%
DK	7 1%	5 2% 71%	2 1% 29%	1 1% 14%	3 1% 43%	1 0% 14%	0 0% 0%	0 0% 0%	7 14% 100%	4 3% 57%	3 1% 43%	1 1% 14%	0 0% 0%	0 0% 0%	0 0% 0%	6 5% 86%
Mean	1.51	1.62	1.39	1.53	1.49	1.40	1.00	2.00	5.08	1.54	1.50	1.59	1.35	1.39	1.40	1.86
Chi Square		7.16 .306		21.91 .038			1000+ .001			10.10 .120		62.77 .001				

Table 25b: Race/ Ethnicity

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
White non-Hispanic	453 76%	194 73% 43%	94 82% 21%	22 73% 5%	93 74% 21%	50 76% 11%	92 74% 20%	90 78% 20%	92 78% 20%	104 73% 23%	102 75% 23%	105 78% 23%	108 72% 24%	138 77% 30%	286 78% 63%	166 72% 37%
Hispanic/ Latino	96 16%	41 16% 43%	13 11% 14%	7 23% 7%	23 18% 24%	12 18% 13%	24 19% 25%	15 13% 16%	18 15% 19%	21 15% 22%	20 15% 21%	20 15% 21%	24 16% 25%	32 18% 33%	48 13% 50%	47 20% 49%
Black non-Hispanic	7 1%	7 3% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	4 3% 57%	1 1% 14%	0 0% 0%	2 1% 29%	2 1% 29%	2 1% 29%	2 1% 29%	1 1% 14%	5 1% 71%	2 1% 29%
Asian	7 1%	6 2% 86%	1 1% 14%	0 0% 0%	0 0% 0%	0 0% 0%	1 1% 14%	2 2% 29%	1 1% 14%	3 2% 43%	2 1% 29%	1 1% 14%	4 3% 57%	0 0% 0%	4 1% 57%	3 1% 43%
Other	19 3%	7 3% 37%	4 3% 21%	1 3% 5%	3 2% 16%	4 6% 21%	1 1% 5%	6 5% 32%	5 4% 26%	6 4% 32%	5 4% 26%	4 3% 21%	6 4% 32%	4 2% 21%	15 4% 79%	4 2% 21%
REF	11 2%	7 3% 64%	2 2% 18%	0 0% 0%	2 2% 18%	0 0% 0%	2 2% 18%	1 1% 9%	2 2% 18%	4 3% 36%	4 3% 36%	1 1% 9%	4 3% 36%	2 1% 18%	4 1% 36%	6 3% 55%
DK	7 1%	2 1% 29%	1 1% 14%	0 0% 0%	4 3% 57%	0 0% 0%	1 1% 14%	0 0% 0%	0 0% 0%	2 1% 29%	1 1% 14%	2 1% 29%	2 1% 29%	2 1% 29%	3 1% 43%	3 1% 43%
Mean	1.51	1.56	1.42	1.37	1.55	1.42	1.44	1.45	1.43	1.63	1.56	1.44	1.64	1.40	1.46	1.54
Chi Square		29.41 .205					16.20 .579				11.36 .879				10.47 .106	

Table 25c: Race/ Ethnicity

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
White non-Hispanic	453 76%	168 71% 37%	235 81% 52%	50 70% 11%	392 76% 87%	59 75% 13%	291 76% 64%	43 72% 9%	119 76% 26%	368 76% 81%	44 70% 10%	41 80% 9%	149 74% 33%	180 77% 40%	65 77% 14%	44 73% 10%
Hispanic/ Latino	96 16%	53 22% 55%	33 11% 34%	10 14% 10%	84 16% 88%	11 14% 11%	62 16% 65%	11 18% 11%	23 15% 24%	80 16% 83%	9 14% 9%	7 14% 7%	33 16% 34%	35 15% 36%	14 17% 15%	11 18% 11%
Black non-Hispanic	7 1%	4 2% 57%	3 1% 43%	0 0% 0%	7 1% 100%	0 0% 0%	4 1% 57%	0 0% 0%	3 2% 43%	6 1% 86%	1 2% 14%	0 0% 0%	5 2% 71%	2 1% 29%	0 0% 0%	0 0% 0%
Asian	7 1%	3 1% 43%	3 1% 43%	1 1% 14%	6 1% 86%	1 1% 14%	4 1% 57%	1 2% 14%	2 1% 29%	6 1% 86%	0 0% 0%	1 2% 14%	1 0% 14%	6 3% 86%	0 0% 0%	0 0% 0%
Other	19 3%	4 2% 21%	13 4% 68%	2 3% 11%	17 3% 89%	2 3% 11%	13 3% 68%	3 5% 16%	3 2% 16%	15 3% 79%	3 5% 16%	1 2% 5%	7 3% 37%	6 3% 32%	3 4% 16%	2 3% 11%
REF	11 2%	4 2% 36%	3 1% 27%	4 6% 36%	6 1% 55%	4 5% 36%	5 1% 45%	0 0% 0%	6 4% 55%	6 1% 55%	4 6% 36%	1 2% 9%	3 1% 27%	4 2% 36%	2 2% 18%	1 2% 9%
DK	7 1%	2 1% 29%	1 0% 14%	4 6% 57%	5 1% 71%	2 3% 29%	5 1% 71%	2 3% 29%	0 0% 0%	5 1% 71%	2 3% 29%	0 0% 0%	3 1% 43%	1 0% 14%	0 0% 0%	2 3% 29%
Mean	1.51	1.50	1.42	1.92	1.47	1.68	1.49	1.63	1.49	1.47	1.87	1.37	1.53	1.46	1.43	1.60
Chi Square		37.48 .001			9.09 .168		13.10 .362			14.08 .296			17.25 .506			

Table 26: Gender

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	599	300	299	121	221	248	453	95	51	127	472	106	141	113	128	111
		50%	50%	20%	37%	41%	76%	16%	9%	21%	79%	18%	24%	19%	21%	19%
Male	300	300	0	63	106	127	219	48	33	62	238	34	71	62	78	55
	50%	100%	0%	52%	48%	51%	48%	51%	65%	49%	50%	32%	50%	55%	61%	50%
		100%	0%	21%	35%	42%	73%	16%	11%	21%	79%	11%	24%	21%	26%	18%
Female	299	0	299	58	115	121	234	47	18	65	234	72	70	51	50	56
	50%	0%	100%	48%	52%	49%	52%	49%	35%	51%	50%	68%	50%	45%	39%	50%
		0%	100%	19%	38%	40%	78%	16%	6%	22%	78%	24%	23%	17%	17%	19%
Mean	1.50	1.00	2.00	1.48	1.52	1.49	1.52	1.49	1.35	1.51	1.50	1.68	1.50	1.45	1.39	1.50
Chi Square		599.00		0.71			4.92			0.10		20.83				
		.001		.701			.086			.748		.001				

Prepared by RBI Strategies and Research

Table 26b: Gender

	Total	DISTRICT					CON DATE				BILL				Central Air and Heating?	
		Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	599	264 44%	114 19%	30 5%	125 21%	66 11%	124 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	178 30%	365 61%	230 38%
Male	300 50%	134 51% 45%	56 49% 19%	18 60% 6%	61 49% 20%	31 47% 10%	63 51% 21%	64 56% 21%	62 53% 21%	61 43% 20%	65 48% 22%	70 52% 23%	77 51% 26%	88 49% 29%	197 54% 66%	101 44% 34%
Female	299 50%	130 49% 43%	58 51% 19%	12 40% 4%	64 51% 21%	35 53% 12%	61 49% 20%	51 44% 17%	56 47% 19%	81 57% 27%	71 52% 24%	65 48% 22%	73 49% 24%	90 51% 30%	168 46% 56%	129 56% 43%
Mean	1.50	1.49	1.51	1.40	1.51	1.53	1.49	1.44	1.47	1.57	1.52	1.48	1.49	1.51	1.46	1.56
Chi Square		1.61 .807					4.62 .202				0.58 .902				5.71 .017	

Prepared by RBI Strategies and Research

Table 26c: Gender

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	599	237 40%	291 49%	71 12%	517 86%	79 13%	383 64%	60 10%	156 26%	486 81%	62 10%	51 9%	201 34%	234 39%	84 14%	59 10%
Male	300 50%	131 55% 44%	146 50% 49%	23 32% 8%	255 49% 85%	45 57% 15%	204 53% 68%	22 37% 7%	74 47% 25%	256 53% 85%	26 42% 9%	18 35% 6%	106 53% 35%	111 47% 37%	43 51% 14%	30 51% 10%
Female	299 50%	106 45% 35%	145 50% 48%	48 68% 16%	262 51% 88%	34 43% 11%	179 47% 60%	38 63% 13%	82 53% 27%	230 47% 77%	36 58% 12%	33 65% 11%	95 47% 32%	123 53% 41%	41 49% 14%	29 49% 10%
Mean	1.50	1.45	1.50	1.68	1.51	1.43	1.47	1.63	1.53	1.47	1.58	1.65	1.47	1.53	1.49	1.49
Chi Square		11.44 .003			1.60 .206		6.31 .043			7.41 .025			1.28 .735			

Table 27: Patagonia Sonoita Elgin Area

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	599	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	95 16%	51 9%	127 21%	472 79%	106 18%	141 24%	113 19%	128 21%	111 19%
Y	127 21%	62 21% 49%	65 22% 51%	15 12% 12%	60 27% 47%	49 20% 39%	95 21% 75%	23 24% 18%	9 18% 7%	127 100% 100%	0 0% 0%	19 18% 15%	27 19% 21%	21 19% 17%	34 27% 27%	26 23% 20%
N	472 79%	238 79% 50%	234 78% 50%	106 88% 22%	161 73% 34%	199 80% 42%	358 79% 76%	72 76% 15%	42 82% 9%	0 0% 0%	472 100% 100%	87 82% 18%	114 81% 24%	92 81% 19%	94 73% 20%	85 77% 18%
Mean	1.79	1.79	1.78	1.88	1.73	1.80	1.79	1.76	1.82	1.00	2.00	1.82	1.81	1.81	1.73	1.77
Chi Square		0.10 .748		10.66 .005			0.91 .633			599.00 .001		4.03 .402				

Prepared by RBI Strategies and Research

Table 27b: Patagonia Sonoita Elgin Area

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	599	264 44%	114 19%	30 5%	125 21%	66 11%	124 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	178 30%	365 61%	230 38%
Y	127 21%	0 0% 0%	3 3% 2%	0 0% 0%	124 99% 98%	0 0% 0%	3 2% 2%	5 4% 4%	10 8% 8%	9 6% 7%	25 18% 20%	24 18% 19%	27 18% 21%	51 29% 40%	69 19% 54%	57 25% 45%
N	472 79%	264 100% 56%	111 97% 24%	30 100% 6%	1 1% 0%	66 100% 14%	121 98% 26%	110 96% 23%	108 92% 23%	133 94% 28%	111 82% 24%	111 82% 24%	123 82% 26%	127 71% 27%	296 81% 63%	173 75% 37%
Mean	1.79	2.00	1.97	2.00	1.01	2.00	1.98	1.96	1.92	1.94	1.82	1.82	1.82	1.71	1.81	1.75
Chi Square		575.58 .001					4.82 .185				8.43 .038				2.92 .087	

Prepared by RBI Strategies and Research

Table 27c: Patagonia Sonoita Elgin Area

	Total	Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
		Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	599	237 40%	291 49%	71 12%	517 86%	79 13%	383 64%	60 10%	156 26%	486 81%	62 10%	51 9%	201 34%	234 39%	84 14%	59 10%
Y	127 21%	56 24% 44%	57 20% 45%	14 20% 11%	95 18% 75%	30 38% 24%	89 23% 70%	23 38% 18%	15 10% 12%	92 19% 72%	29 47% 23%	6 12% 5%	49 24% 39%	21 9% 17%	24 29% 19%	29 49% 23%
N	472 79%	181 76% 38%	234 80% 50%	57 80% 12%	422 82% 89%	49 62% 10%	294 77% 62%	37 62% 8%	141 90% 30%	394 81% 83%	33 53% 7%	45 88% 10%	152 76% 32%	213 91% 45%	60 71% 13%	30 51% 6%
Mean	1.79	1.76	1.80	1.80	1.82	1.62	1.77	1.62	1.90	1.81	1.53	1.88	1.76	1.91	1.71	1.51
Chi Square		1.38 .501			15.88 .001		24.03 .001			28.49 .001			52.33 .001			

Prepared by RBI Strategies and Research

Table 28: BILL

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
0 - 55	136 23%	65 22% 48%	71 24% 52%	19 16% 14%	45 20% 33%	68 27% 50%	102 23% 75%	20 21% 15%	14 27% 10%	25 20% 18%	111 24% 82%	26 25% 19%	34 24% 25%	28 25% 21%	22 17% 16%	26 23% 19%
56 - 85	135 23%	70 23% 52%	65 22% 48%	29 24% 21%	47 21% 35%	57 23% 42%	105 23% 78%	20 21% 15%	10 20% 7%	24 19% 18%	111 24% 82%	31 29% 23%	28 20% 21%	23 20% 17%	28 22% 21%	25 23% 19%
86 - 130	150 25%	77 26% 51%	73 24% 49%	32 26% 21%	53 24% 35%	63 25% 42%	108 24% 72%	24 25% 16%	18 35% 12%	27 21% 18%	123 26% 82%	27 25% 18%	36 25% 24%	26 23% 17%	38 30% 25%	23 21% 15%
130+	179 30%	88 29% 49%	90 30% 50%	41 34% 23%	76 34% 42%	60 24% 34%	138 30% 77%	32 33% 18%	9 18% 5%	51 40% 28%	127 27% 71%	22 21% 12%	44 31% 25%	36 32% 20%	40 31% 22%	37 33% 21%
Mean	2.62	2.63	2.61	2.79	2.72	2.46	2.62	2.71	2.43	2.82	2.56	2.42	2.63	2.62	2.75	2.64
Chi Square		0.58 .902		10.94 .090			6.46 .374			8.43 .038		10.92 .536				

Prepared by RBI Strategies and Research

Table 28b: BILL

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
0 - 55	136 23%	54 20% 40%	35 30% 26%	7 23% 5%	26 21% 19%	14 21% 10%	38 30% 28%	28 24% 21%	24 20% 18%	27 19% 20%	136 100% 100%	0 0% 0%	0 0% 0%	0 0% 0%	78 21% 57%	56 24% 41%
56 - 85	135 23%	74 28% 55%	18 16% 13%	4 13% 3%	24 19% 18%	15 23% 11%	30 24% 22%	28 24% 21%	25 21% 19%	32 23% 24%	0 0% 0%	135 100% 100%	0 0% 0%	0 0% 0%	80 22% 59%	54 23% 40%
86 - 130	150 25%	74 28% 49%	30 26% 20%	4 13% 3%	26 21% 17%	16 24% 11%	28 22% 19%	25 22% 17%	28 24% 19%	46 32% 31%	0 0% 0%	0 0% 0%	150 100% 100%	0 0% 0%	98 27% 65%	52 23% 35%
130+	179 30%	62 23% 35%	32 28% 18%	15 50% 8%	49 39% 27%	21 32% 12%	29 23% 16%	34 30% 19%	41 35% 23%	37 26% 21%	0 0% 0%	0 0% 0%	0 0% 0%	179 100% 100%	109 30% 61%	69 30% 39%
Mean	2.62	2.55	2.51	2.90	2.78	2.67	2.38	2.57	2.73	2.65	1.00	2.00	3.00	4.00	2.65	2.58
Chi Square		26.73 .008					11.75 .228				1000+ .001				1.71 .634	

Prepared by RBI Strategies and Research

Table 28c: BILL

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
0 - 55	136 23%	42 18% 31%	81 28% 60%	13 18% 10%	116 22% 85%	17 22% 13%	90 23% 66%	16 27% 12%	30 19% 22%	105 22% 77%	17 27% 13%	14 27% 10%	38 19% 28%	64 27% 47%	21 25% 15%	8 13% 6%
56 - 85	135 23%	54 23% 40%	60 21% 44%	21 30% 16%	122 24% 90%	13 16% 10%	82 21% 61%	11 18% 8%	42 27% 31%	114 23% 84%	8 13% 6%	13 25% 10%	28 14% 21%	72 31% 53%	15 18% 11%	17 28% 13%
86 - 130	150 25%	61 26% 41%	76 26% 51%	13 18% 9%	131 25% 87%	19 24% 13%	97 25% 65%	17 28% 11%	36 23% 24%	117 24% 78%	19 30% 13%	14 27% 9%	44 22% 29%	60 26% 40%	25 30% 17%	14 23% 9%
130+	179 30%	81 34% 45%	74 25% 41%	24 34% 13%	148 29% 83%	30 38% 17%	115 30% 64%	16 27% 9%	48 31% 27%	150 31% 84%	19 30% 11%	10 20% 6%	91 45% 51%	38 16% 21%	23 27% 13%	21 35% 12%
Mean	2.62	2.76	2.49	2.68	2.60	2.78	2.62	2.55	2.65	2.64	2.63	2.39	2.94	2.31	2.60	2.80
Chi Square		13.84 .031			3.62 .306		4.14 .658			7.29 .295			54.06 .001			

Prepared by RBI Strategies and Research

Table 29: DISTRICT

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	600	300 50%	299 50%	121 20%	221 37%	248 41%	453 76%	96 16%	51 9%	127 21%	472 79%	106 18%	142 24%	113 19%	128 21%	111 19%
Sierra Vista	264 44%	134 45% 51%	130 43% 49%	72 60% 27%	87 39% 33%	102 41% 39%	194 43% 73%	41 43% 16%	29 57% 11%	0 0% 0%	264 56% 100%	36 34% 14%	60 42% 23%	51 45% 19%	68 53% 26%	49 44% 19%
Benson	115 19%	56 19% 49%	58 19% 50%	22 18% 19%	42 19% 37%	49 20% 43%	94 21% 82%	13 14% 11%	8 16% 7%	3 2% 3%	111 24% 97%	26 25% 23%	35 25% 30%	19 17% 17%	15 12% 13%	20 18% 17%
Wilcox	30 5%	18 6% 60%	12 4% 40%	7 6% 23%	8 4% 27%	15 6% 50%	22 5% 73%	7 7% 23%	1 2% 3%	0 0% 0%	30 6% 100%	7 7% 23%	6 4% 20%	7 6% 23%	5 4% 17%	5 5% 17%
Elgin Sonoita Patagonia	125 21%	61 20% 49%	64 21% 51%	15 12% 12%	59 27% 47%	48 19% 38%	93 21% 74%	23 24% 18%	9 18% 7%	124 98% 99%	1 0% 1%	19 18% 15%	25 18% 20%	21 19% 17%	34 27% 27%	26 23% 21%
Sunsites/Elfrida	66 11%	31 10% 47%	35 12% 53%	5 4% 8%	25 11% 38%	34 14% 52%	50 11% 76%	12 13% 18%	4 8% 6%	0 0% 0%	66 14% 100%	18 17% 27%	16 11% 24%	15 13% 23%	6 5% 9%	11 10% 17%
Mean	2.36	2.33	2.38	1.83	2.52	2.45	2.36	2.50	2.04	3.95	1.93	2.59	2.31	2.38	2.18	2.37
Chi Square		1.61 .807		24.76 .002			7.94 .439			575.58 .001		26.84 .043				

Table 29b: DISTRICT

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	600	264 44%	115 19%	30 5%	125 21%	66 11%	125 21%	115 19%	118 20%	142 24%	136 23%	135 23%	150 25%	179 30%	365 61%	231 39%
Sierra Vista	264 44%	264 100% 100%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	77 62% 29%	67 58% 25%	54 46% 20%	66 46% 25%	54 40% 20%	74 55% 28%	74 49% 28%	62 35% 23%	170 47% 64%	93 40% 35%
Benson	115 19%	0 0% 0%	115 100% 100%	0 0% 0%	0 0% 0%	0 0% 0%	27 22% 23%	26 23% 23%	27 23% 23%	33 23% 29%	35 26% 30%	18 13% 16%	30 20% 26%	32 18% 28%	72 20% 63%	41 18% 36%
Wilcox	30 5%	0 0% 0%	0 0% 0%	30 100% 100%	0 0% 0%	0 0% 0%	8 6% 27%	3 3% 10%	8 7% 27%	11 8% 37%	7 5% 23%	4 3% 13%	4 3% 13%	15 8% 50%	19 5% 63%	11 5% 37%
Elgin Sonoita Patagonia	125 21%	0 0% 0%	0 0% 0%	0 0% 0%	125 100% 100%	0 0% 0%	3 2% 2%	4 3% 3%	10 8% 8%	10 7% 8%	26 19% 21%	24 18% 19%	26 17% 21%	49 27% 39%	66 18% 53%	58 25% 46%
Sunsites/Elfrida	66 11%	0 0% 0%	0 0% 0%	0 0% 0%	0 0% 0%	66 100% 100%	10 8% 15%	15 13% 23%	19 16% 29%	22 15% 33%	14 10% 21%	15 11% 23%	16 11% 24%	21 12% 32%	38 10% 58%	28 12% 42%
Mean	2.36	1.00	2.00	3.00	4.00	5.00	1.74	1.90	2.26	2.22	2.35	2.17	2.20	2.64	2.26	2.51
Chi Square		1000+ .001					17.35 .137				26.73 .008				5.36 .253	

Prepared by RBI Strategies and Research

A Survey of Sulphur Springs Valley Electric Cooperative Members

Table 29c: DISTRICT

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	600	238 40%	291 49%	71 12%	517 86%	79 13%	384 64%	60 10%	156 26%	486 81%	63 11%	51 9%	201 34%	234 39%	84 14%	60 10%
Sierra Vista	264 44%	118 50% 45%	117 40% 44%	29 41% 11%	229 44% 87%	34 43% 13%	166 43% 63%	21 35% 8%	77 49% 29%	224 46% 85%	16 25% 6%	24 47% 9%	77 38% 29%	148 63% 56%	23 27% 9%	8 13% 3%
Benson	115 19%	34 14% 30%	64 22% 56%	17 24% 15%	105 20% 91%	9 11% 8%	76 20% 66%	9 15% 8%	30 19% 26%	93 19% 81%	12 19% 10%	10 20% 9%	42 21% 37%	38 16% 33%	21 25% 18%	8 13% 7%
Wilcox	30 5%	13 5% 43%	14 5% 47%	3 4% 10%	27 5% 90%	3 4% 10%	19 5% 63%	1 2% 3%	10 6% 33%	27 6% 90%	1 2% 3%	2 4% 7%	12 6% 40%	10 4% 33%	4 5% 13%	3 5% 10%
Elgin Sonoita Patagonia	125 21%	55 23% 44%	56 19% 45%	14 20% 11%	92 18% 74%	31 39% 25%	87 23% 70%	23 38% 18%	15 10% 12%	90 19% 72%	28 44% 22%	7 14% 6%	47 23% 38%	22 9% 18%	23 27% 18%	29 48% 23%
Sunsites/Elfrida	66 11%	18 8% 27%	40 14% 61%	8 11% 12%	64 12% 97%	2 3% 3%	36 9% 55%	6 10% 9%	24 15% 36%	52 11% 79%	6 10% 9%	8 16% 12%	23 11% 35%	16 7% 24%	13 15% 20%	12 20% 18%
Mean	2.36	2.25	2.44	2.37	2.34	2.47	2.35	2.73	2.22	2.29	2.94	2.31	2.49	1.80	2.79	3.48
Chi Square		13.56 .094			24.42 .001		27.31 .001			27.97 .001			91.98 .001			

Prepared by RBI Strategies and Research

Table 30: CON DATE

		Gender		Age			Race/ Ethnicity			Patagonia Sonoita Elgin Area		What was your approximate household income for 2008 before taxes?				
	Total	Male	Female	18-44	45-64	65+	White non-Hisp	Hisp	All other	Y	N	Under 25k	25k-50k	50k-75k	75k+	DK
Base	500	250	249	110	172	211	378	78	44	27	472	95	121	94	102	88
		50%	50%	22%	34%	42%	76%	16%	9%	5%	94%	19%	24%	19%	20%	18%
2008 or after	125	63	61	63	41	19	92	24	9	3	121	23	34	29	26	13
	25%	25%	24%	57%	24%	9%	24%	31%	20%	11%	26%	24%	28%	31%	25%	15%
		50%	49%	50%	33%	15%	74%	19%	7%	2%	97%	18%	27%	23%	21%	10%
2005-2007	115	64	51	30	44	40	90	15	10	5	110	21	32	18	28	16
	23%	26%	20%	27%	26%	19%	24%	19%	23%	19%	23%	22%	26%	19%	27%	18%
		56%	44%	26%	38%	35%	78%	13%	9%	4%	96%	18%	28%	16%	24%	14%
1998-2004	118	62	56	15	41	59	92	18	8	10	108	19	24	24	25	26
	24%	25%	22%	14%	24%	28%	24%	23%	18%	37%	23%	20%	20%	26%	25%	30%
		53%	47%	13%	35%	50%	78%	15%	7%	8%	92%	16%	20%	20%	21%	22%
1997 or before	142	61	81	2	46	93	104	21	17	9	133	32	31	23	23	33
	28%	24%	33%	2%	27%	44%	28%	27%	39%	33%	28%	34%	26%	24%	23%	38%
		43%	57%	1%	32%	65%	73%	15%	12%	6%	94%	23%	22%	16%	16%	23%
Mean	2.55	2.48	2.63	1.60	2.53	3.07	2.55	2.46	2.75	2.93	2.54	2.63	2.43	2.44	2.44	2.90
Chi Square		4.62		122.36			4.49			4.82		16.82				
		.202		.001			.611			.185		.157				

Table 30b: CON DATE

		DISTRICT					CON DATE				BILL				Central Air and Heating?	
	Total	Sierra Vista	Benson	Wilcox	Elgin Sonoita Patagon	Snsites/ Elfrida	2008 or after	2005-2007	1998-2004	1997 or before	$0 - $55	$56 - $85	$86 - $130	$130+	Yes	No
Base	500	264 53%	113 23%	30 6%	27 5%	66 13%	125 25%	115 23%	118 24%	142 28%	117 23%	115 23%	127 25%	141 28%	309 62%	187 37%
2008 or after	125 25%	77 29% 62%	27 24% 22%	8 27% 6%	3 11% 2%	10 15% 8%	125 100% 100%	0 0% 0%	0 0% 0%	0 0% 0%	38 32% 30%	30 26% 24%	28 22% 22%	29 21% 23%	79 26% 63%	43 23% 34%
2005-2007	115 23%	67 25% 58%	26 23% 23%	3 10% 3%	4 15% 3%	15 23% 13%	0 0% 0%	115 100% 100%	0 0% 0%	0 0% 0%	28 24% 24%	28 24% 24%	25 20% 22%	34 24% 30%	85 28% 74%	30 16% 26%
1998-2004	118 24%	54 20% 46%	27 24% 23%	8 27% 7%	10 37% 8%	19 29% 16%	0 0% 0%	0 0% 0%	118 100% 100%	0 0% 0%	24 21% 20%	25 22% 21%	28 22% 24%	41 29% 35%	80 26% 68%	38 20% 32%
1997 or before	142 28%	66 25% 46%	33 29% 23%	11 37% 8%	10 37% 7%	22 33% 15%	0 0% 0%	0 0% 0%	0 0% 0%	142 100% 100%	27 23% 19%	32 28% 23%	46 36% 32%	37 26% 26%	65 21% 46%	76 41% 54%
Mean	2.55	2.41	2.58	2.73	3.00	2.80	1.00	2.00	3.00	4.00	2.34	2.51	2.72	2.61	2.42	2.79
Chi Square		17.35 .137					1000+ .001				11.75 .228				24.19 .001	

Prepared by RBI Strategies and Research

Table 30c: CON DATE

		Employment Status			Satisfaction with SSVEC		Should Line be Built?			Build Line Revote			What is the primary way you heat your home?			
	Total	Full/part time	Retired	Other	V + SW Satisfd	Neutral or dissatis	Build/ Lean	Not Build/ Lean	Und/DK	Build/ Lean	Not Build/ Lean	Und/DK	Electric heat	Natural gas	Propane	Wood
Base	500	194 39%	247 49%	59 12%	442 88%	56 11%	311 62%	44 9%	145 29%	411 82%	43 9%	46 9%	157 31%	220 44%	69 14%	35 7%
2008 or after	125 25%	73 38% 58%	28 11% 22%	24 41% 19%	111 25% 89%	13 23% 10%	70 23% 56%	10 23% 8%	45 31% 36%	108 26% ·86%	8 19% 6%	9 20% 7%	48 31% 38%	52 24% 42%	9 13% 7%	8 23% 6%
2005-2007	115 23%	50 26% 43%	52 21% 45%	13 22% 11%	103 23% 90%	12 21% 10%	73 23% 63%	10 23% 9%	32 22% 28%	91 22% 79%	10 23% 9%	14 30% 12%	40 25% 35%	53 24% 46%	15 22% 13%	3 9% 3%
1998-2004	118 24%	40 21% 34%	64 26% 54%	14 24% 12%	102 23% 86%	15 27% 13%	69 22% 58%	11 25% 9%	38 26% 32%	97 24% 82%	12 28% 10%	9 20% 8%	31 20% 26%	54 25% 46%	21 30% 18%	10 29% 8%
1997 or before	142 28%	31 16% 22%	103 42% 73%	8 14% 6%	126 29% 89%	16 29% 11%	99 32% 70%	13 30% 9%	30 21% 21%	115 28% 81%	13 30% 9%	14 30% 10%	38 24% 27%	61 28% 43%	24 35% 17%	14 40% 10%
Mean	2.55	2.15	2.98	2.10	2.55	2.61	2.63	2.61	2.37	2.53	2.70	2.61	2.38	2.56	2.87	2.86
Chi Square		69.49 .001			0.44 .932		8.13 .229			3.55 .737			16.27 .061			

Prepared by RBI Strategies and Research

270 HOURS OF OUTAGES PROVES IT IS NEEDED.
270 VS 3 HOURS OF OUTAGES SEEMS LIKE A GOOD REASON AND THEY NEED THE POWER.
ABLE TO BUILD TO FIT THE POWER IN THAT AREA
ADDITIONAL GROWTH.
ALL ABOUT PROGRESS.
ALLEVIATE THE PROBLEM BY THE EXTRA POWER CREATED BY ALTERNATIVE POWER SOURCES FROM WIND & SOLAR.
ALOT OF POWER OUTAGES AND RUINING APPLIANCES.
ANOTHER LINE SHOULD BE BUILT TO SUPPORT ALL THE PEOPLE IN THE AREA.
AREA IS GROWING FASTER THAN WHAT COOP CAN ACCOMIDATE.
AS LONG AS THEY KEEP RATES LOW AND DON'T DESTROY FARM LAND.
AS LONG AS UNDERGROUND POWER IS CONSIDERED.
AS THE AREA GROWS-MORE NEED FOR ELECTRICITY.
AS THE POPULATION GROWS MORE ELECTRICITY IS NEEDED.
AS THE POPULATION GROWS MORE ELECTRICITY IS NEEDED.
BASED ON GROWTH, THEY NEED AND EXTRA LINE.
BE ABLE TO HAVE ENOUGH POWER INTO THE AREA.
BECASUE THEY HAVE THE RIGHT TO BULD IT THERE AND IT IS NEEDED.
BECASUE THEY SHOULD HAVE DONE IT LAST YEAR. THEY'RE WASTING THE TAXPAYERS MONEY.
BECASUE WE NEED A BACK-UP ON THE POWER. IT IS MORE IMPORTANT THAN THE VIEW.
BECAUSE DOWN THE ROAD THEY'RE GOING TO HAVE POWER.
BECAUSE I LIKE POWER - ELECTRICITY IS MY FRIEND.
BECAUSE IF YOU DELAY IT WILL BE EXPENSIVE AND JUST PUT THE LINE UP.
BECAUSE IT HAS TO BE DONE NOW. THEY NEED RELIABLE ELECTRICITY.
BECAUSE IT NEEDS MORE LINES BECAUSE ONE LINE WON'T BE ABLE TO HANDLE THE ELECTRICITY.
BECAUSE IT WILL HELP MAKE THE OUTAGES LESS AND IT WILL HELP WITH THE COST OF THE UTILITIES.
BECAUSE IT'S CRAVING AND IT NEEDS MORE LINES TO HANDLE THE GROWTH.
BECAUSE IT'S NECESSARY FOR THE GROWTH. ONE LINE CAN'T HOLD ALL THAT ELECTRICITY.
BECAUSE IT'S NEEDED.
BECAUSE MORE PEOPLE ARE GONNA KEEP COMING.
BECAUSE OF ALL THE PROBLEMS THEY ARE HAVING. WE NEED A NEW POWER LINE.
BECAUSE OF POWER OUTAGES AND SOMETHING NEEDS TO BE DONE.
BECAUSE OF POWER OUTAGES!
BECAUSE OF POWER OUTAGES, WE NEED MORE POWER.
BECAUSE OF THE POOR QUALITY OF POWER.
BECAUSE ONE LINE IS NOT ENOUGH AND IT WILL HELP WITH THE OUTAGES.
BECAUSE POPULATION HAS INCREASED THERE AND THEY NEED IT.
BECAUSE THAT'S WHAT THE STUDY CONCLUDED.
BECAUSE THE AREA IS GROWING AND THEY NEED MORE POWER LINES TO HANDLE ALL THAT ELECTRICITY.
BECAUSE THE AREA OUT THERE IS GROWING TOO FAST, AND THEY NEED IT.
BECAUSE THE DEMAND IS THERE & THEY NEED IT.
BECAUSE THE GROWTH IN THAT AREA NEEDS MORE POWER LINES FOR THE GROWTH.
BECAUSE THE LINE IS OUT DATED AND THEY SHOULD BUILD IT.
BECAUSE THEY DON'T HAVE TOO MANY OUTAGES. 2ND SO IT'S NOT A BURDEN ON THE OTHER TAXPAYERS.
BECAUSE THEY NEED EXTRA LINES TO NOT HAVE THOSE OUTAGES.
BECAUSE THEY NEED IT DESPERATELY BECAUSE OF THE ONE LINE IS NOT ENOUGH.
BECAUSE THEY NEED IT.
BECAUSE THEY NEED IT. A LOT OF BUILDING GOING ON IN THAT AREA.
BECAUSE THEY NEED IT. BECAUSE THEY'RE ALWAYS OUT OF POWER.
BECAUSE THEY NEED MORE LINES TO SUPPORT THE UTILITIES, AND THAT WOULD ELEMINATE THE SHORTAGES THEY ARE GETTING.
BECAUSE THEY NEED MORE POWER IN THAT AREA.
BECAUSE THEY NEED MORE THAN ONE LINE.
BECAUSE THEY NEED NEW LINES NOW, SO IT CAN HAVE THE COST LESS.
BECAUSE THEY NEED THE ELECTRICITY.
BECAUSE THEY SAY IT IS REQUIRED.
BECAUSE THEY WON'T GO NUCLAR. SO WE NEED MORE POWER LINES.
BECAUSE TOO MUCH GROWTH. THEY NEED MORE LINES TO HANDLE THAT ELECTRICITY.
BECAUSE WE NEED ANOTHER LINE.
BECAUSE WE NEED POWER.
BECUASE WE NEED MORE LINES BECAUSE OF THE GROWTH.
BEFORE I SUPPORT THE NEW TIME I WOULD LIKE THEM TO USE ALTERNATIVE & RENEWABLE SOURCES.
BETTER POWER TO PEOPLE IN THAT REGION. MOST COST EFFECTIVE POWER.
BETTER SERVICE AND THE AREA IS GOING TO GROW.
BETTER SERVICE THEN WE HAVE NOW.
BETTER SERVICE.
BETTER SERVICE.
BUILD A NEW LINE OR FIND ANOTHER SOURCE FOR ELECTRICITY.
CAN'T STOP PROGRESS & COOP HAS THE RIGHT TO DO WHAT THEY WANT.
CHEAPER FOR EVERYONE.
CHEAPEST FAIREST WAY TO GO.
CHEAPEST WAY TO DO THIS.
COMMON SENSE. IT'S NOT THAT NEGATIVE A THING.
COMPLY WITH THE LAWS TO BUILD IF ITS THE RIGHT WAY.
COST AND FUTURE RESOURCES
COST AND GROWTH.

COST AND NEED.
CUSTOMER NEEDS AND RELIABILITY.
DANGER FACTOR ON OVERLOADING ELECTRICAL LINES.
DECREASE POWER OUTAGES, KEEPING UP WITH TECHNOLOGY.
DEMAND FOR DEVELOPMENT.
DEMAND OF NEED & CONTINUED NEED OF ALTERNATIVE SOURCES COULD BE BUILT & BROUGHT ONLINE QUICKLY ENOUGH TO BE EFFECTIVE.
DEMAND.
DEPENDABLE SERVICE TO THE AREA.
DEVELOPMENT OF MORE PEOPLE WE NEED MORE POWER - THE MOST ECONOMICAL THING THEY CAN DO.
DONE ALL THE STUDIES THEY NEED AND SULPHUR SPRINGS IS A GOOD COOPERATIVE. ALL STUDIES ARE AGREEABLE WITH SULPHUR SPRINGS.
DON'T CONTINUE TO DO STUDY'S AND COST ME MONEY. I WISH WE COULD DO IT UNDERGROUND. IF THEY DON'T LIKE IT THEY SHOULD PAY THE DIFFERENCE.
ECONOMICALLY FIT. IT WILL NOT HURT THE ENVIRONMENT THAT MUCH.
ECONOMICS.
ELECTRICITY IS ESSENTIAL AND IS NEEDED.
ELECTRICITY IS OUR LIFE STYLE. ELDERS NEED POWER.
ELECTRICITY IS VIABLE SINCE 1930'S IN RURAL ELECTRIC KITCHEN PROGRAM. THEREFORE SHOULD BE DONE.
ENERGY NEEDED FOR THAT AREA.
EVERYONE DESERVES ELECTRICITY OT MEET DEMAND.
EVERYONE NEEDS POWER.
EVERYONE'S COMPLAINING ABOUT POWER BUT THEY DON'T WANT A POWER LINE. THEY DON'T REALIZE HOW MUCH WIND, ETC POWER IS.
FI THEY WANT IT. THEY NEED A LINE.
FOR GROWTH.
FOR HEALTH, SAFETY & ECONOMIC VIABILITY.
FOR IT, BUT WANT IT UNDERGROUND
FOR LESS OUTAGES-WOULD NOT WANT TO BE INCONVIENCED.
FOR PEOPLE DOWN THERE TO HAVE POWER.
FOR PEOPLE WHO NEED IT.
FOR THE COMOFRT OF AMERICAN CITIZENS.
FOR THE PEOPLE LIVING THERE.
FROM WHAT THEY SAY IT'S GOING TO HAVE TO BE DONE SOONER THAN LATER.
GET IT DONE NOW BEFORE IT GETS MORE EXPENSIVE.
GETTING ELECTRICITY TO THE PEOPLE WHO NEED IT.
GROWING AREA. WE HAVE GOT TO KEEP UP DEMAND & SUPPLY.
GROWING POPULATION.
GROWTH IN AREA NEEDS IT.
GROWTH OF THE AREA
GROWTH.
HAVE TO USE A LINE ANYWAY. MORE COST EFFECTIVE.
HAVING EXPERIENCE FROM LINE OVERLOADS.
HELP CUT DOWN ON POWER OUTAGES IN THE AREA. THEY'RE GUILDING MORE DOWN THERE & THEY NEED POWER.
HELP PROMOTE GROWTH OUT THAT WAY.
HELP WITH THE ELECTRICAL OUTAGES.
HELP WITH THE OUTAGES.
I AGREE WITH THE PEOPLE. ELECTRICITY COULD BE MORE.
I AM TIRED OF ALL POWER OUTAGES. WE NEED A RELIABLE SYSTEM.
I DIDN'T MOVE HERE TO LIVE IN A 3RD WORLD COUNTRY. WE NEED ELECTRICITY TO HANDLE THE GROWTH.
I DON'T KNOW.
I HAD PROBLEMS WITH OVER-POPULATION & FREQUENT OUTAGES TILL A NEW LINE WAS BROUGHT IN.
I JSUT GENERALLY AGREE WITH THEM.
I OWN LAND AND WE HAVE COMMERCIAL PROPERTIES. I AM FOR JUCING UP THE AREA.
I THINK IT.WILL TAKE FOREVER FOR SOLAR & WIND POWER AND AT A DECENT PRICE.
I THINK IT'S DOABLE IN THE TIME FRAME. WE NEED IT. THE OTHERS I DON'T THINK ARE DOABLE.
I THINK MAYBE IT IS NEEDED.
I THINK THE POWER COMPANY HAS LOOKED INTO ALL ALTERNATIVES AND IS DOING THE BEST THEY CAN BY BUILDING THE NEW POWER LINE.
I THINK THEY CAN USE IT.
I USED TO LIVE IN DOUBLE ADOBE HOUSES AND HAD ALOT OF OUTAGES, SO THEY NEED A NEW LINE. I KNOW WHAT IT IS LIKE.
I WILL SUPPORT IT AS LONG AS IT DOES NOT COST MORE MONEY.
I WORKED FOR AN ELECTRIC COMPANY BACK EAST AND 2 FEEDER LINES IS THE BEST WAY TO GO.
IF IT'S NEEDED THEN THEY SHOULD BUILD IT.
IF IT'S NOT DONE, PEOPLE WILL COMPLAIN ESPECIALLY NEW PEOPLE.
IF IT'S THE MOST LOW IMPACT WAY FOR THE ENVIRONMENT & PEOPLE, I'M ALL FOR IT.
IF PEOPLE WANT ELECTRICITY, THEY HAVE TO BUILD THE POWER LINES.
IF POWER IS NEEDED THEN THEY NEED TO BUILD THE LINES.
IF THE OPPONENTS WANT MORE STUDIES, THEY SHOULD PAY FOR THEIRSELVES & ADDITIONAL MATERIAL COSTS FROM WAITING TO INSTALL THE POWER LINE.
IF THE STUDY SAYS IT'S THE BEST THEN THEY SHOULD.
IF THERE ARE PEOPLE THERE AND MORE TO COME YOU NEED TO BE ABLE TO SERVE THEM.
IF THERE IS A POWER SHORTAGE THEY NEED IT. THEY HAVE HANDLED THIS WRONG. THEY CHOSE THE WRONG ROUTE.
IF THEY ARE GROWING, THEN THEY NEED TO HAVE MORE ELECTRICITY, NO MATTER WHAT.
IF THEY ARE HAVING TOO MANY OUTAGES THEN THEY NEED THE LINE NO MATTER WHAT THE PROBLEM IS.
IF THEY NEED THE POWER, THEN THEY SHOULD UP THE LINES.
IF THEY WANT SOLAR, IT WOULD TAKE UP ALOT MORE LAND AREA. ONCE THE LINE IS IN, PEOPLE WON'T EVEN NOTICE IT.
IF THEY WERE WORRIED ABOUT MOUNTAINS AND VIEW THEY WOULDN'T HAVE BUILT THEIR HOMES THERE.
IF TO PROVIDE MORE JOBS. THERE IS ALREADY EXISTING LINES. THEY DON'T NEED TO DISTURB ANYTHING ELSE USE WHAT'S THERE. JUST UPGRADE.
IF WE NEED IT, WE NEED IT.

I'M NOT REALLY FAMILIAR W/THE ISSUES. I JUST MOVED HERE, BUT IF WE NEED NEW POWER LINES & IT'S A BIG ISSUE, THEN WE NEED A NEW POWER LINE!
IMMEDIATE NEEDS OUT WEIGH ANY DELAYS SO MOVE FORWARD EXPEDIOUSLY TOWARDS RENEWABLE ENERGY.
IN THE LONG RUN MORE POWER WILL BE NEEDED.
INCREASE IN POPULATION.
IT HAS TO BE DONE THE ALTERNATIVE ENERGY SOURCE AREA READY YET.
IT IS A NECESSITY.
IT IS CHEAPER AND IT SOUNDS LIKE THEY NEED IT.
IT IS COST EFFECTIVE. RESIDENTS KNEW IT COULD HAPPEN.
IT IS GOOD FOR THE COMMUNITY.
IT IS NEEDED AND OUR RATES WOULD STAY LOW.
IT IS NEEDED AND PEOPLE IN THE AREA HAVE WAITED A LONG TIME FOR ANOTHER LINE.
IT IS NEEDED FOR DEPENDABLE ELECTRIC SERVICE.
IT IS NEEDED TO TAKE CARE OF POWER OUTAGES AND HANDLE THE GROWTH.
IT IS NEEDED.
IT IS NEEDED. STUDY HAS EXPLAINED THAT IT IS THE MOST REALISTIC WAY TO GO.
IT IS WHAT NEEDS TO BE DONE FOR THE COMMUNITY.
IT JUST MAKES SENSE OVER THE OTHER ALTERNATIVES.
IT JUST MAKES SENSE. BUILD IT IF THEY NEED IT.
IT MAKES MORE SENSE ELECTRIC IS MORE DEPENDABLE THE OTHERS SHOULD ONLY BE USED FOR BACK UP.
IT MAKES SENSE. MOST COST EFFECTIVE & EFFECTS LESS PEOPLE.
IT MAKES THE MOST SENSE AND MOST COST EFFECTIVE FOR WHAT THEY ARE GETTING.
IT NEEDS POWER AND THEY CAN'T HAVE EXPANSION WITHOUT IT.
IT ONLY GOOD BUSINESS IF YOU WANT A GOOD COMPANY TO SERVE YOU, YOU SHOULD SUPPORT THEM.
IT SEEMS LIKE A GOOD IDEA TO ME.
IT SEEMS THEY ARE EXPERIENCING A NUMBER OF OUTAGES AND THAT SHOULD BE ENOUGH REASON.
IT SHOULD BE BUILT 3-TIMES AS LARGE SO THIS WON'T HAPPEN IN THE FUTURE.
IT SOUNDS LIKE IT WOULD BENEFIT THE PEOPLE OUT THERE.
IT SOUNDS LIKE THE MOST COST PRODUCTIVE WAY TO REDUCE OUTAGES IN THE AREA.
IT WILL BE MOST EFFICIENT.
IT WILL BE THERE WHEN MORE PEOPLE MOVE TO THE AREA AND IT WILL HAVE LESS OUTAGES.
IT WILL CUT DOWN ON OUTAGE PROBLEMS AND THE AREA NEEDS IT.
IT WILL GIVE PEOPLE POWER. THE OUTAGES WE HAVE ARE SOMETIMES LIKE 3 HOURS LONG TO RESTORE THE AREA.
IT WILL HELP ALOT OF PEOPLE OUT ALOT.
IT WILL HELP KEEP OUR RATES DOWN.
IT WILL HELP MORE PEOPLE THAN HURT
IT WILL HELP THE OUTAGES FROM HAPPENING OUT THERE.
IT WILL HELP THE RATES.
IT WILL REDUCE EVERYONE'S RATES IN DUE TIME.
IT WON'T HURT PROPERTY VALUES. IT WILL INCREASE IT. IF THEY DON'T HAVE POWER, HOW WILL THEY SELL THEIR HOMES ANYWAY?
IT WOULD AID DEVELOPMENT OF THAT AREA.
IT WOULD HELP GET POWER TO THE REST THAT DON'T HAVE IT
IT'S A GROWING AREA AND THEY NEED PROGRESS.
IT'S AN NECESSITY.
IT'S BEEN A GROWING COMMUNITY AND THEY NEED MORE POWER.
IT'S BEEN NEEDED FOR A LONG TIME, THE ALTERNATIVES AREN'T FEASIBLE AT THIS TIME.
IT'S COST EFFECTIVE. TOO MANY DELAYS COULD IMPACT THE COST.
IT'S GOOD FOR THE WHOLE COUNTY. DOWN THERE IT WON'T MATTER IF IT WAS WATER. THEY STILL DISAPROVE. SOMEONE WILL ALWAYS COMPLAIN.
IT'S MUCH MORE EXPENSIVE TO WAIT, THEY WILL KEEP WANTING STUDIES TO DRAG IT OUT LONGER AND LONGER.
IT'S NECESSARY.
IT'S NEEDED
IT'S NEEDED BECAUSE THEY NEED THE POWER.
IT'S NEEDED OUT THERE.
IT'S NEEDED.
IT'S PROGRESS. PEOPLE NEED POWER.
IT'S THE ONLY LOGICAL WAY TO SOLVE THE PROBLEM.
IT'S THEIR LAND THEY SHOULD BE ABLE TO BUILD ON ITIN ORDER TO BEST ALLOW BEST SERVICE FOR CUSTOMERS, WAITED AS LONG AS THEY COULD HAVING TO PUT OUT
IT'S WHAT IS BEST FOR THE COMMUNITY.
IT'S WHAT IS NEEDED
I'VE LIVED IN SONAITA AND THE POWER OUTAGES ARE UNTOLERABLE. IT HAS TO BE DONE.
KEEP IT ECONOMICAL & IT'S NEEDED FOR RELIABILITY SO I SAY BUILD IT.
KEEP THE COST DOWN AND PREVENT OVERLOADING.
KEEP THE COST DOWN FOR EVERYONE.
KEEP THE POWER ON.
LATER IT WILL COST MORE AND THEY'RE GOING TO HAVE TO HAVE IT SO MIGHT AS WELL DO IT NOW.
LESS OUTAGES.
LESS OUTAGES.
LESS POWER OUTAGES AND MORE PEOPLE COMING OUT TO ELGIN TO PICK FRUIT FROM FARMERS.
LESS POWER OUTAGES!
LESS POWER OUTAGES, LESS COMPLAINTS.
LESS POWER OUTAGES.
LESS POWER OUTAGES.
LESS POWER OUTAGES. COST EFFECTIVE.
LIMIT HURTING RATES. KEEP RATES LOWER.
LIVED IN RURAL AREAS & EVERYBODY HAS A RIGHT TO ELECTRICITY.

LONG TERM SOLUTION AND COST EFFECTIVE.
LOWER OUR RATES. LIMIT OUTAGES.
LOWER RATES.
MONEY.
MORE COST EFFECTIVE IF THEY ARE HAVING THAT MANY OUTAGES THEY MUST NEED IT.
MORE ELECTRICITY IS NEEDED.
MORE EXPENSIVE THE LONGER THEY WAIT.
MORE PEOPLE MOVED IN OUT THERE.
MORE PEOPLE YOU GET, THE MORE POWER YOU'RE GOING TO NEED. IT'S BETTER TO FIX IT EARLY.
MORE POWER ACCESS, LESS OUTAGES.
MORE POWER IS NEEDED IN THE AREA. TOO MANY OUTAGES.
MOST REALISTIC WAY OF DEALING WITH THE PROBLEM.
NA
NEED IT DESPERATELY.
NEED MORE ELECTRICITY A YEAR.
NEED MORE GROWTH.
NEED POWER & OUT OF POWER. THEY NEED TO ACCOMODATE PEOPLE AND BE PRACTICLE.
NEED THE LINE.
NEED THE POWER AND ARE COMPLAINING ABOUT POWER OUTAGES BUT WON'T ALLOW THE LINE.
NEEDED TO AVOID THAT FUTURE PROBLEM. NEED TO TAKE CARE OF OLD FEEDS.
NO ENOUGH LINES.
NO NEW HOOK UPS ALLOWED RIGHT NOW.
NO OTHER ALTERNATIVE BUT A NEW LINE.
NO OTHER ALTERNATIVES WOULD BE AS EFFECTIVE & MAKE LAND VALUES GO UP.
NOT TO HAVE POWER OUTAGES.
ONCE ESTABLISHED & PEOPLE LEARN TO ADAPT TO WHAT WAS ONCE A PROBLEM AND SOLVE BLACK OUT PROBLEMS.
ONE LINE IS OVER-LOADED.
ONLY IF IT DOESN'T RAISE CURRENT ELECTRIC RATE.
ONLY IF THE POWER LINE'S ARE UNDERGROUND
OUTAGES
OUTAGES ARE VERY STRESSFUL.
OVERALL GROWTH. CUT OFF GROWTH WITHOUT POWER.
PEOPLE ARE GOING TO MOVE DOWN THERE AND THERE WILL NOT BE ENOUGH POWER.
PEOPLE ARE GOING TO NEED THE ELECTRIC. IF THEY DON'T GET IT THEY'LL BLAME THE COOP & IT'S THEIR FAULT FOR NOT LETTING THEM DO THEIR JOB.
PEOPLE ARE GOING TO NEED THE POWER.
PEOPLE DESERVE MORE POWER.
PEOPLE DO NEED POWER.
PEOPLE NEED ELECTRICITY, AND THAT EXTRA POWER LINE.
PEOPLE NEED ELECTRICITY.
PEOPLE NEED ELECTRICITY.
PEOPLE NEED POWER.
PEOPLE NEED POWER.
PEOPLE NEED THE CHEAPEST WAY.
PEOPLE NEED THE ELECTRICITY NOW.
PEOPLE NEED THE ELECTRICITY.
PEOPLE NEED THE ELECTRICITY.
PEOPLE SHOULD NOT HAVE TO EXPERIENCE THAT MUCH OUTAGE.
PEOPLE WHO LIVE IN THE AREA WITH THEIR VIEWS & ALTERNATIVE ENERGY IS NOT WORKING. THEY NEED IT. THE COST WILL CONTINUE TO GO UP.
PEOPLE WHO LIVE THERE NEED THE SERVICE.
PEOPLE WHO MOVE THERE WANT POWER, SO THEY NEED A POWER LINE.
PLAN FOR THE FUTURE.
POPULATION & GROWING & IT'S REALLY NEEDED WITH A GROWING POPULATION
POPULATION EXPLOSION.
POPULATION IS INCREASING.
POWER IS NEEDED IN THE LONG RUN.
POWER IS NEEDED.
POWER OUTAGES ARE DANGEROUS.
POWER REQUIREMENTS - OLD PEOPLE NEED THAT POWER MORE THAN ANYONE ELSE.
PROGRESS FOR THE WHOLE SOUTHERN PART OF THE STATE.
PROVIDE POWER FOR MORE PEOPLE WITH LESS OUTAGES.
PUBLIC SERVICE PROBLEM TO LESSEN.
QUIT WINING! THEY NEED THE POWER.
RELIABILITY - AND THE PLACE IS GROWING & THEY WILL NEED IT ANYWAY.
RELIABILITY ISSUES AS FAR AS IT GOING ON AND OFF.
RELIABILITY OF POWER.
RELIABILITY OF SERVICE IT CAN PROVIDE.
RELIABLE POWER AND PREVENT RATE INCREASES FROM THE DELAY.
SAFETY.
SERVICE.
SO I DON'T HAVE TO START MY GENERATOR EVERY TIME I NEED TO WATER MY HORSES.
SO MY ELECTRIC BILLS WON'T SKY ROCKET.
SO PEOPLE DON'T END UP WITH POWER OUTAGES CONSTANTLY.
SO THEY CAN HAVE BETTER SERVICES.
SO THEY CAN HAVE MORE POWER.

SO THEY CAN HAVE NEW BUILDING.
SO THEY CAN PROVIDE SERVICE FOR THE PEOPLE.
SO THEY DON'T HAVE OUTAGES & THE LONGER YOU WAIT THE MORE IT WILL COST.
SO THEY DON'T HAVE POWER OUTAGES.
SO THEY WON'T BE WITHOUT POWER WITH THAT MANY OUTAGES.
SO THEY WON'T HAVE SO MANY OUTAGES. THE WINDMILLS (GENERATORS) ARE BIG & UGLY WHICH BLOCK VIEW ALSO.
SO WE DON'T HAVE AS MANY POWER OUTAGES.
SO WE DON'T HAVE SO MANY POWER OUTAGES.
SO WE HAVE LESS INTERRUPTIONS & POWER OUTAGES.
SOONER OR LATER IT'S GOING TO HAVE TO BE DONE.
SOUTHEAST ARIZONA IS ALWAYS LOOKING FOR MORE GROWTH & THEY WILL HAMPER THAT GROWTH IF THEY DON'T BUILD THE POWER LINE.
STOP BLACKOUTS AND HELP PEOPLE. IT WON'T INTERFERE WITH THE VIEW OF THE MOUNTAINS.
STOP POWER OUTAGES. ITS GROWING AND IT NEEDS TO BE DONE.
SULPHUR SPRINGS VALLEY ELECTRIC CO-OP HAD THE RIGHTS TO BUILD THERE FIRST.
SUPPLY & DEMAND.
THAT PEOPLE ARE GOING THROUGH POWER OUTAGES.
THE ALTERNATIVE NEEDS INFRASTRUCTURE AND STILL BLOOCKS VIEWS
THE AREA & POPULATION IS GROWING & IT'S A NECESSITY.
THE AREA HAS GROWN AND IT NEEDS IT.
THE AREA IS EXPANDING.
THE AREA IS GROWING AND DEMAND IS THERE.
THE AREA IS GROWING TOO FAST. THEY NEED MORE SERVICE.
THE AREA IS GROWING.
THE CONTINUED DEVELOPMENT OF THE AREA.
THE CO-OP HAS THE RIGHT OF WAY.
THE COOP SAYS IT'S NECESSARY THEY WOULDN'T WASTE OUR MONEY.
THE COST ISSUE AND THE INDEPENDENT STUDY.
THE COST RIGHT NOW WILL NOT AFFECT MY PROFITS DOWN THE ROAD.
THE COST WOULD DECREASE.
THE EASTENERS ARE MOVING IN. THEY HAVE TO BUILD IT TO PROVIDE POWER.
THE ELECTRICITY IS NEEDED AS MORE PEOPLE MOVE THERE.
THE ELECTRICITY IS NEEDED.
THE ELECTRICITY IS REALLY NEEDED.
THE ELECTRICITY IS RELIABLE.
THE ELECTRICITY SHOULD BE GIVEN TO EVERYONE AS A FAIR ADVANTAGE. EVERYONE SHOULD HAVE ELECTRICITY.
THE EXPANDING POPULATION.
THE GROWTH AND IT WOULD SOLVE THE PROBLEM TO PUT UP A NEW LINE.
THE GROWTH IN THE AREA.
THE HIGH GROWTH THAT HAS BEEN ALLOWED.
THE INDEPENDENT STUDY IS ON THE INTERNET. READ IT.
THE MORE PEOPLE THEY HAVE THE MORE ELECTRICITY THEY ARE GOING TO USE.
THE NEED FOR ELECTRICTY FOR THE PEOPLE LIVING IN THE AREA.
THE NEED FOR IT.
THE NEED FOR IT.
THE NEED OF THE PEOPLE.
THE NEEDS THERE.
THE OUTAGES ARE THE BEST REASONS TO BUILD THE LINE.
THE OUTAGES.
THE PEOPLE ARE HAVING PROBLEMS WITH THE SYSTEM AND OVER LOADING THE SYSTEM AND LOOSING POWER.
THE POPULATION GROWTH - THERE USED TO BE A LOT OF LIVE STOCK BUT NOT ANYMORE.
THE POPULATION GROWTH.
THE POWER IS NEEDED.
THE POWER IS NEEDED.
THE POWER OUTAGES, WHEN NOT ENOUGH POWER IN FEED LINES TO COVER IT.
THE RELIABILITY OF ELECTRICY IN THIS AREA IS REQUIRED.
THE REST OF US SHOULD NOT SUFFER THE COST IF THE LINE IS NOT PUT IN.
THE STUDY & IF THEY WAIT IT WILL COST MORE.
THERE ARE ALOT OF PEOPLE WHO HAVE SUFFERED ALOT OF OUTAGES.
THERE HAS BEEN ALOT OF GROWTH TO THAT AREA. THEY NEED IT.
THERE WILL BE MORE RELIABILITY.
THERE'S A NEED FOR IT & LONG RANGE THEY NEED IT, BECAUSE THERE IS NOT MUCH OUT THERE.
THESE OPPONENTS DO NOT WANT THEIR VIEW OBSTRUCTED - IF YOU PUT IN AN ALTERNATE SOURCE THEY WILL ALSO COMPLAIN.
THESE PEOPLE DESERVE BETTER SERVICE THAN THEY ARE GETTING.
THEVE ALLOWED PEOPLE TO BUILD IN THE AREA SO THEREFORE, THEY HAVE TO HAVE IT.
THEY ARE GOING TO BUILD IT SOMEWHERE IT MIGHT AS WELL BE THERE.
THEY ARE HAVING OUTAGE PROBLEMS. THEY NEED A NEW LINE.
THEY ARE TRYING TO FIX A PROBLEM. THEY HAVE OWNED THE RIGHTS FOR YEARS.
THEY CAN HAVE ELECTRICITY THAT IS NEEDED.
THEY CAN'T ADD ANY NEW CUSTOMERS TO THE AREA.
THEY COMPLAIN ABOUT THE POWER OUTAGES THEY'RE TRYING TO MOSTLY KEEP IT OUT SITE.
THEY DON'T HAVE ENOUGH POWER. YOU CAN'T STOP PROGRESS.
THEY HAD ALREADY PLANNED FOR THIS YEARS AGO & THEY HAVE THE RIGHT TO BUILD IT.
THEY HAVE HAD RIGHTS TO IT FOR A LONG TIME. IT IS LESS EXPENSIVE THEN SOLAR.
THEY HAVE SO MANY OUTAGES AND NOT ENOUGH POWER.

THEY HAVE TO BUILD IT. WE NEED MORE POWER.
THEY HAVE TOO MANY BLACKOUTS. IT IS NEEDED.
THEY HAVE TOO MANY OUTAGES.
THEY NEED A NEW LINE. WHY WAIT TILL IT COSTS MORE AND THERE WILL BE NEW GROWTH.
THEY NEED ELECTRICITY.
THEY NEED ELECTRICITY.
THEY NEED ELECTRICITY.
THEY NEED IT AND ANY DELAY ON BUILDING. IT WILL END UP COSTING US MORE MONEY.
THEY NEED IT AND IT WOULD BE COST EFFECTIVE.
THEY NEED IT SO THERE AREN'T AS MANY OUTAGES.
THEY NEED IT.
THEY NEED IT.
THEY NEED IT. IF IT WAS PUBLIC RECORD WHEN HOME OWNERS BOUGHT THEIR PROPERTY, THEN THAT IS THEIR FAULT FOR NOT PAYING ATTENTION.
THEY NEED IT. THERE HAS BEEN ALOT OF BUILDING OUT THERE.
THEY NEED IT. TOO MANY OUTAGES.
THEY NEED MORE ELECTRICITY IN THE AREA.
THEY NEED MORE ELECTRICITY.
THEY NEED MORE LINES OF POWER. BECAUSE ITS GROWING.
THEY NEED MORE LINES TO HANDLE THE ELECTRICITY AND IT WILL CREATE TO HAVE JOBS AS WELL.
THEY NEED MORE POWER AND IT'S THE MOST COST EFFECTIVE. I DON'T WANT TO PAY FOR THE OTHER ALTERNATIVES.
THEY NEED POWER AND IT IS THE MOST REALISTIC.
THEY NEED POWER.
THEY NEED POWER.
THEY NEED POWER. TOO MANY OUTAGES.
THEY NEED THE EXTRA ELECTRICITY IT WOULD PROVIDE.
THEY NEED THE EXTRA ENERGY.
THEY NEED THE POWER IT WOULD PROVIDE.
THEY NEED THE POWER NOW.
THEY NEED THE POWER TO ACCOMODATE CURRENT & NEW RESIDENTS.
THEY NEED THE POWER, AND IT'S THE CHEAPEST WAY.
THEY NEED THE POWER.
THEY NEED THE POWER.
THEY NEED THE POWER.
THEY NEED THE POWER.
THEY NEED THE POWER. THEY CAN'T COMPLAIN BOTH WAYS. THEY KNEW IT WAS COMING.
THEY NEED THE SERVICE BECAUSE OF OUTAGES.
THEY NEED THEIR ELECTRICITY.
THEY NEED THIS BECAUSE OF THE GROWTH.
THEY NEED TO BUILD NOW INSTEAD OF LATER.
THEY NEED TO BURY IT.
THEY NEED TO DO IT TO AVOID MORE OUTAGES.
THEY NEED TO SUPPORT THE GROWTH.
THEY NEED TO UPGRADE THEIR SYSTEM.
THEY OWN THE LAND. THEY SHOULD BE ALLOWED TO DO WHAT THEY WANT. I DO WHAT I WANT ON MY LAND.
THEY SHOULD NOT BURN THE EXISTING CUSTOMERS. THEY SHOULD PAY FOR THAT EXTRA LINE.
THEY WANT THE ELECTRICITY.
THEY WON'T HAVE AS MANY OUTAGES AND BETTER SERVICES.
THEY WON'T HAVE ENOUGH POWER WITHOUT IT.
THEY WOULDN'T PUT IT IN IF WE DIDN'T NEED IT.
THEY'RE HAVING BURN OUTS.
THEY'RE TRYING TO ACCOMODATE EVERYONE COMING IN. A FEW DON'T WANT IT, BUT MROE NEED IT.
THINK GROWTH IS GOOD.
THOSE PEOPLE DESERVE TO HAVE GOOD POWER.
THOSE POEPLE NEED THOSE BUILT WINDED & SOLAR WILL TAKE TOO LONG. THE AREA IS GROWING TOO FAST.
TIRED OF THE OUTAGES.
TO ACCOMIDATE GROWTH.
TO ACCOMODATE GROWTH.
TO AVOID OUTAGES.
TO CONTINUE POWER FOR NEW HOMES.
TO CUT THE OUTAGES DOWN.
TO ELIMINATE THE AMOUNT OF POWER CURCUITS.
TO END OUTAGES IN THAT AREA.
TO GIVE THE PEOPLE WHAT THEY NEED.
TO GIVE THE RESIDENTS THE POWER THAT THEY NEED.
TO GIVE THEM ELECTRICITY.
TO HAVE BETTER SERVICE. HAVE MORE CONSTANT SERVICE.
TO HAVE CONSISTENT SERVICE.
TO HAVE LESS OUTAGES.
TO HELP LOWER EVERYONES RATES
TO IMPROVE THE SERVICE.
TO KEEP POWER OUTAGES TO A MINIMUM.
TO KEEP RATES LOWER. IT IS THE BEST SOLUTION.
TO MAKE SURE THAT EVERYONE THAT LIVES OUT THERE HAS ELECTRICITY WITHOUT OVER LOADING THE ONE LINE.
TO PREVENT MORE OUTAGES AND GIVE PEOPLE ELECTRICITY.

TO PREVENT THE OUTAGES
TO PROVIDE ADEQUATE SERVICE TO THAT AREA.
TO PROVIDE POWER TO THE PEOPLE IN SONOITA, PATAGONIA & ELGIN AREA.
TO PROVIDE SERVICE TO PEOPLE THAT ARE REQUESTING IT.
TO REDUCE NUMBER OF POWER OUTAGES. TO ALLOW MORE PEOPLE TO BUILD HOMES IN THAT AREA BECAUSE OF REFUSALS FOR HOOKUPS.
TO REDUCE POWER OUTAGES.
TO REDUCE THE NUMBER OF OUTAGES.
TO REDUCE THE NUMBER OF POWER OUTAGES.
TO RELIEVE THE POWER OUTAGES IN THAT AREA.
TO SERVE PEOPLE WHO SUBSCRIBE IN THAT AREA.
TO STOP THE POWER OUTAGES.
TO SUPPORT GROWTH IN THE AREA.
TOO MANY OUTAGES.
TOO MANY OUTAGES.
TOO MANY OUTAGES.
TOO MANY OUTAGES.
TOO MANY PEOPLE ARE MOVING INTO THE AREA.
TOO MANY POWER OUTAGES. IT NEEDS TO BE DONE ASAP.
TOO MANY PROBLEMS IN PAST.
TOO SHORTEN OUTAGE TIME.
WE ALL NEED LIGHT.
WE ALL NEED POWER.
WE ARE EXPANDING THE AREA AND IF THEY WANT TO CUT DON ON POWER OUTAGES THEY NEED TO DO IT.
WE DON'T HAVE A LOOP & NEED A LOOP.
WE HAVE TO IF WE NEED TO PROVIDE ELECTRICITY TO A GROWING COMMUNITY.
WE HAVE TOO MANY OUTAGES AND TOO MUCH GROWTH.
WE KEEP LOSING POWER IN PATAGONIA.
WE NEED ELECTRICITY & IT WILL STOP OUTAGES.
WE NEED EXTRA LINE FOR POWER.
WE NEED GOOD SERVICE & THE POPULATION IS GROWING.
WE NEED IT AND DO IT NOW WHILE THE COST IS LOW.
WE NEED MORE POWER FOR MORE HOUSES.
WE NEED MORE POWER.
WE NEED THE ELECTRICITY FOR THE AMOUNT OF NEW PEOPLE.
WE NEED THE EXTRA POWER LINES AND THEY NEED TO BUILD THEM.
WE NEED THE EXTRA POWER THAT IT WOULD PROVIDE.
WE NEED THE POWER.
WE NEED TO THINK OF LONG TERM RESOURCES WE WOULD USE.
WE OWN A VERY LARGE BUSINESS & IT COSTS US THOUSANDS OF DOLLARS. EVERY TIME THERE IS AN OUTAGE. BEEN HERE SINCE 1947. PEOPLE SHOULD DO THEIR RESEARCH.
WE RECEIVE TOO MANY OUTAGES.
WE'VE ALREADY SPENT ENOUGH MONEY ON THIS, JUST GET IT DONE.
WHEN WE HAVE STORMS & WINTER TIME, THE POWER GOES OUT ALOT, SO WE NEED IT.
WILL BE LESS OUTAGES.

(CONT'D) MORE STUDIES IT WILL COST MORE.
2010 WE HAVE INTELLIGENCE, THEY NEED TO LOOK AT ALTERNATIVE POWER OR ALTERNATIVE WAY INSTEAD OF RUINING THE VIEWS.
ALTERNATIVE ENERGY MAKES SENSE IN THE LONG RUN.
ALTERNATIVE ENERGY SHOULD BE USED.
ALTERNATIVE IS THE WAY TO GO FOR THE FUTURE.
BECAUSE 100% OF THIS PURPOSE IS FOR THE EXPANSION FOR FUTURE USE.
BECAUSE I DON'T KNOW WHERE THE LINE GOES.
BECAUSE THE COST WOULD BE PROHIBITED.
BECUASE IT'S GOING TO COST ME MORE MONEY.
DESTRUCTION OF LANDS AND VIEWS. ALTERNATIVE FUELS ARE THE BETTER WAY TO GO RIGHT NOW.
DON'T KNOW.
GROWTH & THE STRAIN ON OUR AQUAFER. IT WILL CAUSE TOO MUCH GROWTH.
HALT THE GROWTH.
I DON'T BELIVE WE NEED IT.
I DON'T THINK EITHER SIDE HAS DISCLOSED ALL THE INFORMATION SULPHUR SPRINGS HAS BEEN VERY VINDICTIVE ON A PERSONAL LEVEL AND IT'S VERY UNPROFESSIONAL.
I DON'T WANT THE TAXPAYERS TO PAY FOR IT.
I QUESTION IF THIS IS THE ONLY WAY TO PROVIDE ADAQUATE POWER TO THE VALLEY.
I THINK ALTERNATIVE IS THE WAY TO GO.
I THINK I DON'T LIKE THE POWER LINES, I LIKE THE VIEW OF THE MOUNTAINS AND I THINK THEY COULD FIND A BETTER WAY.
I THINK IT'S CRITICAL TO DEVELOP ALTERNATIVE MEANS TO POWER, NO MATTER TIME OR COST.
IF PEOPLE DON'T WANT IT, THEN DON'T PUT IT OUT THERE.
IF THEY BUILD IT, THEY WON'T EVEN LOOK INTO RENEWABLE ENERYG SOURCES.
IF THEY WANT MORE ELECTRICITY THEY CAN MAKE IT THEMSELVES.
I'M NOT AGAINST IT BEING BUILT BUT IT NEEDS TO BE PUT SOMEWHERE ELSE.
I'M NOT OPPOSED TO ANOTHER LINE. I AM OPPOSED TO WHERE THEY WANT TO PUT IT. THEY CAN PUT IT WHERE THE OTHER ONE THAT DOESN'T WORK IS.
IN 1985 I SUGGESTED THAT THEY GO INTO ALTERNATIVE ENERGY-WE SHOULD ALL HAVE ALTERNATIVE ENERGY FOR OUR HOMES-THEY BELIEVED I HAD A DUMB IDEA.
INCORRECT ON OUTAGES AND NEEDS
IT COULD BE DONE EASIER. THERE ARE NATURAL LINES.
IT DISTRACTS FROM THE SCENERY & BEAUTY OF THE PLACE & THE POWER ALWAYS WENT OUT ANYWAYS. MORE POWER LINES AREN'T GOING TO HELP.
IT NEEDS TO BE 50/50. THAT WOULD BE FAIR, THEN IT WON'T MATTER.
IT WILL DAMAGE ALL OF THE COMMUNITY SHOUL WE GO WITH ALTERNATIVE ENERGY.
IT'S A BEAUTIFUL PLACE HERE AND WE NEED TO KEEP THE BEAUTY.
IT'S DESTROYING A BEAUTIFUL AREA.
IT'S NOT FAIR TO THE PEOPLE THAT LIVE HERE. IF WE KEEP BUILDING WE WILL LOOK LIKE NEW YORK. WHY NOT START W/RENEWABLE ENERGY NOW?
MAJOR CONSIRACY. BIO'S STUDY.
NEED TO DO MORE WITH SOLAR ENERGY.
NO CONCERNS. I LIVE IN THAT AREA.
NOT NECESSARY.
OFFER MORE ALTERNATIVE ENERGY OPTIONS. THEY NEED TO FIGURE OUT A NEW WAY TO DO THINGS.
PROVIDES THE OPPORTUNITY TO PUSH FOR ALTERNATIVES.
SULPHUR SPRINGS IS TRYING TO BUILD A PATHWAY TO RORENMONT MINES AND I DON'T WANT THEM USING ANYONE.
THE ALIGNMENT & ROUTE - USE THE SAME ALIGNMENT THAT THE CURRENT POWER LINE OR THE ALIGNMENT THAT TEP ALREADY HAS.
THE ALTERNATIVE ENERGY NEEDS TO IMPLEMENT THE USE OF ALL SOLAR ENERGY.
THE COST AND INFRINGEMENT ON OTHER PEOPLE.
THE COST AND VIEW OF THE MOUNTAINS.
THE DISAGREEMENT OF THE PEOPLE. IF THEY SEE NO NEED FOR IT, WHY PUT IT IN?
THE ENVIRONMENTAL IMPACT. LOOK INTO ALTERNATIVES MORE DEEPLY.
THE HOME OWNERS BOUGHT THERE TO GET AWAY FROM POWER LINES AND NOT OBSTRUCT THEIR VIEW.
THE PEOPLE SHOULD BE RESPECTED AND IF THEY CHOOSE NOT TO HAVE THE LINE THERE, THEN IT SHOULD NOT.
THE VIEWS OF THE MOUNTAINS AND THE COST.
THE WILD-LIFE WILL BE AFFECTED. THEY SHOULD HAVE IT BUILT UNDERGROUND WOULD SOLVE ALOT BETTER.
THEY COULD PUT IN SOLAR ENERGY.
THEY DO NOT HAVE ENOUGH MONEY TO SUPPORT WHAT THEY HAVE, WHY WOULD THEY SPEND MORE.
THEY HAVEN'T LOOKED AT ALTERNATIVES.
THEY NEED TO DISCUSS WHAT OTHER OPTIONS CAN BE DONE, LIKE PUT THE LINES UNDERNEATH THE GROUND. SO THE OPPONENTS CAN STILL HAVE THEIR VIEW.
THEY NEED TO LOOK AT OTHER ALTERNATIVES.
THEY NEED TO TAKE CARE OF THE PROBLEMS THEY ALREADY HAVE.
THEY SHOULD SHARE POWER WITH TETON BASE.
THIS IS TO INCREASE THE BILLS ON THE UTILITIES.
TOO MUCH EXPENSE.
WE USE SHORT TERM GAINS & NEGLECT THE LONG TERM.
WE WANT THE ALTERNATIVE SOURCES DEVELOPED.
WE WON'T EVEN GET ANY OF THE POWER FROM THE NEW LINE.

ALTERNATIVE ENERGY SOURCE WOULD BE BETTER.
COOP NOT TRYING TOO HARD TO GO SOLAR OR WIND - DO PROPERTY OWNERS WANT TO SEE WIND MILLS?
COST & REALIBILITY.
COST AND OUTAGES.
COST AND WHAT'S BEST FOR PEOPLE AND ENVIRONMENT.
COST EFFECTIVNESS & COST OF WHATEVER RATE PAYER'S HAVE TO PAY.
COST EFFECTIVNESS & DESTROYING THE VIEW.
COST TO THE SULPHER SPRINGS VALLEY SHAREHOLDERS.
FIRST, WHO THE OPPONETS ARE AND SECOND, EXACTLY WHAT THE COST OF THE ALTERNATIVE ENERGY SOURCES ARE.
GETTING RELIABLE POWER TO THE PEOPLE IS IMPORTANT AND SO IS KEEPING THE COST DOWN.
HOW THE NEEDS CAN BEST BE MET. HOW CAN WE BUILD IT?
I CAN'T SAY BECAUSE I DON'T LIVE THERE AND I DON'T HAVE ANY INFORMATION.
I DON'T KNOW ENOUGH YET TO SAY ONE WAY OR ANOTHER.
I DON'T KNOW MUCH ABOUT ANY OF THIS.
I DON'T KNOW WHERE THE POWER LINE IS GOING.
I DON'T KNOW.
I DON'T KNOW.
I DON'T KNOW. I HAVE HEARD VERY LITTLE.
I DON'T LIVE THERE DO I DON'T HAVE ANY OPINION AT THIS TIME.
I FEEL THE PUBLIC NEEDS TO BE EDUCATED MORE ABOUT THIS. I THINK THERE COULD BE OTHER ALTERNATIVES BESIDE RENEWABLE ENERGY. NOT ENOUGH INFORMATION.
I NEED INFORMATION BEFORE I CAN MAKE A DECISION.
I NEED MORE INFORMATION. I DON'T KNOW WHAT THEY NEED.
I THINK I WOULD LIKE SOMETHING IN THE SOLAN AREA TO BE CHECKED OUT.
I WANT TO SEE THEM PUT IT UNDERGROUND.
IF IT'S SOMETHING THAT WILL BRING IN MORE JOBS, WHY WOULD THEY WANT TO EXTEND IT? IS IT ONLY FOR RESIDENTS?
IF SOLAR IS ALTERNATIVE LOOK INTO IT.
IF THE PEOPLE WANT IT THEY SHOULD GET IT AND IF THEY DON'T THEN THEY SHOULDN'T - KEEPING MY ELECTRICITY LOWER.
I'M UP IN THE AIR. WE NEED MORE POWER BUT THEY NEED TO FIND ANOTHER WAY.
IS IT REALLY NEEDED?
KEEP IT WHERE IT DOESN'T DISTURB THE ENVIRONMENT TOO BAD.
LEARNING TO OPPOSE, TOO MUCH MONOLOPY.
LOOK AT ALL ALTERNATIVES & TRY TO WORK WITH THE PEOPLE.
MAKE THEM PAY FOR IT! WIND MILLS ARE WAY WORSE FOR THE VIEW THAN POWER LINES!
NO OPINION
POWER LINES SHOULD BE PUT IN BUT UNDERGROUND ONLY.
RAISES IN RATES.
RELIABILITY OF SERVICE. RE-USE OF RENEWABLE ENERGY.
THE COST IS ONE AND HOW MUCH THE CUSTOMERS NEED THE POWER.
THE HIKE IN COST. THE ECONOMY DOESN'T CALL FOR SPENDING MORE MONEY.
THE PEOPLE WHO LIVE THERE.
THE PEOPLES VIEWS AND THE LAND
THE SOONER THE BETTER.
THEY DO NEED SOMETHING DONE.
THEY NEED POWER LINES. IT SHOULD BE BUILT UNDERNEATH.
THEY NEED TO GIVE ME A LOT MORE INFORMATION. THIS SURVEY IS THE FIRST I'VE HEARD ABOUT IT.
THEY SHOULD NOT PUSH THAT SO FAST AND DO PHONE STUDIES FIRST.
WE DO NOT NEED A NEW FEEDER LINE. NOT OUTAGES WHERE I LIVE.
WHETHER IT IS REALLY NECESSARY.
WHETHER PEOPLE CARE ABOUT THE OUTAGES.
WHY CAN'T THEY BURY THEM.
WISH SOMETHING COULD BE DONE W/O ELECTRIC BILL GOING UP.
WOULDN'T WANT TO BLOCK VIEW/WOULDN'T COST MORE.

BECAUSE ITS A GREAT VALUE AND RELIABLE SERVICE.
I DON'T WANT IT.
I HAVE A DIFFERENT SERVICE THAT I LIKE.
IT IS RELIABLE.
IT WORKS BETTER THAN WHEN I LIVED ON THE OTHER SIDE OF THE STATE.
NOT GREAT SERVICE.
PHONE SUCKS BUT INTERNET IS GOOD.
SHE GETS WHAT SHE WANTS OUT OF IT.
THE INTERNET SERVICE IS SLOW & EXPENSIVE.
TOO SLOW.
WE ARE RETIRED AND WE DON'T NEED THESE SERVICES.

ALREADY HAVE SERVICE.
ALREADY WITH ANOTHER PROVIDER.
BECAUSE AN ANTENNA IS NEEDED & THATS TO MUCH WORK
BECAUSE I LIKE THE SERVICE I ALREADY HAVE. THE PEOPLE I KNOW WHO HAVE THEIR SERVICE SAY IT'S NOT RELIABLE.
BECAUSE I LIKE THE SERVICE WE HAVE.
BECAUSE I SPEND ONLY SEVEN MONTHS OF THE YEAR HERE SO FAR.
BECAUSE I WANT THEM TO STICK TO ELECTRICITY.
BECAUSE I'M WITH QWEST.
BECAUSE IT DOES NOT REACH OUT HERE AT HOME.
BECAUSE ITS NOT AVAILABLE TO US IN THIS AREA.
BECAUSE IT'S TOO EXPENSIVE.
BECAUSE MY HUSBAND RUNS COMPETITION.
BECAUSE OF COST.
BECAUSE THE INSTALATION IS TOO EXPENSIVE.
BECAUSE THEY DON'T OFFER T.V. AND MY HUSBAND WOULD HAVE A HISSY FIT!
BECAUSE WE WERE LEAVING.
BETTER PROVISION BY ANOTHER SOURCE (QWEST).
BROADBAND IS CHEAPER.
BUNDLE WITH QWEST.
CABLE IS FASTER.
CHEAPER PACKAGE.
CONTENT WITH WHAT I HAVE.
COST & AVAILABILITY.
COST AND ANTENA ON THE HOUSE.
COST.
COST.
COST.
COST.
COST. QWEST IS BETTER.
DIDN'T HAVE THAT GOOD OF COVERAGE.
DIDN'T KNOW UNTIL TOO LATE.
DIRECT TV WILL KICK THEIR BUTT.
DO NOT HAVE COMPUTER.
DO NOT HAVE THE EXPENSES.
DON'T LEAVE IN THE HOME.
DON'T USE INTERNET.
DON'T USE THE COMPUTER MUCH.
FAMILARITY WITH COMPETING COMPANIES.
FIND OTHER CHEAPER SERVICES.
GO WITH A DIFFERENT COMPANY BECAUSE IT'S CHEAPER.
HATE TO SWITCH IT'S A HASSEL, WHEN THE TIME IS RIGHT I WILL.
HAVE A BETTER OFFER FROM A DIFFERENT COMPANY.
HAVE SATELLITE INTERNET
HERE IN TOWN (COX) DOES A BETTER JOB.
I ALREADY HAD SERVICE IN PLACE WHEN THEY STARTED OFFERING IT. IT'S TOO MUCH OF A HASSLE TO CHANGE IT.
I ALREADY HAVE ANOTHER SERVICE.
I ALREADY HAVE COX CABLE AND SEPERATE PHONE SERVICE AND SEPARATE PHONE SERVICE. I DON'T WANT TO CHANGE OR DEAL WITH ANY MORE CARRIERS.
I ALREADY HAVE INTERNET THROUGH THE CABLE COMPANY.
I AM ALREADY SET UP.
I CAN GET OTHERS CHEAPER.
I CAN'T REMEMBER WHY.
I DID NOT KNOW HOW LONG I WOULD BE LIVING THERE.
I DON NOT NEED IT.
I DON'T BECAUSE THEY REQUIRE A CONTRACT.
I DON'T DO COMPUTERS.
I DON'T HAVE & I DON'T WANT A COMPUTER.
I DON'T HAVE A COMPUTER AND DON'T TRUST THEM.
I DON'T HAVE A COMPUTER AND DON'T WANT ONE.
I DON'T HAVE A COMPUTER.
I DON'T HAVE A COMPUTER.
I DON'T HAVE A COMPUTER.
I DON'T HAVE A COMPUTER.
I DON'T HAVE A COMPUTER.
I DON'T HAVE A COMPUTER.
I DON'T HAVE A COMPUTER.
I DON'T HAVE A COMPUTER.
I DON'T HAVE A COMPUTER.
I DON'T HAVE A COMPUTER. I ONLY OWN A CELL PHONE. I TOOK OUT THE LAND LINE.

I DON'T HAVE INTERNET.
I DON'T HAVE THE CONNECTIONS FOR IT.
I DON'T KNOW HOW TO USE A COMPUTER
I DON'T KNOW.
I DON'T LIKE MODEM INTERNET.
I DON'T NEED IT.
I DON'T NEED IT.
I DON'T NEED IT.
I DON'T NEED IT.
I DON'T THINK IT WOULD BE AS EFFECTIVE AS QWEST, WHICH I HAVE.
I DON'T WANT IT.
I DON'T WANT IT.
I DON'T WANT TO CHANGE.
I DON'T WANT TO GET INTO THE INTERNET OR DIGITAL PHONE SERVICE STUFF. I'M TOO OLD.
I FIND IT NOT AS RELIABLE AS CABLE.
I FOUND BETTER SERVICE.
I GET BETTER RATES WITH OTHER PEOPLE.
I GET HIGH SPEED INTERNET FROM ANOTHER PROVIDER.
I GET MINE FROM THE TELEPHONE COMPANY.
I HAVE A BETTER DEAL NOW COSTWISE.
I HAVE ANOTHER SERVICE I'M HAPPY WITH.
I HAVE BEEN WITH VALLEY TELECOM FOR LONG TIME.
I HAVE COX CABLE.
I HAVE FASTER SERVICE WITH CABLE.
I HAVE HIGH SPEED THROUGH COX.
I HAVE NO COMPUTER.
I HAVE OTHER INTERNET SERVICE.
I HAVE QWEST.
I HAVE SERVICE ELSEWHERE.
I HAVE SOMETHING ELSE.
I HAVEN'T CHECKED INTO IT ENOUGH TO KNOW.
I HAVEN'T HAD A NEED FOR IT YET.
I HAVEN'T HEARD ABOUT IT. I HAVE EVERYTHING THROUGH COX.
I HAVEN'T INQUIRED ABOUT IT, I USE ANOTHER SERVICE AND JUST STUCK WITH IT.
I JUST DON'T NEED IT AT THIS POINT IN MY LIFE.
I JUST FOUND OUT ABOUT THE SERVICE.
I JUST HAVEN'T LOOKED INTO IT.
I LIKE COX INTERNET.
I LIKE MINE BETTER.
I LIKE WHAT I ALREADY HAVE.
I LIKE WHAT I HAVE.
I NEVER HAVE, I'M HAPPY WITH QWEST.
I PREFER CABLE MODEMS & CELL PHONES.
I SERVICE THROUGH QWEST.
I WAS WITH QWEST BEFORE I FOUND OUT ABOUT IT.
I'M HAPPY WITH COX.
I'M HAPPY WITH COX.
I'M HAPPY WITH VTC.
I'M HAPPY WITH WHAT I HAVE - ANOTHER SERVICE.
I'M HAPPY WITH WHAT I'VE GOT.
I'M KIND OF CHALLENGED BY TECHNOLOGY. I DON'T HAVE A COMPUTER.
I'M LAZY.
I'M NOT INTERESTED IN THIS.
I'M ON A FIXED INCOME AND CAN'T AFFORD THAT LUXERY.
I'M ONLY HERE FOR A SHORT TIME IN THE WINTER, SO I DON'T NEED IT. I DO LEAVE THE ELECTRICITY ON ALL YEAR.
I'M PRETTY HAPPY WITH QWEST.
I'M RETIRED FROM QWEST AND I GET MY PHONE FREE.
I'M SATISFIED WITH MY CURRENT SERVICE.
I'M SATISFIED WITH WHAT I HAVE.
I'M WITH ANOTHER PROVIDER.
INCOME.
IS NOT COST EFFECTIVE.
IT DOESN'T REACH TO MY RESIDENCE.
IT DOESN'T WORK VERY WELL.
IT IS TOO EXPENSIVE.
IT WOULD BE MORE COSTLY TO ME.
IT'S CHEAPER WITH ANOTHER COMPANY.
IT'S EXPENSIVE.

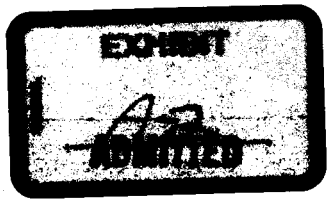
IT'S MORE EXPENSIVE THAN MY SERVICE.
IT'S NOT AVAILABLE IN MY AREA ANYMORE.
IT'S NOT WORTH THE MONEY TO ME.
IT'S TOO EXPENSIVE AND THE ECONOMY IS BAD.
IT'S TOO EXPENSIVE.
IT'S TOO EXPENSIVE.
IT'S TOO EXPENSIVE.
IT'S TOO EXPENSIVE.
I'VE GOT QWEST & TOO MUCH WORK TO CHANGE OVER.
I'VE HAD THE SAME SERVICE FOR OVER 10 YEARS AND AM HAPPY WITH IT!
JUST USE CELL PHONE RURAL AREA.
MONEY!
MORE EXPENSIVE.
MUCH BETTER DEAL WITH DIFFERENT PROVIDERS.
MY COMPANY PROVIDES FOR FREE.
MY COMPUTER IS NOT THAT GOOD, SO IT WOULDN'T BE WORTH IT FOR ME
MY FATHER IS 91. HE HAS NO INTEREST IN COMPUTERS.
MY HUSBAND HAS RETIRED FROM QWEST AND GETS IT FREE.
NEVER NEEDED IT. I'M HAPPY WITH THE SERVICE SHE HAS.
NEVER REALLY THOUGHT ABOUT IT.
NEW TO RECENT SERVICE.
NO BECAUSE CAN'T EXCEPT IT WHERE I LIVE AT THIS APARTMENT.
NO COMPETITIVE PRICES.
NO COMPUTER.
NO NEED.
NO REASON
NO REASONS.
NONE
NOT ENOUGH EFFICIENCY IN SERVICE.
NOT ENOUGH MONEY.
NOT HOME ENOUGH.
NOT INTERESTED. NO NEED.
OUT OF THE AREA.
PHONE DON'T EXCEPT HIGH SPEED.
PRICES TOO HIGH.
PROBLEMS WITH RELIABILITY.
QWEST HAS BETTER PRICES
QWEST IS CHEAPER & BETTER & THAT'S WHAT WE HAVE.
QWEST IS CHEAPER.
SERICE ELSEWHERE.
SERVICE ELSEWHERE.
SET WITH SOMEONE ELSE.
SIGNING A CONTRACT.
SOMEONE ELSE IS MORE COST EFFICIENT.
SOMEONE ELSE PROVIDES IT.
THE COST
THE COST IS TOO HIGH.
THE COST MORE EXPENSIVE.
THE SPEED AND RELIABILITY.
THE TIMING WAS WRONG.
THERE IS HIGHER SPEED INTERNET WHERE I AM.
THEY ARE A POWER COMPANY, NOT A COMPUTER/INTERNET COMPANY.
THEY DON'T RESPOND TO MY PHONE CALLS!
THEY WEREN'T COMPETITIVE TO OTHER COMPANY BUNDLES.
TOO COSTLY.
TOO EXPENSIVE.
TOO EXPENSIVE.
TOO EXPENSIVE.
TOO EXPENSIVE.
TOO MUCH TROUBLE AND COST.
WE ALREADY HAVE ANOTHER SERVICE WE'RE HAPPY WITH.
WE ALREADY HAVE COX.
WE ALREADY HAVE IT THRU DIRECT.
WE ARE AN OLDER COUPLE AND NOT UP ON TECHNOLOGY TODAY.
WE ARE HAPPY WITH THE SERVICE WE HAVE.
WE ARE HAPPY WITH WHAT WE HAVE AND THEY MAKE TOO MANY CHANGES.
WE ARE SET WITH WHAT WE HAVE.
WE ARE WITH VALLEY TELEPHONE - LOCAL COOP & SULPHUR SPRING'S INTERNET IS NEWER.

WE BUNDLE WITH COX BECAUSE IT'S CHEAPER.
WE DON'T HAVE LAND LINES. WE ONLY HAVE CELL PHONES.
WE HAD IT AND IT WAS SLOWER WE HAVE BROADBAND NOW.
WE HAD QWEST FIRST AND NEVER DECIDED TO SWITCH.
WE HAD QWEST FIRST AND NEVER SWITCHED.
WE HAVE A BUNDLED PACKAGE FROM ANOTHER PROVIDER.
WE HAVE ALWAYS HAD OTHER SERVICE.
WE HAVE DIFFERENT SOURCES
WE HAVE IT WITH VALLEY.
WE HAVEN'T LOOKED INTO MUCH!
WE SUBSCRIBE TO VERIZON AND WE GET A MAJOR DISCOUNT BECAUSE MY HUSBAND IS RETIRED FROM VERIZON.
WE USE A COMPUTER AT OUR IN-LAWS HOME.
WE WENT WITH SOMETHING BETTER.
WE WERE NOT ABLE TO GET IT.
WE'RE REMODELING.
WE'VE HAD QWEST FOR YEARS & I'M HAPPY WITH THEIR SERVICE.
WHEN I FIRST MOVED HERE VALLEY TELECOM GOT HERE 1ST.
WHEN I MOVED HERE THE ONLY ONE I COULD GET WAS VALLEY TEL AND THAT'S WHAT I HAVE NOW.
WHEN IF FIRST GOT MY CURRENT SERVICE, I DIDN'T KNOW SULPHUR SPRINGS ELECTRIC OFFERED IT.
WHERE I AM, IT IS NOT AVAILABLE YET.
WHERE I'M AT SERVICES ARE NOT THAT GREAT. I USE WIRELESS AND IT WORKS GREAT.

BEFORE THE ARIZONA CORPORATION COMMISSION

COMMISSIONERS

KRISTIN K. MAYES, Chairman
GARY PIERCE
PAUL NEWMAN
SANDRA D. KENNEDY
BOB STUMP



IN THE MATTER OF THE APPLICATION OF SULPHUR SPRINGS VALLEY ELECTRIC COOPERATIVE, INC. FOR A HEARING TO DETERMINE THE FAIR VALUE OF ITS PROPERTY FOR RATEMAKING PURPOSES, TO FIX A JUST AND REASONABLE RETURN THEREON, TO APPROVE RATES DESIGNED TO DEVELOP SUCH RETURN AND FOR RELATED APPROVALS.	DOCKET NO. E-01575A-08-0328
IN THE MATTER OF THE APPLICATION OF SULPHUR SPRINGS VALLEY ELECTRIC COOPERATIVE, INC. FOR AN ORDER INSTITUTING A MORATORIUM ON NEW CONNECTIONS TO THE V-7 FEEDER LINE SERVING THE WHETSTONE, RAIN VALLEY, ELGIN, CANELO, SONOITA, AND PATAGONIA, ARIZONA AREAS.	DOCKET NO. E-01575A-09-0453

PRE-FILED DIRECT TESTIMONY OF EUGENE L. SHLATZ
ON BEHALF OF NAVIGANT CONSULTING, INC.
FOR
SULPHUR SPRINGS VALLEY ELECTRIC COOPERATIVE, INC.
(A.R.S. §40-252 Proceeding)

FEBRUARY 23, 2010

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Eugene L. Shlatz, and my business address is 77 South Bedford St, Burlington, Massachusetts.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am employed by Navigant Consulting, Inc. ("Navigant") as a Director in its Energy Practice. As a Director, I am responsible for managing engagements for Energy Practice clients in the areas of electric power system operations, engineering and planning, electric reliability, emerging and renewable technologies, integration of distributed generation and asset management, among other related assignments. Clients where I have had project management responsibility include public and private electric utilities (including electric cooperatives and municipal-owned systems), utility commissions, state energy ageNavigantes, the Department of Energy, federal power ageNavigantes (e.g., Bonneville Power Administration) and manufacturers of electric power equipment. I have been employed by Navigant for over ten years.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND AND WORK EXPERIENCE.

A. My educational background includes undergraduate and graduate degrees, each in Electric Power Engineering, from Rensselaer Polytechnic Institute in Troy, New York. I am a Professional Engineer (Vermont: Electrical, License No. 5253) and a member of IEEE (formerly the Institute of Electric and Electronic Engineers). Currently, I am the Chair for the Vermont Section of IEEE.

My qualifications include 30 years' of experience in electric utility energy delivery and power generation systems. It includes electric distribution planning

and reliability benchmarking, emerging technology integration and economic assessment, transmission and bulk power system engineering, operational and performance assessment, asset management and strategic planning, and expert witness support for applications of Certificate of Public Good authorizing construction of electric transmission facilities before state regulatory ageNavigantes. I have managed projects for companies located in the United States, Canada, and several South American nations. My experience includes nine years as the Director of Engineering and Operations for an electric utility (Green Mountain Power), a mostly rural and suburban electric utility with loads and lines comparable to those owned by SSVEC. I have testified before state commissions on electric transmission and distribution capacity, reliability and performance, and the Federal Energy Regulatory Commission (FERC) on Open Access Transmission under Orders 888 and 889. I have published many articles in leading journals on electric power reliability and advanced technologies and presented at several industry conferences on these topics as well. A copy of my qualifications and prior related assignments is included as Exhibit A.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE ARIZONA CORPORATION COMMISSION ("COMMISSION")?

A. No.

Q. ON WHOSE BEHALF ARE YOU TESTIFYING IN THIS MATTER?

A. I am testifying on behalf of Navigant at the request of Sulphur Springs Valley Electric Cooperative, Inc. ("SSVEC" or the "Cooperative").

. . .

. . .

Q. WHY HAVE YOU BEEN ASKED TO TESTIFY ON BEHALF OF SSVEC?

A. I have been asked to summarize my experience and the qualifications of the Navigant team and its contractors that performed the work presented in our December 31, 2009, report titled, "Independent Feasibility Study of Electric Supply Alternatives" ("Study") and to respond to questions that may arise during the March 24, 2010, hearing to be held before the Commission regarding the conclusions and recommendations contained in our Study. A copy of the Study is included as Exhibit B.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of my testimony is to describe our overall approach in responding to SSVEC's Request for Proposal ("RFP"), our study approach, and to summarize key findings, conclusions, and recommendations contained in our Study.

Q. WHAT PROCESS DID NAVIGANT FOLLOW IN RESPONDING TO SSVEC'S REQUEST FOR PROPOSALS?

A. In October 2009, a Managing Director in Navigant's Energy Practice received and distributed a copy of an RFP forwarded by a representative, Richard Goodwin, from TRC Solutions ("TRC"). Once received, I indicated to Navigant management that Energy Practice staff had the credentials and availability to conduct the study referenced in the RFP and that I would take the lead in preparing and submitting a proposal. Shortly thereafter, I participated in a pre-bid conference call facilitated by TRC. From the information and responses provided during the call, I made a determination that Navigant should submit a bid. Soon thereafter, I contacted other senior Navigant managers and subject matter experts to assist in preparing a bid,

and to ensure we included personnel with the proper credentials in our proposal. From these discussions and subsequent conversations with TRC, we determined that additional outside expertise would be needed to perform certain environmental studies. Accordingly, we brought in three outside firms to enhance our credentials and to ensure the team we included in our proposal had the right experience and capabilities to perform the tasks outlined in the RFP. The three subcontractors include Pacific Legacy, Environmental Visions, and Harris Consulting. In our proposal, we emphasized that Navigant offered not only the expertise to conduct the tasks outlined in the RFP, but also the depth of experience and resources needed to complete and submit a report to meet SSVEC's December 31, 2009, filing deadline. A summary of Navigant and service offerings and subcontractor qualifications are included as Exhibits C and D, respectively. I also have included the resume of David Larson, a Navigant expert on electric transmission as Exhibit E.

An important activity that Navigant performs before committing to a client engagement is to determine whether there is a potential direct or indirect conflict of interest. This is performed by notifying all senior managers throughout Navigant of the nature of the engagement and potential client. Any potential conflicts of interest are reviewed by Navigant legal staff – none were identified for SSVEC - which then makes a determination as to whether it is appropriate to submit a bid. Navigant followed this process for the SSVEC Study, which resulted in a determination that a conflict of interest did not exist. Consistent with RFP requirements, Navigant also confirmed that it and the staff the Company proposed to assign to the engagement had not conducted prior studies on behalf of SSVEC or otherwise had an interest in the outcome of Study results.

. . .

As Director and project manager of this engagement, I also had contractual responsibility to complete all work contained in our Proposal for Services, consistent with the Master Service Agreement (MSA) that Navigant entered into with SSVEC shortly after notification of SSVEC's intention to award the Study to Navigant.

Q. WHAT PROCESS DID NAVIGANT FOLLOW TO PERFORM THE STUDY?

A. Similar to most project engagements, Navigant assigned a project manager with overall responsibility for completing the study. Given my background and expertise, I assumed responsibility as the Navigant project manager. One of the initial tasks I performed as the project manager was to develop a project work plan and schedule for key tasks and milestones corresponding to each of the required work tasks listed in the RFP. It included a kick-off meeting with TRC to discuss our proposed work plan, identify information and data requests, confirm the performance studies and long-term solutions and strategies that Navigant would conduct, and to schedule a site visit. We also agreed to hold weekly project status conference calls to review progress, outstanding issues, and assess issues needing resolution or follow-up action. (The weekly meetings were held as scheduled throughout the duration of the project.) During the kick-off, TRC again emphasized the RFP requirement that Navigant and its subcontractors should (1) not contact SSVEC staff or its customers, and (2) not rely on the results of prior studies conducted by SSVEC or on behalf of SSVEC to assess performance issues and to identify a long-term solution correct deficieNavigantes on the V-7 feeder served from SSVEC's Huachuca West substation.

. . .

Q. WHAT METHODS, ASSUMPTIONS, AND TOOLS WERE USED TO CONDUCT THE STUDY?

A. Generally, the methods Navigant and its subcontractors employed to conduct the Study are consistent with accepted and commonly applied approaches and metrics used by utilities and consultants to conduct feasibility studies for electric utility energy delivery systems. Specifically, Navigant employed sophisticated computer simulation models to assess the performance of the V-7 feeder and to evaluate the effectiveness and technical viability or candidate solutions to meet electrical demand over the next 20 years. We evaluated performance by making a determination as to whether the feeder voltages, equipment loadings, and reliability metrics were consistent with industry standards and practices. We applied IEEE guidelines to evaluate V-7 reliability performance versus similar metrics adopted by other utilities.

The long-term capacity and performance options that Navigant identified as candidate solutions included commercially available, mature technologies. We relied on public information from sources such as the National Renewable Energy Laboratory (NREL) to identify wind and solar profiles for southeastern Arizona. We employed models Navigant has used in Department of Energy studies to predict hourly solar output patterns. The cost of conventional and renewable technologies was based on data recently published by NREL, DOE, and other public sources. The cost of line construction options was consistent with prior SSVEC estimates, but independently confirmed by Navigant for reasonableness.

We employed life-cycle economic methods to compare each option over the 20-year planning horizon. The economic comparison studies included the benefits of reduced line losses and the cost SSVEC would incur if it were to purchase and operate diesel generators for the distributed generation option. Our studies also

included incentives SSVEC likely would pay to incent customers to convert electric heating systems to fossil fuel for the demand management option.

The methods employed to assess the environmental impact of candidate solutions were consistent with those employed for feasibility studies, including site inspections, literature searches, and assessment of data available from public sources. In particular, Navigant's environmental consultants relied on prior archeological records and studies from public sources to support its findings. Findings for the visual impact studies was based largely on field visits of the alternative routes and sites for new or upgraded lines and equipment. Estimates for fossil emissions were based on formulaic templates obtained from State of Arizona Department of Environmental Quality, Air Quality Division. The EMF levels were estimated using engineering software that calculates electric potential and electro-magnetic levels at various distances based on likely construction types, voltage rating and amperage.

Q. WHAT ARE THE KEY FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS FROM NAVIGANT'S STUDY?

A. The primary findings, conclusions, and recommendations are presented below:

(1) The performance and reliability of the V-7 feeder has degraded to a level where near-term solutions are needed to correct deficieNavigantes. The length and amount of load served by the feeder causes large voltage perturbations, a high level of sustained and momentary customer interruptions, and high energy losses. From my experience, power quality as measured by momentary interruptions and voltage perturbations also is below levels utilities generally deem to be acceptable.

(2) The capability of existing substation equipment and the V-7 feeder to reliably serve new load is at or near limits. Recent loads are just below the nameplate rating of the substation transformer and load imbalances on individual phase conductors severely restrict SSVEC's ability to add new load. Further, voltages at the end of very long line segments are near or below acceptable levels during periods of high demand. A recent outage event on the V-7 feeder in December 2009 underscores the susceptibility of the V-7 feeder to overloads and extended outages; in this instance, loads exceeded substation transformer ratings by over ten (10) percent and all customers served by the V-7 lost service until repairs were made to the line.

(3) The ability of renewable resources such as wind and solar photovoltaic systems provide little, if any, relief to performance problems cited above, nor do they provide any meaningful capacity support. The V-7 feeder is located in an area where average wind speeds are low. The feeder experiences peak loads during early morning, winter hours, which precludes any significant contribution from solar photovoltaic generation to reduce V-7 feeder peak demand.

(4) The installation of oil-fired diesel or natural gas generators in the Sonoita area could meet long-term capacity needs. However, installation of generators would require SSVEC to obtain an air quality permit, create noise during early morning operation, and most importantly, would not mitigate the performance and reliability problems above cited. Installation of diesel generators

also is a less reliable solution than new transmission or distribution lines, as they have lower availability.

(5) An aggressive load reduction program achieved by the conversion of existing electric heating systems also may meet long-term capacity needs. However, a large number of customers – 100 immediately and up to 500 homes and businesses over 20 years - would need to agree to permanently convert and remove electric heating systems and replace them with fossil fuel systems. Also, similar to the diesel option, conversion of electric hearing units to fossil fuel systems would not address V-7 performance and reliability problems.

(6) The preferred option from a reliability, performance, and capacity standpoint is the construction of a new 69kV line to a new substation located in Sonoita. The preferred site for the substation is on new land SSVEC recently purchased in Sonoita, as it is located near the intersection of several line segments suitable for reconfiguration and routing of new lines. The preferred routing is along what is described in our report as the "T1" path, which follows rights-of-way along the Babacomari Ranch and existing distribution lines. The T1 option is preferable over a route following existing distribution lines along State Highway 82 and Lower Elgin Road due to the higher cost and absence of rights-of-way easements. Further, the T1 option did not present any material environmental or architectural impacts that could not be addressed through modest mitigation measures, such as low-profile design and selection of materials that blend

with the natural landscape. The undergrounding of the 69kV transmission, while preferable from a visual perspective, is impractical due to the much higher cost of construction.

Q. DID SSVEC MANAGEMENT, ITS STAFF, CUSTOMERS, OR REPRESENTATIVES INFLUENCE ANY OF THE CONCLUSIONS OR RECOMMENDATIONS PRESENTED ABOVE OR IN YOUR REPORT?

A. No. Navigant strictly followed RFP instructions that it not contact SSVEC, its customers, or others in the Sonoita community at any time during the study. To ensure objectivity, I regularly reminded Navigant staff and its contractors that such communications were prohibited. The only communications that occurred with SSVEC staff were during the field/site visit, where an SSVEC supervisor described the facilities we would be visiting and to accompany Navigant during the field visit, which included access to restricted Babacomari Ranch property. At no time did Navigant either solicit or did the supervisor offer opinions on the Sonoita project during the field visit. Further, SSVEC's project representative, TRC, continually emphasized the need to maintain objectivity; TRC's primary role was to respond to data requests and to monitor project status.

Pursuant to the RFP, Navigant submitted a draft of our report to SSVEC in late December to ensure our study complied with each of the work tasks included in the RFP. We incorporated several comments and suggestions offered by TRC and SSVEC related to the RFP to clarify our findings and conclusions. However, these clarifications did not in any way alter results, conclusions, or recommendations in our draft report, including any calculations or analyses used to assess V-7 feeder performance or the economic analyses of supply options.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.

11205083.2

Exhibit A

Eugene Shlatz
Director

Navigant Consulting
31 Deer Run Drive
Shelburne, VT 05482
Tele: 802.985.5216

eshlatz@navigantconsulting.com

Education and Professional

M.S. Electric Power Engineering, Rensselaer Polytechnic Institute

B.S. Electric Power Engineering, Rensselaer Polytechnic Institute

Employment

Navigant Consulting (1999 – present) Director

Stone & Webster Management Consultants (1994-1999) Executive Consultant

Green Mountain Power Corp (1985-1994)

- Assistant Vice President, Energy Planning
- Director of Engineering and Operations

Ernst & Whinney (1984-1985) Supervisor

Gilbert/Commonwealth (1980-1984) Senior Consulting Engineer

Westinghouse Electric Corporation (1978-1979)

Systems Analysis Engineer

Boston Edison Company (1976-1977) Student Engineer, Cooperative Education Program

Professional Associations

Professional Engineer - State of Vermont

Institute of Electrical and Electronic Engineers, Member & Section Chairman

Eugene L. Shlatz

Mr. Shlatz is a Director in Navigant Consulting Inc.'s Energy Practice. He has over 25 years of management consulting and supervisory experience in energy delivery and power generation for public and investor-owned electric utilities. Engagements he has directed include asset management, reliability, benchmarking, valuation, rate filings, distributed generation, smart grids, and system adequacy reviews for US, Canadian, and South American utilities. Mr. Shlatz is an expert on electric power delivery systems, and has appeared as an expert witness before FERC and State Commissions on open access, transmission expansion and siting, rate cases, regulatory compliance, relicensing and least-cost planning. He is a professional engineer and member of IEEE. Mr. Shlatz has published numerous articles and papers on electric reliability, asset management, electric pricing and distributed generation.

Summary of Professional Experience

Energy Practice. Direct and manage consulting engagements for energy and electric utility clients. Recent assignments have addressed key energy delivery issues including:

- Asset management – project prioritization, performance measurement, asset utilization and cost optimization
- Reliability – analysis of transmission and distribution performance and reliability; remediation analysis
- Benchmarking – review and analysis of industry best practices, service quality standards and business processes
- Technical Assessment –T&D system planning and technology, system infrastructure, and DG/Smart Grid integration
- Innovative pricing – open access, locational pricing and PBR

Testimony and Appearances as an Expert Witness

Case Description	Company	Year	Docket	Jurisdiction
Industry Restructuring & Asset Transactions				
Purchase of Electric Assets	VEC	2004	6853	Vermont
Certificate of Consent, Sale of Distribution Assets	CUC	2004	6850	Vermont
Certificate of Consent, Sale of Transmission Assets	Velco/CUC	2004	6825	Vermont
Prudency Review and Audit Support	CUC	2003	5841/5859	Vermont
Competitive Opportunities Filing	ConEdison	1997	96-E-0897	New York
Rate Cases (Retail and Wholesale)				
Power Purchase Contracts – IURC Complaint	Jay REMC	1998	9704-CP-069	Indiana
Section 205 Filing – Wholesale Rates	NISource	1997	ER96-35-000	FERC
Open Access Transmission Tariff Filing	NISource	1996	ER96-399-000	FERC
Request for Increase in Wholesale Rates	NISource	1996	ER92-330-000	FERC
Request for Increase in Retail Rates	GMP	1991	5532	Vermont
Request for Increase in Retail Rates	GMP	1990	5428	Vermont
Request for Increase in Retail Rates	GMP	1989	5370	Vermont
Request for Increase in Retail Rates	GMP	1988	5282	Vermont
Request for Increase in Retail Rates	GMP	1986	5125	Vermont
Certificates of Public Good				
Northern Loop Transmission Upgrades	Velco/CUC	2004	6792	Vermont

Substation Reconstruction – Richford	CUC	2003	6682	Vermont
Island Pond to Bloomfield Line	CUC	2001	6044	Vermont
HK Webster Substation	CUC	1999	6045	Vermont
Burton Hill Substation	CUC	1999	6046	Vermont
Border to Richford 120/46kV Line	CUC	1998	5331A	Vermont
New Transmission Lines and Substation	IBM	1991	5549	Vermont
New Substation – Barnet	GMP	1990	5459	Vermont
Gas Turbine Interconnection	IBM	1989	5347	Vermont
Dover Substation Expansion	GMP	1987	5226	Vermont

Integrated Resource Planning

Distributed Utility Planning	CUC	2003	6290	Vermont
Least-Cost Planning Integrated Resource Plan	GMP	1991	5270	Vermont

Articles and Publications

- "DER Operational & Grid Benefits" Electric Light & Power, February, 2009.
- "Benefits of Smart Grid Integration with Distributed Energy Storage Systems," Infocast Power Storage Conference, July, 2008.
- "The Rise of Distributed Energy Resources," Public Utilities Fortnightly, February, 2007, with Steven Tobias.
- "Risk Planning & Project Prioritization: Bringing Energy Delivery to the Next Level in Asset Management," InfoCast T&D Asset Management Conference, St. Louis, MI, May 2004.
- "Valuation Methods: Estimating the Value of Avoiding the Risks Associated with T&D Reliability Failures," EEI Spring 2004 T&D Conference, Charlotte, NC, April 2004.
- "Reliability Tradeoffs," EEI Perspectives, January-February, 2004, with Daniel O'Neill.
- "What's the Outlook for Distributed Generation Interconnection Standards?" 2003 Power-Gen International Conference, Las Vegas, Nevada, December 2003.
- "Federal Interconnection Standards: Putting DG in a Box," Public Utilities Fortnightly, April 3, 2003, with Stan Blazewicz.
- "An Innovative Approach to Fact-Based Distribution Reliability Cost Optimization," Distribution 2000, Brisbane, Australia, November 1999, with Cheryl Warren.
- "System Reliability: Competitive Issues," Rethinking Electric Reliability Conference, Chicago Illinois, September 1997.
- "Reliability: Competition & Keeping the Lights On," EUCI, Denver, Colorado, October 1998.
- "Unbundled Distribution Cost of Service," The Electricity Distribution Conference, Denver, Colorado, April 1998.
- "System Reliability in a Restructured Environment," Electric System Reliability in a Competitive Environment Workshop, Denver, Colorado, October 1997.

- "Privatization Efforts in South America" EUCI Workshop, Denver, Colorado, January 1997.
- "Open Access Pricing Issues," Transmission Pricing Conference, Vail, Colorodo, Sept. 1996.
- "Case Study of Radial Overhead Feeder Performance at 12.5 kV and 34.5 kV," IEEE Rural Electric Power Conference, with Roger Clayton and John Undrill, April 1989.

Representative Client List and Engagements

Asset Management

- **Horizon Utilities.** Technical and advisory support for asset management framework initiatives. Includes gap analysis and implementation of asset management strategies and evaluation methods. Addressed infrastructure alternatives of upgrades using AM-based approaches.
- **First Energy**. Responsible for implementing asset management processes and capital prioritization models for 6 operating companies in three jurisdictions. Project leader for model development and applications, technical review and overall quality assurance.
- **Seattle City Light**. Responsible for conducting a benchmarking and gap analysis of the power supply and energy delivery business units. It included a business case analysis to support implementation of asset management methods and new AM organization.
- **Pepco/Conectiv**. Responsible for an asset management and prioritization assessment of capital improvement and O&M programs for three states and the District of Columbia. It included developing asset-specific prioritization methods for transmission, distribution and IT programs.
- **Entergy**. Responsible for an asset management and prioritization assessment of Entergy's capital improvement programs for six jurisdictional utilities in 5 states. It included developing asset-specific prioritization methods for transmission and distribution programs.
- **PacifiCorp**. Responsible for an asset management and prioritization assessment of PacifiCorp's capital improvement programs for six jurisdictional utilities in 6 states. It included developing asset-specific prioritization methods for transmission and distribution and IT programs.

Reliability, Benchmarking and Technical Support

- **Austin Energy.** Performed a benchmarking and gap analysis of performance measures of AE's energy delivery organization. Developed performance measures for reliability, operations and planning activities.

» **Ameren Services.** Conducted a review and predictive assessment of distribution reliability. A strategic methodology was developed to allow Ameren to apply fact-based methods to allocate reliability expenditures.

» **American Electric Power.** Conducted a review and predictive assessment of distribution reliability. Applied fact-based methods to prioritize investment decisions and to quantify risk.

» **National Grid (New England Electric System).** Conducted a system review and predictive assessment of distribution reliability. A strategic methodology was developed to predict system outage performance based on system attributes, equipment performance and historical reliability.

» **Potomac Electric Power Company (Pepco).** Conducted an investigation and benchmarking of PEPCO's T&D system, including transmission and distribution infrastructure. Prepared recommendations to enhance performance and reduce outage risk.

» **Dominion – Virginia Power**. Project manager and lead investigator of a comprehensive technical review and risk assessment of Dominion's secondary networks. Reviewed and analyzed engineering standards, planning criteria, operations and maintenance, construction, materials selection, and simulations methods.

Regulatory and Pricing

» **Canadian Utility (Confidential)** – Confidential study to assess the value and strategic benefits of the acquisition of electric utility energy delivery assets. Included a technical and economic assessment of key regulatory and acquisition risk factors to support a recommendation.

» **Progress Energy.** Project manager of a best practices and compliance review of fixed asset charging practices. Reviewed methods, systems and practices used to record fixed assets for Florida and the Carolinas to support proposed changes filed with state commissions and the SEC.

» **Citizens Utilities/Vermont Electric Cooperative.** Supported numerous Certificate of Public Good (CPG) applications before the Vermont Public Service Board (VPSB). Expert witness for technical, environmental, and costing studies.

» **Potomac Electric Power Company (Pepco).** Conducted a nationwide survey of service quality (SQI) measures and performance-based rate (PBR) mechanisms. Assessed the impact that prospective changes will have on the company's compliance and PBR programs.

» **Vermont Department of Public Service.** Conducted research and prepared sections of the Twenty-Year Electric Plan, including the impact of the independent system operator (ISO) and regional transmission organization (RTO) initiatives on Vermont's transmission providers.

» **Potomac Electric Power Company (Pepco).** Project manager of a best practices and benchmarking study of storm withstand measures in response to regulatory inquiries following major storms in 2003. Assessed the impact of system hardening options on reliability performance and rates.

» **Massachusetts Utility Consortium.** Conducted a best practices and benchmark study of reliability and service quality indices for electric and gas utilities. Provided findings and recommendations regarding use of regional or national benchmarks as a stateside standard.

» **Citizens Utilities (Vermont Electric Division).** Project manager for a T&D Audit mandated by the Vermont Public Service Board. Reviewed T&D plant accounting systems and processes, and provided recommendations for improvement.

» **Massachusetts Department of Telecommunications and Energy.** Project manager of a stray voltage assessment of jurisdictional utilities. Identified causes of stray voltage and provided recommendations to mitigate future events, including action and improvement plans.

Distributed Generation & Renewable Technologies

» **Multi-Client Study.** Project manager of a comprehensive assessment of the integration of smart grid technologies to enhance the value of distributed and central solar photovoltaic systems. The multi-client consortium includes several of the leading electric utilities, manufacturers and industry experts supporting the development and integration of PV technologies.

» **U.S. Department of Energy (DOE).** Project manager or key investigator of numerous advanced technology and system integration (RDSI) studies, including smart grid, energy storage, high-temperature superconductor, and DG valuation and power system integration.

» **Toronto Hydro.** Project manager of comprehensive assessment of distributed resource alternatives to traditional T&D alternatives for a major urban utility. Includes the technical assessment of DG power systems impacts and forecast of cost-effective alternatives.

» **Southern California Edison/Department of Energy.** Project manager of a technical and economic study to assess the value of Distributed Energy Resources (DER) as an alternative to traditional utility investments. Developing an optimized funding plan using asset prioritization methods.

» **Massachusetts Technology Collaborative.** Provided independent technical support to a Collaborative on Distributed Generation, with stakeholders representing distribution companies, developers, government agencies, end-use customers, and public interest groups. Provided technical support on interconnection standards and role of DER in electric utility planning.

Exhibit B

NAVIGANT
CONSULTING

Independent Feasibility Study of Electric Supply Alternatives

Prepared for:

Sulphur Springs Valley Electric Cooperative
Willcox, Arizona

Navigant Consulting, Inc.
77 South Bedford
Burlington, MA 01803

www.navigantconsulting.com
781-270-0101

December 2009

This document is confidential and proprietary in its entirety. It may be copied and distributed solely for the purpose of evaluation.
© 2009 Navigant Consulting, Inc.

NAVIGANT
CONSULTING

Table of Contents

Executive Summary 1

Project Background 6

Background 6
Scope and Objectives 6
Methodology 7

Assessment of Existing Electric Delivery System 9

Description of Electric Supply and V-7 Feeder 9
Reliability Performance 10
Equipment Condition 16
Feeder Voltage Performance 17
Feeder Protection 19
Power Quality 21
Harmonics and Resonance 21
Harmonic Mitigation Options 22
Distribution Line and Equipment Losses 23

Electric Consumption and Demand Forecast 26

V-7 Feeder Customer and Demand 26
Historic Electric Demand and Consumer Statistics 26
Electric Demand Profiles and Capacity Limits 27
Peak Demand Forecast 28
Station Capacity 30
Projected Capacity Need 31

Supply Alternatives 33

Distribution Options 33
Reinforce Existing System (D1) 33
Upgrade Existing Line (D2) 34
New Huachuca West Feeder (D3) 34
Foreign Interconnection (D4) 35
Static Var Compensation (D5) 36
Transmission Supply Options 36
69kV Transmission Supply (T1 & T2) 37
115/138kV Supply Options (T3) 38
46kV Transmission Supply (T4) 38
Underground Transmission (T5) 39
Demand Side Management & Incentive Rates 40
Targeted DSM (DS1) 40

Storage Electric Heating (DS2) 40
Incentive Rate Options (DS3) 41
Space Heating/Fuel Switching (DS4) 42
Composite DSM/Demand Management (D5) 43
Distributed Resources and Renewable Energy 43
Solar Photovoltaic (R1) 43
Wind Generation (R3) 47
Energy Storage (R4) 48
Distributed Generation (R5) 51

Assessment of Supply Alternatives 54

Evaluation Methodology 54
Screening Criterion 54
Technical Evaluation of Feasible Alternatives 58
Distribution Options 58
Distributed Generation (Diesel or Natural Gas) 58
Long-Term Performance of Feasible Supply Options 59
Reliability Considerations 60
Operations and Maintenance 61
Fuel Conversion and Storage 61
Economic Evaluation 62
Base Case Studies 63
Sensitivity Analysis 63
Preferred Alternative(s) 64
Timing and Implementation 64
Regulatory and Legal Considerations 64

Environmental Factors and Site Selection 66

Visual Impacts and Aesthetics 66
Technical Approach and Methods 67
Visual Setting Overview 68
Visual Resources and Potential Receptors 69
Potential Visual Impact Issues and Physical Characteristics of Supply Alternatives 70
Distribution Alternatives 70
Transmission Supply Options 71
Demand-Side Management 73
Renewables and Distributed Generation Options 73
Visual Mitigation Strategies 74
Summary and Conclusions 76
Cultural and Historical Resources 78
Record Search Results 79
Previously Recorded Sites 79

Previous Investigations 80
Recommendations/Proposed Mitigation 81
Biological Impacts 82
Information Reviewed 82
Existing Biological and Wetland Resources 83
Potential Impacts 84
Recommended Mitigation 85
Emissions & Noise 86
Emissions Output – Distributed Generation Options 86
Construction Impacts for Transmission Alternatives 87
Renewable & Distributed Generation Options 87
Electromagnetic Fields 88
EMF Research and Applicable Regulations 89
EMF Levels for Feasible Supply Alternatives 89
Public Health Studies 90
Other Environmental Issues 90
General Land & Permit Issues 90

Summary 92

Attachments

Attachment 1: Proposed Routing & Locations of Supply Alternatives

Attachment 2: Summary of Technically Feasible Supply Alternatives

Attachment 3: Photographs

Attachment 4: Previously Recorded Archaeological Sites and Studies in the General Area

Attachment 5: Arizona Game and Fish Department's (AGFD) and U.S. Fish and Wildlife Service (USFWS) - Species List

References

NAVIGANT
CONSULTING

List of Figures

Figure 1: V-7 Feeder Diagram 10
Figure 2: Annual Average Outage Hours per Customer 11
Figure 3: Total Annual Outages 12
Figure 4: V-7 Feeder Outages by Cause Code 13
Figure 5: Number of Consumers Affected per Outage 13
Figure 6: V-7 Feeder Outages by Equipment Cause 14
Figure 7: Lighting-Related Outages by Month 15
Figure 8: Outage Frequency by Time of Day 15
Figure 9: Typical V-7 Construction 16
Figure 10: V-7 Feeder Voltage at Peak (Canelo) 17
Figure 11: V-7 Feeder Voltage at Peak (Patagonia) 18
Figure 12: V-7 Feeder Voltage under Light Loads (Canelo) 19
Figure 13: V-7 Annual Load Profile 27
Figure 14: V-7 Peak Day Load Profile 28
Figure 15: Historic Feeder Annual Peak Loads 29
Figure 16: 20 -Year Peak Load Forecast 30
Figure 17: 69/25kV Circuit Construction 35
Figure 18: UniSource Electric Service Territory 35
Figure 19: Distribution Static VAR Compensator 36
Figure 20: TEP 46kV Transmission Line 39
Figure 21: Peak and Off-Peak Daily Load Profile 41
Figure 22: Modular Space Heating Unit 42
Figure 23: PV Peak Day Output Profile 43
Figure 24: Photovoltaic (Utility Scale) 44
Figure 25: Parabolic Trough 45
Figure 26: CSP Technologies 45
Figure 27: CSP Potential (Arizona) 47
Figure 28: Southern Arizona Average Wind Profile 48
Figure 29: Energy Storage Device Attributes 49
Figure 30: NaS Energy Storage System (2 MW) 50
Figure 31: 1000 kW NaS Energy Storage Output Profile 50
Figure 32: Typical 1000kW Diesel Generator 51
Figure 33: Alternative Performance (2029) 60

NAVIGANT
CONSULTING

List of Tables

Table 1: V-7 Reliability Indices 11
Table 2: V-7 Recloser Operation 21
Table 3: V-7 Peak Losses (kW) 24
Table 4: V-7 Line & Equipment Losses 24
Table 5: Number of V-7 Customers by Rate Code 26
Table 6: CSP Technology Summary 46
Table 7: Cost Estimate – DG Options 52
Table 8: New 69kV Supply Options 58
Table 9: DG Feeder Impacts 59
Table 10: Space Heating and Electric Storage Conversions 62
Table 11: Capital Costs 62
Table 12: Economic Comparison of Feasible Alternatives 63
Table 13: Visual Constraints of T1 Route Options 72
Table 14: Aesthetic Evaluation Summary 77
Table 15: DG Fossil Fuel Emissions Projections (Diesel) 87
Table 16: EMF Levels 89

NAVIGANT
CONSULTING

Executive Summary

This report presents the result of an independent investigation performed by Navigant Consulting, Inc. (NCI) of feeder performance and supply options for customers served by Sulphur Springs Valley Electric Cooperatives, Inc.'s (SSVEC) V-7 distribution feeder and Huachuca substation. The investigation responds to a mandate outlined in an Arizona Corporation Commission (ACC) Order dated August 17, 2009.[1] Our analysis assesses existing feeder performance and the capability of the existing system to serve current and future electric demand. It includes identification of potentially feasible alternatives to mitigate current performance issues and to identify solutions to serve customers over the next 20 years.

All findings presented herein were prepared independently, without bias or prior knowledge of feeder performance issues or concerns raised by customers and other interested parties. Methods employed to evaluate performance and supply alternatives are consistent with common utility practices and applicable industry design, performance and evaluation standards. The analysis was completed without direct or indirect participation or input from SSVEC staff, management or its customers.[2] Solutions considered include a broad range of electric delivery, demand-side management, distributed generation and renewable energy options. However, these options were limited to commercially available mature technologies versus those which have not advanced beyond pilot or demonstration phases.

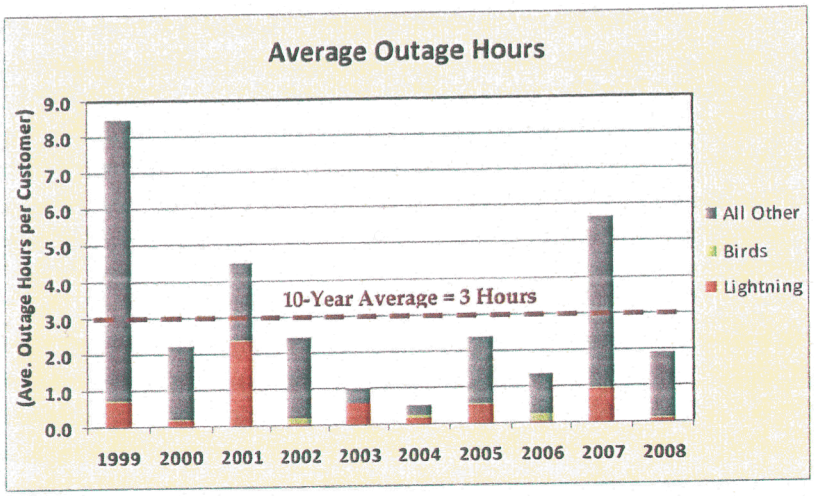
The V-7 feeder serves over 2400 electric meters along 360 miles of lines, and is well above the average line length of other SSVEC feeders. Reliability performance as measured by total outages and duration is inferior to other SSVEC feeders. Table ES - 1 presents average outage hours per customer for the last ten years. However, the large majority of these outages affected less than three to five customers, and these were caused mostly by lightning and animal-related events. While outage rates are high, NCI does not view current feeder outage performance to be unusual for a line with the distance and exposure of the V-7 feeder; among other factors, the remote service territory requires crews to travel longer distances to restore service, which increases average consumer outage duration.

---

[1] The section of the ACC's Order that governs the conduct of NCI's study is summarized in the following excerpt: "Sulphur Springs Valley Electric Cooperative, Inc. as a matter compliance, shall docket by December 31, 2009, a feasibility study prepared by an independent third party that includes alternatives (including use of distributed renewable energy) that could mitigate the need for construction of Sulphur Springs Valley Electric Cooperative, Inc.'s proposed 69kV project."

[2] An independent engineering and consulting firm, TRC Solutions, was engaged by SSVEC to respond to information and data requests submitted by NCI.

Table ES - 1: Average Outage Hours per Customer



Reliability performance as measured by the number of outages and duration has modestly improved, as SSVEC has implemented measures to mitigate lightning, animal and weather-related events. Notably, full feeder outages that interrupt all customers served by the V-7 feeder have been very low – less than one per year over the last five years. The low number of full feeder outages and effective use of reclosing circuit breakers along many sections of the V-7 feeder has limited the average outage hours per customer to about three hours. New supply alternatives which reduce line exposure by creating new feeder segments would improve reliability by 15 to 30 percent beyond current levels. However, the number of momentary interruptions would likely decrease by a much larger percentage.

Feeder voltage regulation has been impacted by growing loads on a long feeder that experiences significant voltage drop. Several voltage regulators operating in tandem are necessary to maintain voltages within acceptable levels. Voltages vary considerably between off- and on-peak loads, and regulating devices must be carefully set and checked to avoid unacceptably high or low voltages. There is evidence that very high voltages may be caused by electrical anomalies that occur under light loading conditions, or on longer line sections equipped with several voltage regulating devices operating in series.

Resolution of voltage anomalies were beyond the scope of this effort, but should be addressed if the V-7 feeder remains in its current configuration. (Voltage perturbation may continue to be a problem even if certain upgrades outlined herein are implemented.) The long lines also create power quality events – mostly voltage sags – characteristic of long lines where fault current is

low, especially for faults occurring on outlying line sections. Further, our studies reveal that full coordination of protective devices may be difficult to achieve due to line-end fault currents that approach normal phase trip settings.

From its investigation, NCI offers the following:

> *The results of NCI's investigation indicates SSVEC should take immediate action to address current performance issues and capacity limits, including carefully assessing the impact of customer requests for new or expanded service on V-7 feeder performance and capacity.*

The historic feeder peak demand *excluding line losses* was approximately 5650 kilowatts (kW) in February 2008; the cost of supplying these losses is estimated at $230,000 annually. The V-7 customer peak is expected to increase to about 8000kW by 2029, above the Huachuca substation and V-7 feeder ratings of approximately 7000kW; line and equipment losses will increase total loading to about 9000kW - the adjustment for losses will depend on which supply option is selected. Several alternatives were considered to meet current and future demand, including demand management (which includes energy efficiency), renewable energy, distributed generation and upgrades to the power delivery system. Up to 20 solutions were considered, including construction options previously evaluated by SSVEC. A screening analysis eliminated options that did not meet technical, environmental and economic criterion.

Notably, several options considered resulted in line loss savings of 500 kW or greater. The significance of this finding is that relatively small amounts of demand management and judiciously placed generation results in net effective generation of up to 150 percent of the nameplate rating of the alternative For example, installation of 2000 kW of generation in the Sonoita area results in a net load reduction of well over 2500 kW as measured at the Huachuca substation. Similarly, transmission supply alternatives reduce peak losses by over 500kW, which would significantly reduce the $230,000 annual cost of supplying these losses.

Candidate solutions were screened to eliminate those which were not technically mature or commercially available, or which did not provide a long-term solution. Alternatives that were deemed to be feasible to meet feeder and substation demand over 20 years include:

- New 69 kilovolt (kV) transmission supply – along the San Ignacio Del Babocomari Ranch (SIDB or Ranch);
- New 69kV transmission supply – along State Route (SR) 82 and Elgin Road;
- Distributed generation – diesel units located at the proposed Sonoita substation site;
- Fuel switching – conversion of electric heating to another fuel to reduce winter peaks; and
- Demand management – electric storage heating to reduce winter peak loads.

These alternatives were analyzed from a technical, economic, and environmental perspective. From an economic perspective, distributed generation (DG) and demand reduction in the form of electric heating conversion produced the lowest cost. However, use of diesel generators burning fossil fuels would produce local emissions in Sonoita and likely would require a permit from the Arizona Department of Environmental Quality (ADEQ).

Table ES - 2 summarizes the results of the economic comparison studies of those options deemed to be most feasible. Results indicate reduction in peak electric heating use produces the lowest costs when evaluated over 20 years. Reduction in electric heating use assumes a significant number of SSVEC customers would agree to permanently convert existing electric heating systems to alternate systems such as modular propane units or electric storage heating; a comprehensive appliance survey would be needed to confirm electric space heating load during feeder peaks.

Table ES - 2: Economic Comparison of Alternatives

Alternative	Capital Investment	Fuel and O&M Cost	Line Loss Savings	Total NPV
New 69kV to Sonoita: Along SIDB Ranch	$13,424	$231	$879	$ 12,776
New 69kV to Sonoita: Along SR 82	$17,004	$288	$879	$16,413
Diesel Generation	$2,277	$3,892	$418	$5,751
Electric Heating Conversion	$1,386	$1,428	$460	$2,355
Electric Storage Heating	$1,788	$ 350	$77	$2,061

Although economic results appear favorable, the viability of electric heating options is at best uncertain, as the level of incentive and marketing efforts would be sufficient to motivate customers is unknown. The willingness of customers to remove existing heating systems and replace them with alternate systems has not been established. Further, there is uncertainty as to whether there are a sufficient number of eligible heating systems to reliably meet feeder demand and mitigate performance issues. For example, customers with heat pump systems would not be candidates for conversion. Further, both DG and fuel switching options do not materially reduce momentary interruptions and voltages sags, nor do they address power quality issues; including those created by high load imbalances and possible circuit resonance.

All 69kV transmission options provide robust capacity support over 20 years (and longer), and improve power quality and feeder performance. The investigation of environmental issues indicates the new 69kV line along new and existing rights-of-way along the SIBD has the greatest impact of the options considered. The 69kV options have the greatest visual impact with modest impacts from a biological and cultural perspective. Most visual impacts are in the Sonoita Hills subdivision and a three-mile portion of SR 83 that transects the SIDB. Options to mitigate visual impacts include low-profile vertical construction and use of poles that blend with the landscape. These mitigation efforts lessen the visual impact of the poles and wires,

and give the line an appearance similar to typical distribution lines, but with heights of 10 to 15 feet above those of typical distribution lines.

Most renewable energy options, including wind and solar photovoltaic, did not provide sufficient coincident peak load reduction to be feasible – the feeder peak occurs during cold winter mornings when the sun is low on the horizon. Concentrated solar power (CSP) could provide a solution, but would be very large, expensive and have potentially undesirable visual impacts; it also requires significant land, which may be difficult to obtain in quantities sufficient to construct devices large enough to reduce peak demand. Energy storage systems show much promise and efforts are underway on a national scale to advance the technology and reduce cost, but are still in the early stages of development – the limited number of suppliers and long lead times for systems that are technically viable precluded energy storage from further consideration. Storage also would require complex monitoring and control schemes to ensure sufficient storage was available and dispatched in a manner that will reduce loads over the full duration of the daily peak.

It is important to note that DG, energy storage and CSP options may be riskier than distribution or transmission options, as each would need to be available when called upon to reduce feeder demand. Several smaller units would need to be installed in the event one or more units were out of service or otherwise unavailable to operate; for example, due to forced outages or inability to start. Further, special operating procedures, and communications and control equipment would be needed in the events these devices are tripped due to momentary operations of reclosing circuit breakers. Although fuel switching and fossil-fuel DG options could meet future demand, possibly up to 20 years, neither would not fully mitigate voltage sags and or materially reduce the number of momentary interruptions. The cost to improve reliability and mitigate performance issues would be in addition to the cost of the conversions or DG options.[3]

The electromagnetic field (EMF) levels associated with existing lines versus options considered indicate each of the proposed upgrades or load management options will likely produce lower EMF levels than existing facilities. However, there are no published standards or findings of health impacts either from the State of Arizona or federal agencies. Accordingly, NCI is not able to offer an opinion on the relative merits of each option on the basis of EMF levels.

The preferred alternative based on feeder performance and firm capacity requirements is the construction of new 69kV line along the Ranch where SSVEC has easement rights.

---

[3] The cost of mitigating reliability and performance issues were beyond the scope of the feasibility study.

Introduction

This study was prepared in response to an Arizona Corporation Commission (ACC) order dated August 17, 2009 that directed Sulphur Springs Valley Electric Cooperative (SSVEC) to engage a third party to investigate "alternatives [including use of distributed renewable energy] that could mitigate the need for construction of SSVEC's proposed 69kV project" and to submit its findings to the Commission by December 31, 2009. The results of this investigation will be available to the general public in forums to be held over six months in the impacted communities.

Background

To support existing and future loads and address operating deficiencies along a 24.9 kilovolt (kV) distribution circuit that includes nearly 360 miles of three-phase and single-phase primary line, SSVEC recently proposed construction of approximately 24 miles of new 69kV transmission lines and a new 10/12/14MVA, 69/24.9kV substation to be located in Sonoita, Arizona. The new Sonoita Substation would reconfigure the V-7 feeder into four separate 24.9kV feeders from the existing overhead distribution lines located near the new substation site. A fifth feeder breaker is proposed for the new substation to serve as an injection point for future distributed generation (DG) resources. Members of local communities have expressed concerns about the need for and the construction of the new 69kV transmission line and the 69/24.9kV substation, and formally raised these concerns to both SSVEC and the ACC.

Scope and Objectives

The purpose of the Sonoita Reliability Project (SRP) Feasibility Study is to independently evaluate the operational performance and to identify deficiencies on SSVEC's 24.9kV V-7 distribution circuit at current and forecast peak load levels, and to identify and evaluate options to mitigate performance deficiencies. The study does not attempt to rebut or support previous studies, findings or recommendations. All options and alternatives considered for mitigation of operational deficiencies include only mature, commercially available technologies. All potential options must provide a long term solution to correct deficiencies, evaluated over a 20-year project life. The evaluation includes an assessment of potentially feasible alternatives from a technical, economic and environmental perspective.

To accomplish the above, Navigant Consulting Inc. (NCI) was engaged by SSVEC to perform the following tasks:

1. Evaluate the operational performance of 24.9kV distribution circuits.
2. Evaluate the operational performance of 69kV-24.9kV distribution substations.
3. Identify the root causes of substation, distribution circuit and transmission line operational deficiencies.
4. Conduct distribution feeder and area load growth studies.
5. Identify and evaluate mature, commercially available distributed renewable energy technologies as potential options for mitigating distribution circuit and substation performance deficiencies.
6. Evaluate the selection of 69kV-24.9kV distribution substation site options.
7. Evaluate 24.9kV distribution line upgrade and new construction options.
8. Evaluate potential environmental impacts of 69kV transmission line route options.
9. Prepare cost estimates and comparisons of DG, renewable energy, and line construction of alternatives to resolve distribution feeder and substation operational deficiencies.
10. Evaluate the potential environmental impacts of line construction and DG alternatives.

Methodology

The approach NCI employed to evaluate options includes a thorough technical, economic and environmental assessment of potentially feasible alternatives. It includes a projection of need for additional feeder and substation capacity, an operational and condition assessment of existing facilities, and a reliability and performance assessment of the V-7 feeder. Both demand and supply-side options are considered, and potentially viable alternatives are compared from a technical, economic and environmental perspective. Viable alternatives include technologies deemed as mature and commercially available (as viewed by those involved in or responsible for electric utility power supply and energy delivery planning and operations). Alternatives that are in the demonstration phase or where equipment has limited availability due to technology limitations or absence of reputable suppliers were not considered.

Most technical, cost and economic assumptions in the feasibility study are based on data acquired from SSVEC, field observations and inspections, and an independent review of available records. Where existing SSVEC data was used, NCI independently reviewed it for reasonableness, and introduced new data and analyses where none existed or was insufficient to develop findings. The analysis includes an independent technical assessment based on current industry practices, experience with similar facilities, and conformance with Rural Utility Services (RUS) planning, design and reliability criteria. NCI did not directly contact or meet

with SSVEC personnel at any time during the study, and all data and information requests were submitted to TRC Solutions, an independent engineering and consulting firm familiar with SSVEC's service territory and electric delivery facilities.[4]

From the independent evaluation, we identified options that SSVEC could pursue to ensure a reliable and dependable supply of electricity is maintained to SSVEC customers in the near and long-term. All options or combination of alternatives deemed to be technically viable are compared over a 20-year horizon using present worth economic evaluation methods. For each option, the relative merits and trade-offs of reliability, environmental, rights-of-way and other factors are presented and quantified. Our analysis recognizes that SSVEC will conduct public review meetings. Accordingly, our findings include actions that should be considered to ensure reliability is not compromised and sufficient capacity is available to meet feeder and substation peak loads during 2010.

[4] An SSVEC employee accompanied NCI and TRC Solutions personnel during site and line routing inspections, including access to the Babocamari Ranch. However, NCI did not request data or seek opinions on the feasibility or viability of proposed reinforcement or expansion options during our inspection.

Assessment of Existing Electric Delivery System

The existing V-7 feeder and Huachuca substation were analyzed to identify current deficiencies. Deficiencies may include line and equipment overloads, violation of steady state voltage limits, sub par reliability performance, operational inefficiency and inadequate line protection. To evaluate feeder performance, NCI conducted load flow studies utilizing Milsoft's Windmil engineering simulation model.[5] Other sources and data used to evaluate performance include feeder outage statistics, applicable design standards and planning criteria, and other SSVEC reports detailing prior performance issues. Where applicable, NCI reviewed databases, engineering studies, and other documents for accuracy and applicability. However, all NCI studies were conducted independently without direct input or recommendations from SSVEC engineering, operation or planning personnel. All methods employed to evaluate the existing system (and applicable supply options) conform to current utility and general RUS practices, including simulation methods and standards used to evaluate feeder performance.

Description of Electric Supply and V-7 Feeder

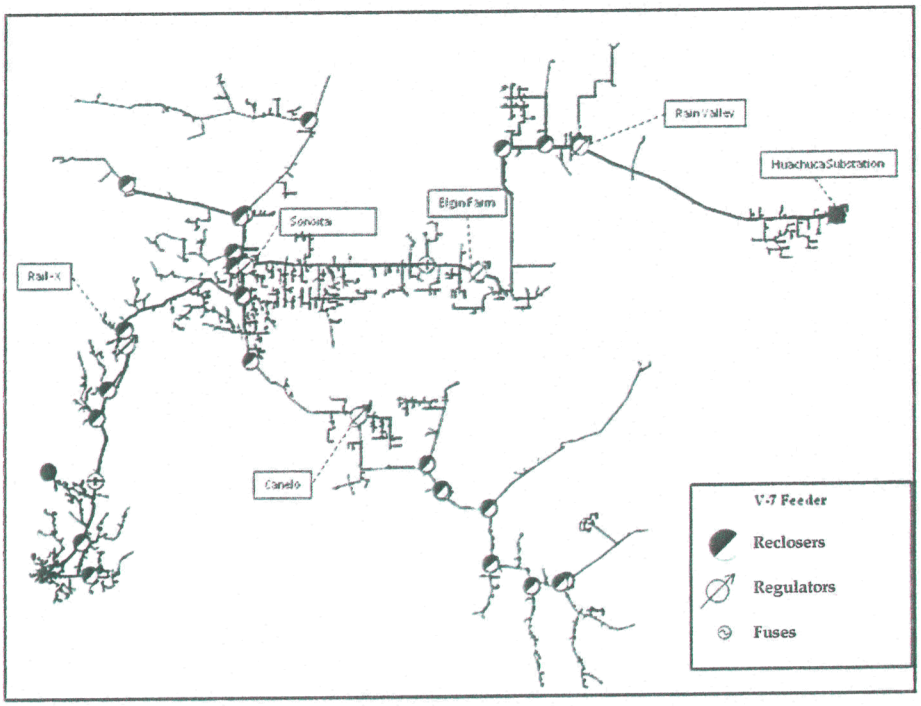
The V-7 feeder is served from SSVEC's Huachuca substation near the intersection of State Routes (SR) 90 and 82 in the town of Whetstone. The Huachuca substation includes two transformers, one rated 69/12.47kV that serves load south and east of the substation; the other transformer is a 69/24.9kV unit rated 7 megavolt amperes (MVa). The two transformers often are referred to as Huachuca East and Huachuca West, respectively. The only circuit fed from the 69/24.9kV transformer is the 24.9kV V-7 feeder. The V-7 feeder serves the furthermost western section of SSVEC's service territory. There are no feeder tie lines backing up any primary lines or lateral taps on the V-7 circuit.

The total length of V-7 is over 350 miles, the longest among SSVEC's feeders. The higher voltage of the V-7 feeder – most of SSVEC's distribution system operates at 12.47kV - is essential in order to maintain voltages within acceptable levels. The V-7 feeder includes approximately 53.1 miles of three-phase lines, 1.6 miles of two-phase lines, and 275.6 miles of single phase distribution. A simplified one-line diagram of the V-7 feeder is displayed in Figure 1. The feeder does not have right-of-way easements, but grandfathered under prescriptive rights. These prescriptive rights allow SSVEC to perpetually operate and maintain these feeder segments, but prohibit material changes to the physical or electrical attributes of the line. The

[5] NCI utilized Windmil data bases provided by SSVEC; including line impedances, nodal loads, and other devices located on the V-7 feeder. NCI reviewed model databases and calibrated the model to match actual loads and to confirm actual line performance.

feeder serves about 2400 electric meters or about seven meters per line mile; low, but not uncommon for a rural feeder serving mostly residential and small commercial load.

Figure 1: V-7 Feeder Diagram



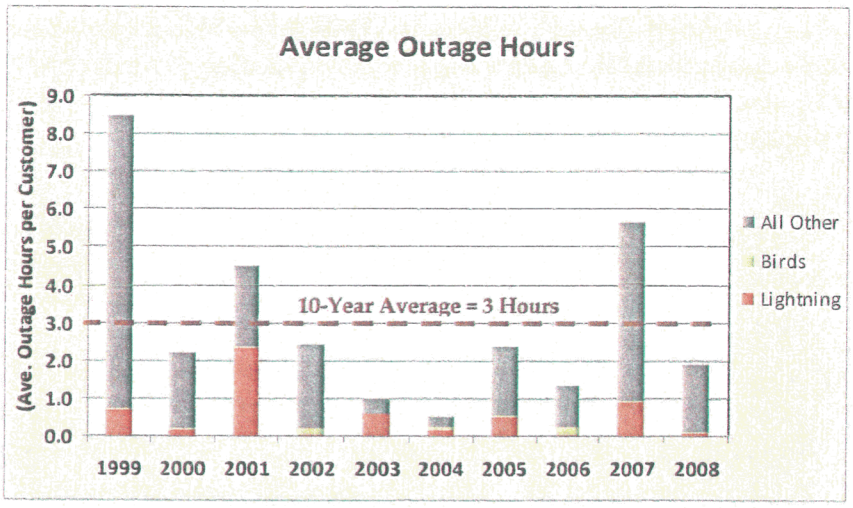
Reliability Performance

For over 10 years SSVEC has collected outage statistics, including the number of sustained outages by cause, duration, and number of customers affected, among other data.[6] (NCI used the SSVEC data without modification to derive each of the reliability charts that follow.) One of the more common statistics utilities collect is the total time that customers are out of service, measured in minutes or hours. Figure 2 presents annual customer outage hours, which over 10 years has averaged three hours per customer. While high, the duration is not unusual for very long feeders; the value drops to 2.4 hours if 1999 is excluded (in 1999 several wind-related events interrupted all customers served by the feeder).

---

[6] Sustained outages typical are those that interrupt service for more than five minutes; outages less than five minutes are classified as momentary interruptions by the Institute of Electrical and Electronic Engineers (IEEE), although some utilities apply a lower time threshold.

Figure 2: Annual Average Outage Hours per Customer



In addition to the above chart, NCI also assessed reliability performance using other common indices that measure interruptions at the system level, often referred to as SAIFI (average frequency of interruptions per customer), SAIDI (average duration of interruptions per customer), and CAIDI (average duration of interruption per customer). Results are for the V-7 feeder summarized in Table 1.[7] Similar to other utilities, the annual values can vary dramatically, often due to changes in the number of severe weather events.

Table 1: V-7 Reliability Indices

Year	SAIFI	SAIDI	CAIDI
1999	1.5	8.9	5.9
2000	0.9	2.2	2.6
2001	2.8	4.5	1.6
2002	1.5	2.3	1.5
2003	0.5	0.9	2.0
2004	0.3	0.5	1.8
2005	1.8	3.0	1.6
2006	0.3	1.1	3.9
2007	1.5	4.8	3.2
2008	1.3	1.6	1.3

[7] The SAIDI index is very similar to the charts that summarize consumer outage hours; the number of customers is used to derive SAIDI and other indices presented above.

Figure 3 presents the annual outages on the V-7 feeder over the last 10 years. Although the number of outages is higher than more compact feeders with fewer feeder miles, the number does not appear inordinately high given the very rural area served and significant outage exposure. Subsequent tables indicate that many V-7 outages affect only one or a few customers. Further, many of these customers are located in remote areas, which mean crews often have to travel long distances to restore service.

Figure 3: Total Annual Outages

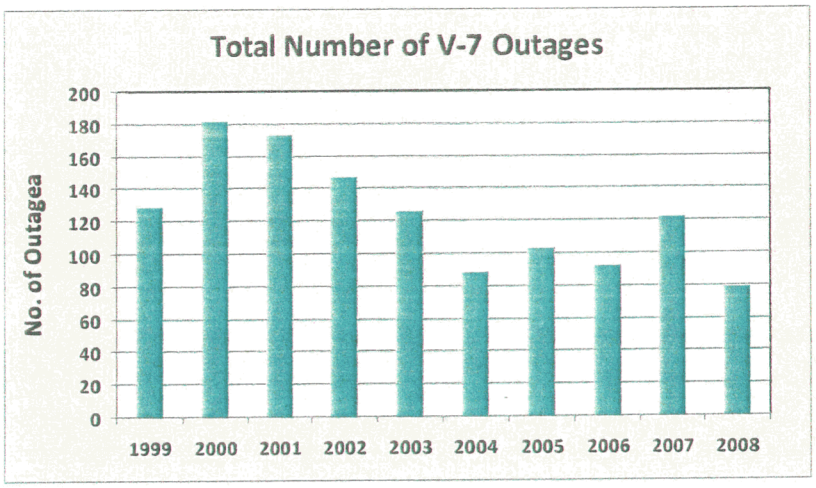
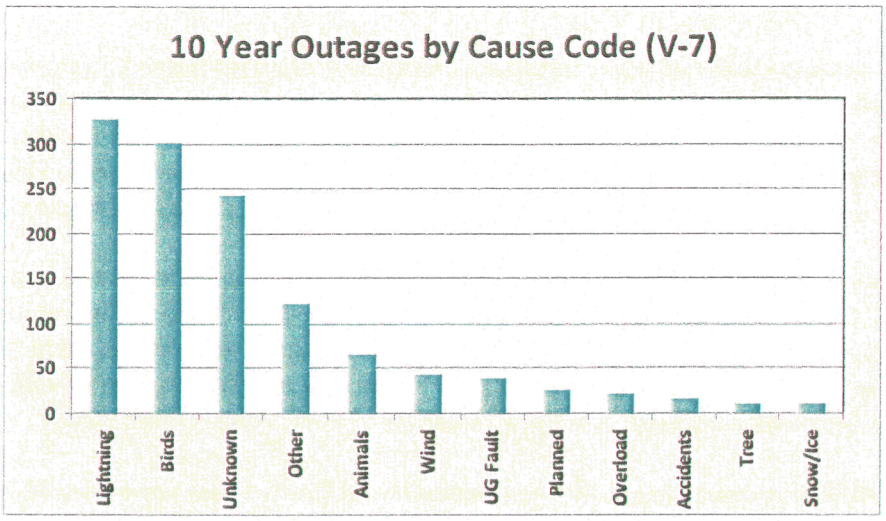


Figure 4 presents composite 10-year outages by cause code for the V-7 feeder. The primary causes of outages have been weather (lightning, wind) and animals (birds, other animals). Other dominant outage causes include unknown and other, many of which could be weather or animal-related, but otherwise not observed by field personnel or customer who reported the outage.

Figure 4: V-7 Feeder Outages by Cause Code



The average number of customers is presented in Figure 5, which indicates the majority of outages only impact fewer than five customers. Also, very few outages interrupted all customers served by V-7.

Figure 5: Number of Consumers Affected per Outage

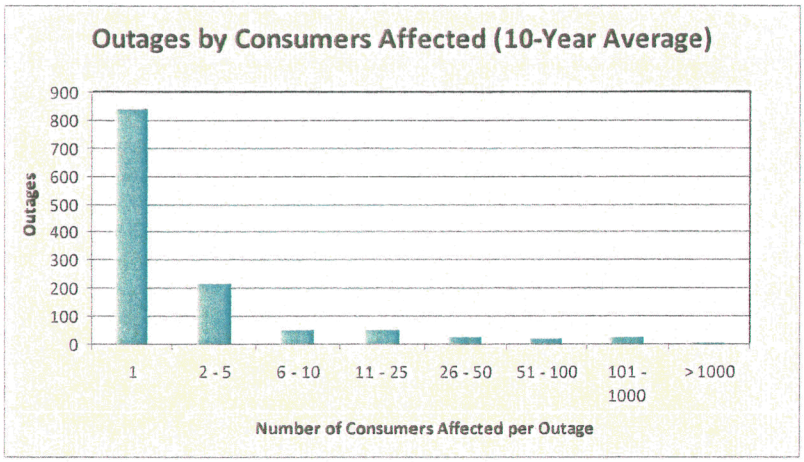


Figure 5 indicates the majority of outages only interrupted a single customer; over 90 percent of the outages interrupted three or fewer customers. These results conform to data from Figure 6, which indicate most outages are due to transformer or pole riser fuses, many of which serve one or a few homes. (The very large lot sizes limit the number of secondary services that

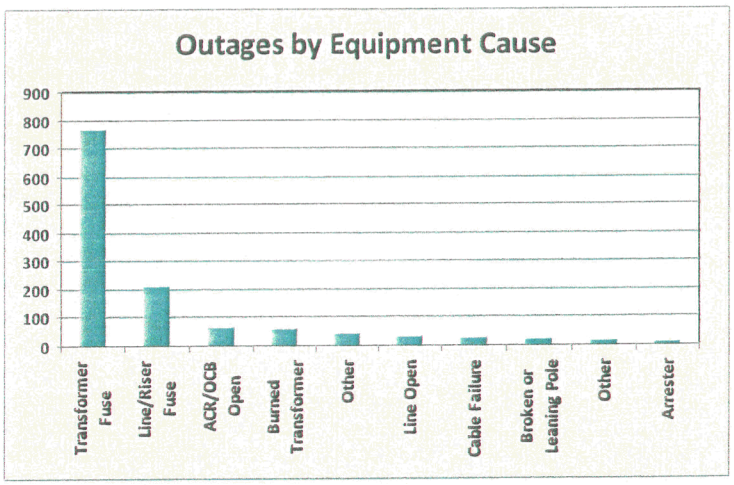
can be served by a single transformer: if the distance between the line transformer and service entrance is over 300 feet, it may create unacceptable voltage drop.)

The low number of full feeder outages and effective use of reclosing circuit breakers along many sections of the V-7 feeder has limited the average outage hours per customer to about three hours. New supply alternatives which reduce line exposure by creating new feeder segments would improve reliability by 15 to 30 percent beyond current levels. However, the number of momentary interruptions would likely decrease by a much larger percentage.

The equipment that caused the outage or that was the interrupting device is presented in Figure 6. The large majority of outages were caused when line or transformer fuses opened. Interestingly, the large number of transformer fuse operations is an unexpected finding, as most animal and lighting-related outages occur on the primary line; whereas transformer fuses typically open when a fault occurs on the secondary side of the line transformer.

It is possible transformer fuses may be opening due to high in-rush currents following recloser operations or because of high voltage potential rise across fused cutouts.[8] However, NCI did not independently research this phenomenon to confirm a relationship between recloser trips and fuse cutout operations.

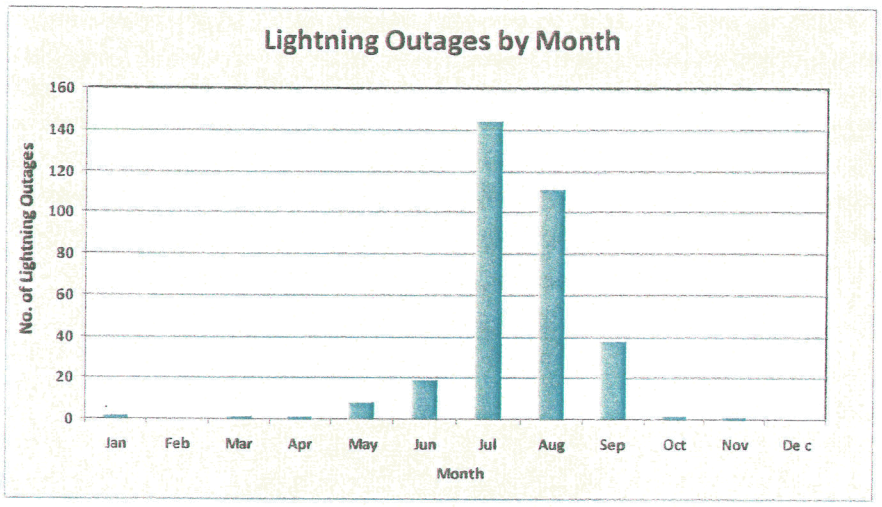
Figure 6: V-7 Feeder Outages by Equipment Cause



[8] SSVEC's standard for line transformer arrester placement is adjacent to the fuse cutout. Industry research suggests the preferred placement for arresters is directly on the transformer to reduce voltage potential rise on the transformer leads.

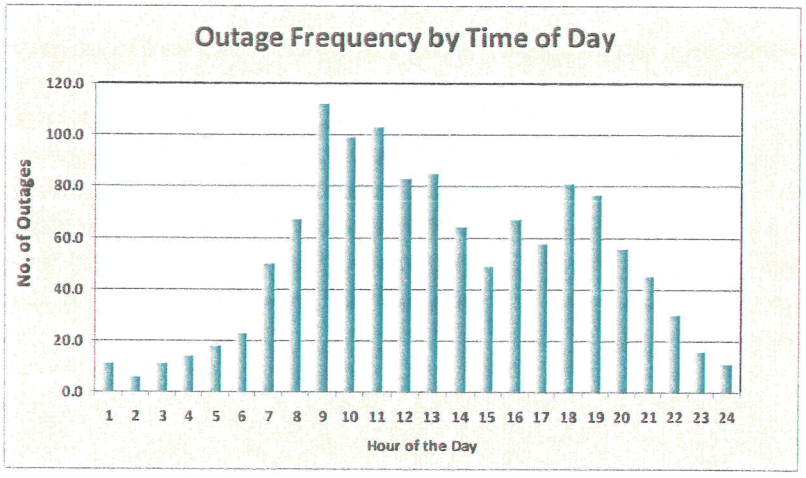
Figure 7 confirms that lightning-related outages, the largest single cause of outages, occur primarily during the summer months. SSVEC may be able to reduce restoration times for outages caused by lightning by supplementing crews or coverage times beyond current levels for summer months only.

Figure 7: Lighting-Related Outages by Month



Similarly, as shown in Figure 8, outage frequency listed by time of day reveals many outages occur during morning hours or late afternoon/early evening hours when crews have just started or ended the work day. Supplementing crews or extending coverage during these hours in months of high outage frequency, if SSVEC has not already implemented such measures, may prove cost effective for reducing outage duration on the V-7 feeder.

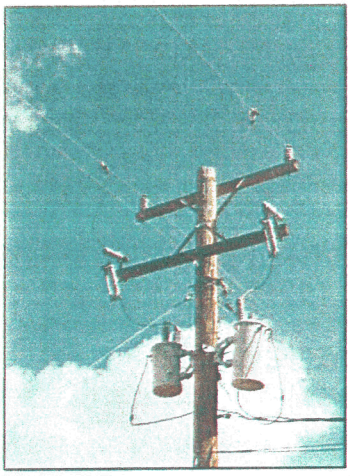
Figure 8: Outage Frequency by Time of Day



Equipment Condition

During its inspection of the V-7 circuit, NCI did not see significant or unusual levels of deterioration of lines or substation equipment. The substation appears reasonably well-maintained with proper clearances and absence of ground scrub, bird nests or rusting. Many new poles appeared to have been installed on several sections of the V-7 circuit. Records indicate SSVEC has replaced many poles and installed lightning protection along many miles of line. Our field observations support these records. Many sections of V-7 have overhead shield wires and regularly spaced arresters on highly exposed sections of lines. Typical V-7 construction is shown on Figure 9. Further, SSVEC has installed animal guards on many transformers, devices and equipment leads. Each of these measures is appropriate given the high incidence of lightning and animal related outages. They also appear to have been effective, given the decline in number of outages over the past 10 years.

Figure 9: Typical V-7 Construction



Historic reliability data also support a finding that outages caused by equipment deterioration have modestly declined over the past 10 years. Notably, the incidence of wind-related outages appears to have declined, most likely due to SSVEC's pole replacement program. SSVEC has proactively replaced deteriorated poles along several miles of line in the past several years. Similarly, installation of lightning and animal protection measures appeared to have had a favorable impact on feeder reliability. Nonetheless, the continued high incidence of lightning related outages suggests targeted improvements such as installation of additional arresters, improving ground resistance and installing overhead shield wires may need to be expanded beyond current levels.

From the above, NCI concludes that feeder and substation facilities are generally in good condition and appropriately maintained. Our findings regarding the need for capacity support generally is independent of feeder and substation equipment condition.

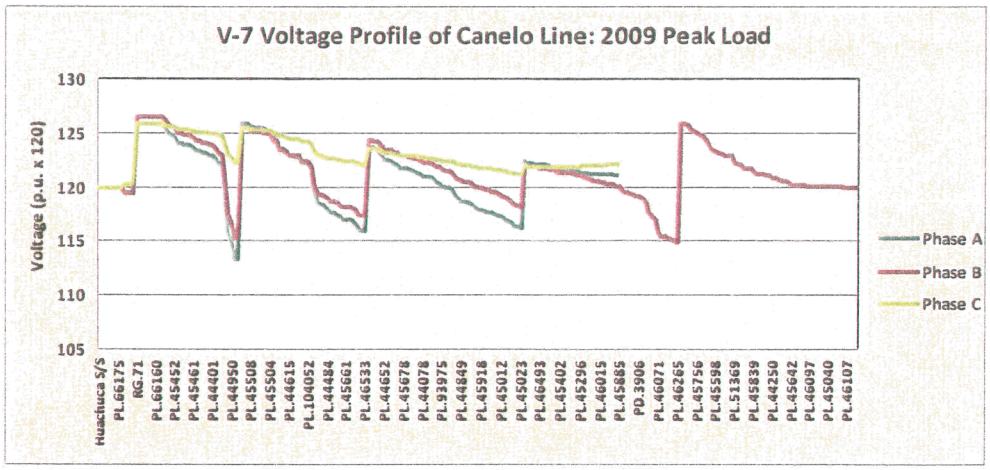
Feeder Voltage Performance

NCI examined steady state feeder voltage performance under light and heavy load conditions. Utilities with long feeders often find upgrades are needed to maintain voltages within prescribed limits as loads increase. The Milsoft Windmil simulation model was used to predict feeder voltage performance. Model data bases, including lines impedances, nodal loads, transformer ratings and impedances, construction types, device characteristics and ratings, substation devices, and power factor were provided by SSVEC. NCI reviewed the data for reasonableness, but did not make any adjustments to the data base; except for future years' studies, where all loads were increased proportionally according to projected load growth. The base case Windmil studies generally confirmed actual loads measured at the Huachuca substation. However, as noted later, the model was not able to predict localized high voltage readings measured by field meters, which appear to be due to non-linear loads or resonance that the model is not designed to calculate.

Figure 10 illustrates the V-7 feeder voltage profile at peak for the segment of line orginating at the Huachuca substation to the end of the southernmost section of the single phase lateral tap line passing through Canelo and south of the San Ignacio Del Babocomari Ranch (SIDB or Ranch). Each segment where voltages increase to 126 volts (or similarly high levels) is where voltages regulators are installed. Although significant regulation is needed to maintain voltages, model results predict that they are within acceptable levels.

Figure 10: V-7 Feeder Voltage at Peak (Canelo)

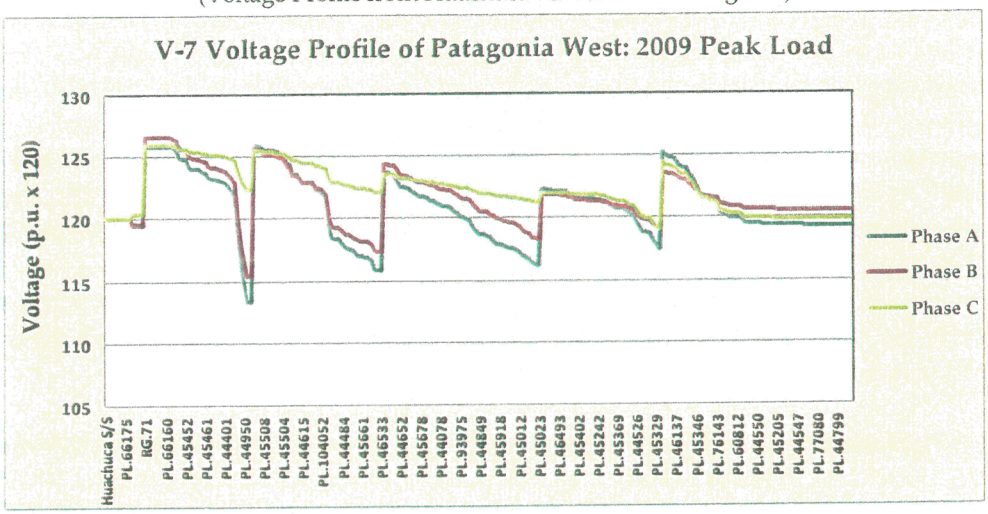
(Voltage Profile from Huachuca Substation to Canelo South)



Similar to line segments to the south, similar sawtooth voltage patterns appear on the line segment originating at Huachuca and extended to the end of the feeder in Patagonia (Figure 11). Other line segments are predicted to follow patterns similar to those presented in these illustrations.

Figure 11: V-7 Feeder Voltage at Peak (Patagonia)

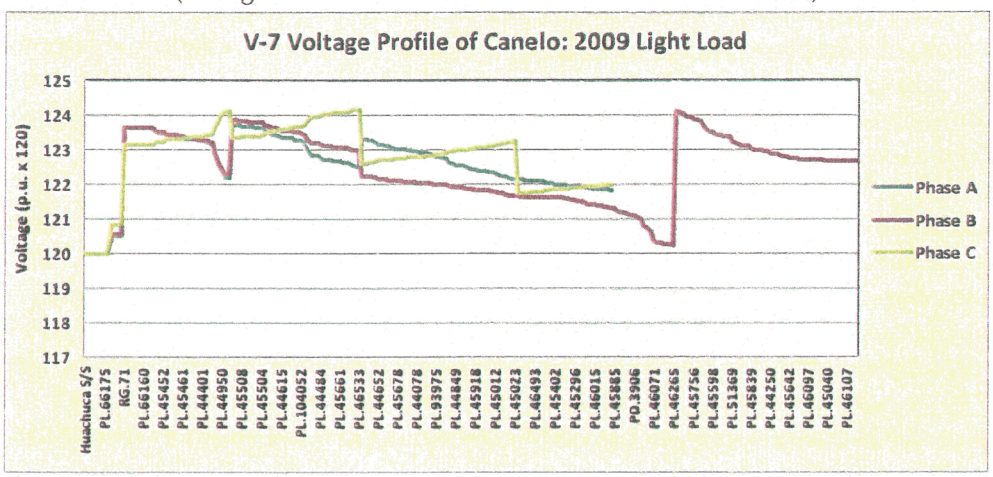
(Voltage Profile from Huachuca Substation to Patagonia)



Each of these diagrams confirm that significant amount of feeder regulation is needed to maintain voltages within prescribed standards (i.e., minimum service voltage of 114 volts). Notably, up to 10 percent boost is needed at several regulator locations. As shown on Figure 12, under light load conditions feeder voltages still vary, but to a lesser extent. The Windmil simulation model reveals that large load imbalances causes individual phase regulation to vary significantly, particularly Phase B is a very long section of single-phase line serving Canelo and areas south of the Ranch.

Figure 12: V-7 Feeder Voltage under Light Loads (Canelo)

(Voltage Profile from Huachuca Substation to Canelo South)



Notably, predicted voltages from the Windmil model *do not* match actual voltages that SSVEC has recorded for over a year. Metered phase voltages recorded in February 2009 reveal voltages over 130 volts on several occasions. Exhibit 1 illustrates the range of voltages recorded via three-hour intervals over the entire month. These voltages are well above industry standards and can potentially harm customer-owned equipment. It is possible that harmonic current and circuit resonance issues may be causing the voltage anomalies[9] - these need to be resolved for whichever long-term option is selected.

Feeder Protection

The length and high impedance of the V-7 feeder presents significant feeder protection challenges, as line-end outages produce fault currents at the Huachuca station approaching phase trip settings. This phenomenon is common for very long circuits, where the impedance of the line from the point of fault to the substation breaker is high. Further, low fault currents can cause difficulties in coordinating recloser and fuse protection. Lastly, the lower fault current can degrade power quality, as the clearing times for reclosers or fuse links is longer compared to shorter feeders with higher fault currents.

---

[9] The time and effort needed to independently conduct controlled measurement studies at different locations on the V-7 feeder was beyond the scope of the feasibility study. NCI understands that SSVEC is currently conducting such measurements. Further, Milsoft, the supplier of the Windmil engineering simulation model used for the feasibility study, indicated the model does not simulate the impact of resonance and harmonics.

One of the advantages of new supply options (substation) located centrally along the existing V-7 feeder is the corresponding increase in available fault current. The higher fault current allows protective devices to operate faster, thereby improving power quality and protection coordination. Protection coordination also is facilitated by the fewer number of protection zones, achieved by creating several independent feeders, each with independent substation feeder breakers – four were proposed for the new 69/24.9kV Sonoita Substation, with one spare for future use or to connect DG.

In addition to protection coordination challenges, the very long length of the V-7 feeder can cause temporary high loads following an outage of a main line section of the V-7 feeder, complicating restoration efforts. Following an outage, customer equipment including appliances and space heating will simultaneously energize, causing high in-rush currents and the potential for utility line and equipment overloads – commonly referred to as cold load pick-up. The temporary overloads are compounded if pre-outage loads are high, as high incremental line losses combined with cold load pick-up can cause loads to be well above normal.[10]

As noted, heavy phase imbalances currently exist on the V-7 feeder, which creates high neutral currents. This imbalance requires higher setting for ground protection relays, effectively de-sensitizing these relays.

In addition to sustained outages, momentary outages that clear via line or substation reclosers also can disrupt customer loads, particularly sensitive electronic devices. Because of the very long length of V-7, SSVEC has installed many line reclosers to limit the number of customers impacted for outages along the feeder main line and lateral tap lines. Outage records indicate these reclosers have been effective at limiting the number of customers impacted by lateral and main line outages. Table 2 lists the number of substation and line recloser operations on the V-7 feeder over the past six years. Each recloser operation either causes a momentary or sustained interruption to V-7 customers.

---

[10] A compelling example of this phenomena is confirmed in an outage that occurred on December 8, 2009; where the substation breaker locked out, causing an interruption of service to all V-7 customers. Because the outage occurred under high load conditions (temperatures in the 40's), cold load pick-up caused load as measured at the Huachuca substation to exceed 8000 kilovolt amperes (kVa), well above the transformer rating of 7000 kVa and near the trip setting of phase conductors.

Table 2: V-7 Recloser Operation

Year	Huachuca Substation		Line Devices	
	No. of Recloser Operations	No. of Recloser Lock-Outs	No. of Recloser Operations	No. of Recloser Lock-Outs
2004	402	4	26	0
2005	137	9	33	0
2006	145	6	46	0
2007	266	18	17	1
2008	147	9	5	0
2009	202	10	4	2
Totals	**1299**	**39**	**138**	**3**

These reclosers have successfully limited the number of full feeder lock-outs, thereby improving reliability. However, customers on other line section likely have experienced voltage dips due to the length of time needed to clear permanent faults. Further, the successful reclosing of the Huachuca substation breakers nonetheless causes a momentary interruption to all customers served by the V-7 feeder.

Power Quality

As noted in prior sections, steady state voltages can vary significantly due to rapid changes in load. Voltage dips caused by recloser or fuse operation can cause voltages to temporarily drop to low levels; particularly for customers located on sections of line far from the Huachuca station or on long tap lines.[11] Absent a new supply source that will strengthen voltages in outlying areas, voltage dips and perturbations are likely to continue, and worsen as loads increase. As noted in other sections, high line losses under high load conditions exacerbate voltage drop.

Harmonics and Resonance

There appears to be some evidence of potential resonance or harmonic performance issues (Exhibit 1), these conditions have not been confirmed or independently verified. SSVEC has measured voltages at several locations on the system, some of which indicate the presence of voltage anomalies, which may be caused by non-linear harmonic currents or system resonance.

---

[11] Momentary interruptions less than five minutes are not considered power quality events, except to the extent customers on adjacent lines encounter voltage dips. IEEE 1366 differentiates power quality events from momentary outages. Power quality events include voltage dips, harmonics, voltage flicker and other waveform anomalies; but exclude interruptions, including those which are momentary; i.e., those less than 5 minutes in duration.

Additional measurements and study is needed to confirm the conditions under which these occur on the V-7 feeder[12]

Poor power quality with the presence of harmonics can affect nearly every element within a power system via thermal and mechanical stresses. These stresses result in additional power losses and reduction in the overall equipment life span to utility and customer equipment. For example, magnetic devices such as motors, transformers or relay coils operating under harmonic conditions experience large thermal losses that can result in high levels of heat which can reduce the overall structural integrity of the device.

Other known affects of the presence of harmonic distortion is caused by telephone interference and faulty metering results. The telephone interference is causes by the harmonic electromagnetic field (EMF) coupling with the transmitted telephone signal. Faulty meter results could occur in the presence of harmonics unless the meter is designed with true-RMS sensing. If the metering device is designed with only peak or average RMS sensing ability then faulty voltage readings could occur from the presence of the non-linear waveform caused by the harmonic distortion.

Mitigation methods commonly used by the utilities include eliminating the system resonance blocking the harmonic source or by removing the harmonic currents of the system. These methods could be applied by feeder sectionalizing, adding or removing system capacitance, or by incorporating filters.

Harmonic Mitigation Options

In case there is a problem with harmonic distortion on the V-7 feeder there may be several options available for mitigation. Two of these methods could include either feeder separation, such as the 69kV Sonoita Substation – four feeder option or by implementing filters along the V-7 feeder. Most likely if the filters were needed, they would be shunt filters designed to mitigate harmonic frequencies observed on secondary voltages for the V-7 feeder.

---

[12] System resonance is the condition when the inductive reactance of the system equals or nearly equals the capacitive reactance. When a system is in a resonant condition, the resonant currents experience minimum losses and is resisted only by the resistance of the conductor. At resonance these currents may magnify and create large abnormal voltages. Distribution systems are designed to function with some reactive impedance to avoid resonant conditions and to supply the reactive power needed by standard loads of the consumer. Harmonics refer to the voltage or current distortions propagated from consumer loads or from other known sources within the distribution system. The harmonics of a system are these voltages or currents at a frequency that is a multiple of 60 Hertz and influence the overall system reactive impedances.

A thorough assessment of the possible harmonic distortion in the V-7 feeder and possible options for mitigation are beyond the scope of this report; however it is possible the V-7 feeder experiences some levels of harmonics due to the long length of the line, number of regulators, past high voltage meter readings, and preliminary measurements made along the feeder. Two solutions that typically are applied to resolve harmonics include:

1. Locate point source of the harmonics and eliminate the source as stated above; or
2. Shorten feeder lengths to reduce total harmonic distortion (THD) on the feeder.

Absent the above, further study would be needed to determine the most effective means of implementing a method of mitigation if the problem is indeed found to exist. Industry sources and articles suggests the following when trying to make a determination as to whether tuning the circuit will mitigate the problem: Utilities should be certain to ensure the existence of harmonic sources on the power system by performing a frequency scan and harmonic resonance evaluation to avoid resonance to guarantee the benefits of applying capacitive compensation, if such measures are appropriate for the V-7 feeder.[13]

Distribution Line and Equipment Losses

Feeder load flow studies confirm that line and equipment losses impact feeder performance and the need for additional capacity. Losses include both no load and load losses. No load losses are independent of feeder load and occur mostly on substation and line transformers. Load losses include those which are a function of line loading. Because losses are proportional to the square of the load, any increase in load can significantly increase line losses, particularly on longer lines. Such is the case with the V-7 feeder, where losses at peak are approximately 30 percent of total feeder demand. Significantly, incremental losses approach 50 percent – that is, for each additional one kilowatt (kW) of load added to the feeder, on average, approximately 1.5 kW must be delivered from the Huachuca substation at peak.

The Windmil model was used to predict historic and future line losses for all supply alternatives. Losses shown below in Table 3 represent a substantial portion of the total electric demand on V-7; over 20 percent of feeder and substation capacity is consumed in losses; capacity that otherwise would be available to serve customer load. However, the losses are not unexpected or unusual, as the length of the line causes losses to be much higher than shorter feeders. Notably, the higher voltage of the line, 24.9kV, produces losses that would otherwise

---

[13] SSVEC recently recorded voltage and current harmonic distortion levels at several points along the V-7 feeder. These results confirm the presence of harmonics, with total current harmonics of up to 10 percent.

be higher if lower voltage lines were to serve the same amount of load (many SSVEC feeders operate at 12.47kV).

Table 3: V-7 Peak Losses (kW)

Year	Peak Load (kW)	Peak Losses (kW)	Total Load (kW)	Percent Losses
2000	4511	715	5226	16%
2001	4856	854	5710	18%
2002	4919	881	5800	18%
2003	4440	689	5129	16%
2004	4668	777	5445	17%
2005	4787	824	5611	17%
2006	5464	1124	6588	21%
2007	5652	1248	6900	22%
2008	5655	1248	6903	22%
2009	5406	1124	6530	21%

The amount of energy losses on the V-7 feeder is estimated at over 3000 megawatt hours (MWh) annually. The cost of energy and demand losses appears as additional power deliveries are paid via purchase power agreements and market purchases. The annual cost of losses is estimated at about $230,000 based on SSVEC's 2010 revenue forecast for demand and energy. A load factor of 45 percent and loss factor of 27 percent was derived by applying standard loss factors using 2008 hourly load data.[14] The costs associated with V-7 line and equipment losses are shown in Table 4.

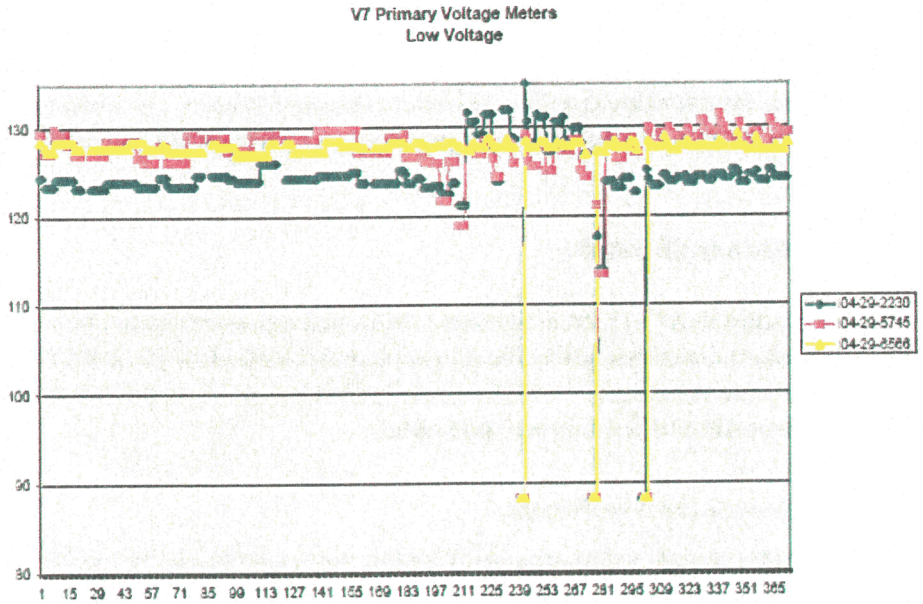
Table 4: V-7 Line & Equipment Losses

Category	Peak Losses (kW)	Energy Losses (MWh)
Line Losses	1024	1063
No Load Equipment Losses	224	1962
Total Losses	1248	3026
Avoided Cost	$81.36/kW	$42.55/MWh
Cost of Losses	$101,539	$128,739
	Total	**$230,279**

[14] The loss factor is estimated by the equation Loss Factor = LF2* CF1 + LF*CF2; where LF equals load factor, CF1 is a coefficient usually set to 0.3, and CF2 is a coefficient usually set to 0.7.

NAVIGANT
CONSULTING

Exhibit 1: V-7 Metered Voltages by Phase



This is a graph of low voltages seen during the month of Feb 2009 approximately every 2hrs 45min. The voltage meters record the peak and low voltage recorded between data reads, which is approximately every 2hrs 45mins. Values below 90V are usually outages.

Electric Consumption and Demand Forecast

Historic feeder and demand profiles are analyzed and the V-7 20-year load forecast is presented in this section. The contribution of line and equipment losses to V-7 peak feeder demand is also calculated to highlight the unadjusted customer load contribution to peak demand, and to provide base line data for developing a 20-year feeder demand forecast. The impact of high line losses has a significant impact on the timing of upgrades to address feeder and substation capacity deficits.

V-7 Feeder Customer and Demand

The Huachuca substation and V-7 feeder loads and load patterns are evaluated in the following subsections. It includes an analysis of historical load patterns, load growth, customer attributes, and a forecast of V-7 peak demand. Existing and future feeder peak demands are normalized to account for line losses and weather, where applicable.

Historic Electric Demand and Consumer Statistics

Table 5 presents the number of customers, listed by rate codes, served by the V-7 feeder. Notably, the largest number of customers are residential and non-demand single-phase small commercial, which reflect the rural character and low load density of V-7. Less than 10 percent are billed for demand, and of these, few take service under the Large Power rate code.

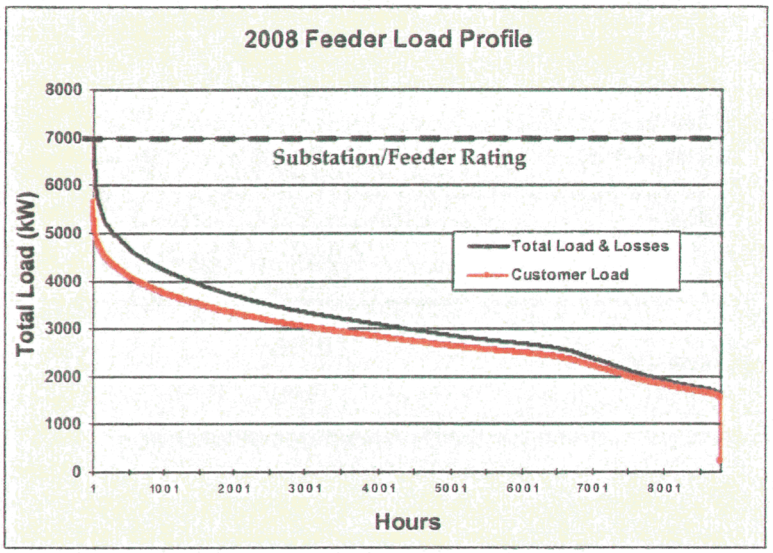
Table 5: Number of V-7 Customers by Rate Code

Rate Code	Rate Description
GS DEMAND 1-PHASE	67
GS DEMAND 3-PHASE	31
GS NON-DEMAND 1-PHASE	536
GS NON-DMD 3-PHASE	8
IRR CONTROL/W	2
IRR LOAD FACTOR DMD	1
IRR SEASONAL	1
LARGE POWER	8
LINE EXTENSION	3
PRE-METER CONST MIN	1
RESIDENTIAL	1675
RESIDENTIAL SUNWATTS	13
RESIDENTIAL TOU ON-PEAK	1
SET-UP RATE	2
TOU TOTAL KWH	6
TOTAL	**2355**

Electric Demand Profiles and Capacity Limits

The feeder and substation load profiles illustrate the number of hours when total load are expected to approach or exceed equipment ratings. The load duration curves in Figure 13 compares the V-7 load profile for 2008 to the substation transformer capacity rating. Notably, the composite 2008 peak, which combines customer load plus line losses, was about 6900 kW, just under the current substation transformer rating. Of this amount, approximately 1600 kW or 30 percent of total load was consumed by line and equipment losses.

Figure 13: V-7 Annual Load Profile

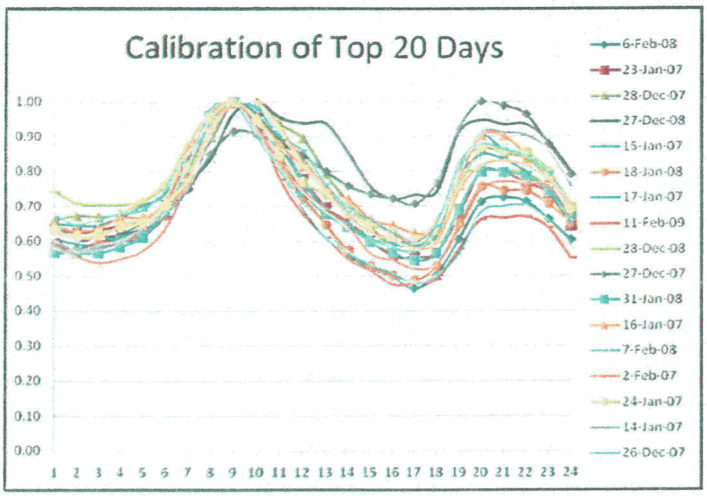


The load duration curve also provides an indication of the minimum number of hours that distributed resources would need to operate (or number of hours that demand reduction would need to be enabled) to reduce load to avoid overloads or to raise line voltages to acceptable levels. For example, if the desired maximum loading limit in 2008 was set at 4500 kW, distributed resources or demand response would need to be operated or enabled for a minimum of about 500 hours.

It is also instructive to examine hourly changes in V-7 daily load profile patterns, particularly on the highest peak days when load approaches feeder capacity limits. Figure 14 presents hourly per unit load data for the 20 highest peak load days over the past three years. Aside from a few outliers or where supervisory control and data acquisition (SCADA) data appears suspect, there is high degree of comparability among the peak day load curves. This consistency likely is due to recurring heating load during colder winter days – all 20 days of highest peak load occurred during winter months. Predictable load patterns enable system planners to design programs to reduce daily peaks; e.g., targeted load reduction programs. Further, the duration of the peak

hours on days with the highest demand is relatively short, as load quickly tapers off after sharp early morning peaks.

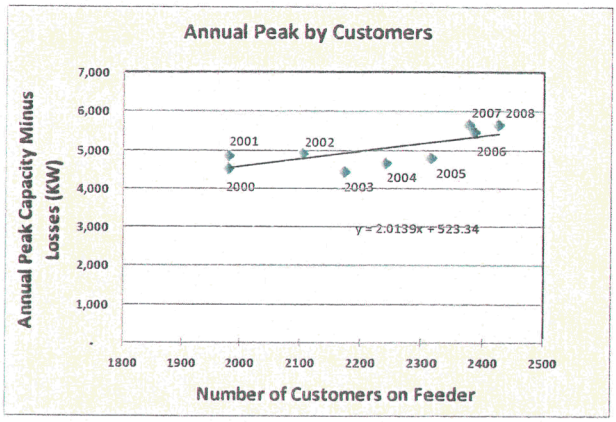
Figure 14: V-7 Peak Day Load Profile



Peak Demand Forecast

The 2008 coincident peak demand of the Huachuca substation and V-7 feeder (Huachuca West serves only a single feeder) was approximately 4.9 MVa; when line losses are added, the total feeder peak load increased to about 6.9 MVa. Over the past 10 years the V-7 feeder peak has increased, on average, 2.5 percent annually (exclusive of line losses); about the same rate as the number of customers over the same period (approximately 1900 to 2400 between 1999 and 2008). Since a linear relationship exists between historic peak capacity and the number of customers, we used customer growth projections to forecast system load growth, as shown on Figure 15.

Figure 15: Historic Feeder Annual Peak Loads

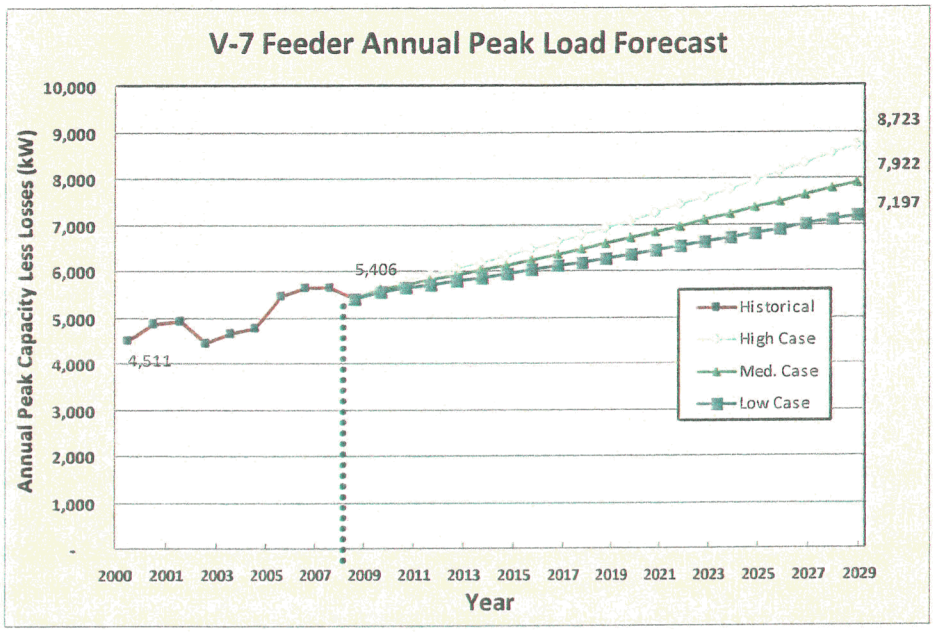


The V-7 feeder serves mostly residential and small commercial customers, with some agricultural load. The large amount of protected acreage, designated preserves and large ranching areas suggests the likelihood of additional major commercial or industrial load is low. Therefore, the customer mix by rate code, previously presented in Table 5 is not expected to vary significantly in the future. Feeder growth is likely to follow historical trends. The number of new customers added to V-7 can be used to reasonably predict increases in feeder peak loads.

County statistics from the Arizona Department of Commerce Population Statistics Unit project Santa Cruz County population growth, where mostV-7 feeder load is located, at a rate of roughly 1.8 percent over the next 20 years.[15] The increase in V-7 peak demand is expected to follow this growth pattern, but with slight adjustments to account for the rural nature of the feeder. Figure 16 illustrates the increase in peak demand for base, low and high forecasts (the base case forecast was increased to 2.0 percent to account for unknown increases and the potential for the peak load in any given year to be higher than average due to lower than normal temperatures).

[15] Arizona Department of Commerce 2006 Population Statistics projects Santa Cruz County will grow by ~1.8% from 2009-2029 (http://www.azcommerce.com/econinfo/demographics/Population%20Projections.html)

Figure 16: 20 -Year Peak Load Forecast



The high case scenario assumes the high population growth rate over the last eight years, roughly 2.5 percent per year from 2000-2008, will continue at the same rate through the next 20 years.[16] The low case forecast assumes that the growth rate will be proportionally lower (roughly 1.5 percent annual growth rate) from the base case. Using the linear relationship between customer and load growth based on historical trends and customer population projections, V-7 feeder peak load was forecast over the next 20 years as previously depicted in Figure 16.

Station Capacity

The existing 69/24.9kV Huachuca substation transformer has a nameplate rating of 7 MVa. The previous peak of over 6.9 MVa indicates virtually all available substation capacity has been used. Any significant additional load will exceed the nameplate rating of the device. Similarly, if power factors are below 1.0 per unit, the transformer will become overloaded for lower real power demand. However, utilities often adjust the rating of substation transformers based on

[16] Annual Customer Growth Rate from 2000 to 2008 for V7 Feeder= ~2.6% (see Figure 15)

ambient conditions and load patterns, and reasonable reduction of equipment life.[17] Because the V-7 feeder and Huachuca substation are winter peaking, the capacity of the transformer typically is higher than nameplate due to ambient cooling. This is in contrast to substations that peak in the summer, in which case maximum transformer loading is closer to nameplate.

NCI did not independently calculate the weather-adjusted transformer rating, but notes that other utilities often will apply rating above nameplate for devices experiencing short-duration, cold weather loading.[18] Notably, the 2008 V-7 summer peak was about 5800 kW, about 16 percent lower than the most recent winter peak of 6903 kW. Hence, an additional 1000kW of substation transformer capacity would be available at Huachuca substation if the winter rating is increased by at least 16 percent above the nameplate rating.

Projected Capacity Need

A comparison of historic and current load indicates that virtually no additional firm capacity is available from the V-7 feeder and Huachuca substation to serve future demand: the V-7 feeder appears to be the limiting element. The need for reinforcement is underscored by current feeder performance, which has very high losses, significant voltage swings, line conductor capacity, and power quality concerns. Accordingly, SSVEC should take immediate steps to ensure sufficient capacity is available to serve existing and new customers in the short and long-term. SSVEC should carefully review the impact any new load will have on feeder loading and performance to ensure voltage and loading standards are not exceeded or violated. An exception would be load that is proven to peak at times other than the current peak – these typically occur on cold winter mornings with a secondary peak during early evening hours.

The load forecast indicates about 2500 kW of new load will added to V-7 over the next 20 years *prior* to losses, an increase of about 40 percent. As noted, incremental line losses at peak are approximately 50 percent. Accordingly, supply alternatives that reduce total feeder load also reduce the percent losses on the V-7 feeder. Supply options that create a new source in Sonoita or other central locations of the feeder will cause losses to decline significantly due to the reduced loading on the primary section of line between the Huachuca substation and V-7 load

---

[17] IEEE, an industry group that develops guidelines and standards for electrical equipment, has published guidelines that enable electric utilities to determine the increase in transformer rating as a function of device pre-loading, ambient temperature and expected increase in loss of equipment life. Our experience indicates winter-peaking utilities often increase transformer ratings by 25 percent (or higher) for devices in good condition. In contrast, transformers known to have operational or design constraints often are limited to nameplate capacity ratings.
[18] The determination of acceptable transformer loading is utility and location-specific. The value typically is based a combination of several factors including average ambient temperature, transformer pre-loading, transformer design, condition, performance history (including number of high current through-faults), and acceptable loss of life.

centers. If total losses are brought down to more reasonable levels of 10 to 15 percent at peak, total capacity deficits will be about 1500kW in 10 years and 3500kW in 20 years.

Supply Alternatives

Potentially viable options for meeting current and future demand for the V-7 feeder are presented below. In the Assessment of Supply Alternatives section, a screening analysis identifies options among these alternatives deemed to be technically feasible, commercially available, and capable of meeting performance and capacity requirements for 20 years. Options that meet screening criteria are then analyzed in greater detail from a technical, economic and environmental perspective.

Twenty options covering four categories of demand and supply alternatives were considered as potential solutions. These are listed in Exhibit 2, with each option designated by a two to three character code to facilitate option reference and analyses. It includes transmission and distribution options previously evaluated by SSVEC (T1, T2, T4, T5 and D4). All other construction, DG, renewable energy and demand management options presented in Exhibit 2 and described below were prepared by NCI.[19]

Supply-side options include expanding or adding new line or substation capacity, whereas demand-side options include conservation and demand-side management (DSM). We also investigate the implications and viability of a status quo option, which assumes no additional station or feeder capacity; but relies, instead, on other mitigation measures to resolve reliability issues and free up capacity to meet future demand.

Distribution Options

Distribution options include line reinforcement and facilities operating at voltages 25kV and below; it assumes no new transmission lines or substations are installed. Reinforcement options include upgrading or modifying existing lines and facilities to mitigate performance problems and meet capacity requirements. The latter option is evaluated first among those considered.

Reinforce Existing System (D1)

This option assumes existing station and feeder capacity would be used to the extent possible to serve future load. It includes rebalancing of feeder and transformer load, improving feeder voltage regulation, reducing losses and maximizing utilization of available capacity. The reinforcement of the existing system may be combined with other supply and demand-side

[19] SSVEC previously opined on the applicable of renewable energy options, including solar; but NCI is not aware of any technical or economic analyses performed for these options.

alternatives as part of an overall solution. Further, it includes steps that can be taken to mitigate voltage regulation and power quality issues, including improved fault isolation and protection coordination.

Upgrade Existing Line (D2)

This option includes line upgrades that increase feeder capacity and improve voltage regulation by replacing conductor along main three-phase trunk lines and line taps. To the extent possible, existing poles would be re-used, with taller poles or new mid-span poles installed where needed to avoid clearance violations. It includes replacing 1/0 conductor with larger 477 aluminum conductor steel-reinforced (ACSR) wire along key three-phase line sections. Similar to reinforcement of the existing system, this option includes rebalancing, and improving voltage regulation and feeder reliability. The Huachuca West substation transformer also would need to be upgraded or replaced with a unit with a higher capacity rating (also applies to D3 below). It includes acquisition of new rights-of-way (ROW) along State Route (SR) 82 and Elgin Road where prescriptive rights prohibit SSVEC from materially upgrading existing lines.[20] Approximately 99.98 percent of the 23 miles of three-phase distribution lines are along ROW's where only prescriptive rights apply.

New Huachuca West Feeder (D3)

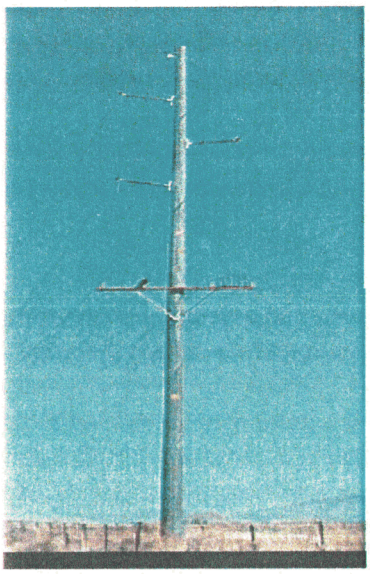
The addition of a new 24.9kV feeder fed from the Huachuca West substation would unload the V-7 feeder and potentially improve reliability and performance. It would require construction of a new feeder bay position at the Huachuca station and require the reconstruction of approximately 23 miles of the V-7 feeder along SR 82 and Elgin Road to operate as a double circuit line. The reconstruction would require the replacement of virtually all poles along SR 82 and the Elgin Road with poles approximately 10 to 15 feet taller than existing poles.

Figure 17 presents 69/25kV circuit construction, representative of Alternative D3. Double circuit 25kV construction would have a slightly lower profile and tighter spacing for the upper circuit. As noted above, several miles of line would require new easements as the existing line is constrained by prescriptive rights that allows SSVEC to replace existing equipment in kind (e.g., where deteriorated or damaged); but excludes upgrades for capacity or functionality.

---

[20] Prescriptive rights apply to electric facilities where ROW easements have not been obtained, but where the facilities have been in service for a sufficiently period of time such that the utility is allowed to continue to operate the line "as is." The utility can replace deteriorated facilities in kind, but cannot increase conductor size or functionality of the line.

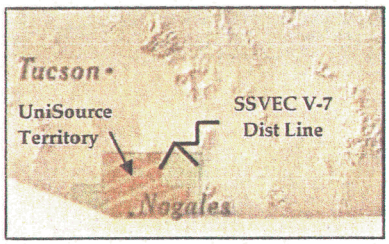
Figure 17: 69/25kV Circuit Construction



Foreign Interconnection (D4)

The segment of the V-7 line serving Patagonia extends to the western boundary of SSVEC's service territory. This segment of line also requires significant voltage boost using multiple regulators to maintain voltages within acceptable levels. Approximately two to three miles southwest along SR 82 is a 13.8 kV line owned and operated by UniSource Energy Services (UniSource). The UniSource line originates at the Valencia substation in Nogales, more than 17 miles from SSVEC's V-7 feeder serving Patagonia. If the UniSource line were extended to SSVEC's and has sufficient spare capacity at peak, it might be able to unload the Patagonia line spur to defer by several years the need to install new capacity to serve future V-7 load. The line extension would require a three-phase 13.8/24.9kV step-up transformer. Figure 13 illustrates the approximately location of the V-7 line relative to UniSource's service territory. A more detailed illustration of the location and length of the 13.8kV line extension appears in Attachment 1.

Figure 18: UniSource Electric Service Territory



Since a portion of the SSVEC load would be served by facilities owned by another utility, SSVEC would have to purchase power from UniSource, obtain transmission service from UniSource, or petition the ACC to transfer this segment of its service territory to UniSource. Further, if the latter applies, SSVEC's Board of Director's would need to approve the transfer.

Recently, SSVEC received formal notice from TEP that UES does not have sufficient capacity on the Valencia feeder to provide firm capacity on its system to serve SSVEC Patagonia load.

Static Var Compensation (D5)

Static Var Compensation (SVC) is a fast-response technology utilizing electronic controls to rapidly inject Vars into the power system to respond to reactive power deficits or voltage fluctuations caused by contingency events or rapidly changing loads; for example, those caused by the start-up of large generators on longer distribution lines. The technology also is installed on large power systems; but, smaller devices are available for application on distribution system. These devices do not provide capacity support (except in the case of network contingencies), but may be part of an overall solution, particularly if dynamic system support is needed in addition to capacity support. A typical distribution SVC is displayed in Figure 19.

Figure 19: Distribution Static VAR Compensator

Transmission Supply Options

There are several lines operating at four different voltages that cross paths with or supply the V-7 feeder:

(1) 69kV – SSVEC line that runs north-south and supplies the Huachuca substation.
(2) 46kV – Tucson Electric Power Company (TEP) line provides back-up power to Fort Huachuca Military Base.
(3) 115kV – Southwest Transmission Cooperative (SWTC) line supplies load in the Sierra Vista area.
(4) 138kV – TEP line supplies Fort Huachuca.

The capability of these lines to serve V-7 load and routing alternatives are described below. The location of each line is displayed and annotated Attachment 1.

69kV Transmission Supply (T1 & T2)

The use of 69kV transmission lines to provide a new source of supply is consistent with SSVEC's system planning and design practices – SSVEC's low-voltage transmission system is 69kV. The most appropriate location for a new 69kV substation from an electric perspective is near the physical and electric load center of the V-7 feeder. There are two vacant sites that SSVEC owns that meet this criterion; both are located within Sonoita: SSVEC refers to these as the Buchanan and Sonoita sites. Each of these sites appears in Attachment 1.

All 69kV options would originate from an existing 69kV line that serves the Huachuca substation and substations south of Huachuca. This line travels north-south and is located over 20 miles from either the Buchanan or Sonoita sites. All 69kV options are radial only, as there appears to be no basis for creating a looped or networked configuration for load located at the far western end of SSVEC's service territory, nor are there any 69kV lines that would provide a suitable source for a 69kV looped system.

From an electric standpoint, all 69kV options provide the same level of capacity and performance benefits, as the minor difference in line-miles for each options has virtually no impact on performance. Four variations of the T1 69kV Supply option are considered, the primary differences are the routing of transmission through Sonoita Hills subdivision: T1-A routing is along existing rights-of-way running parallel to the Bronco Trail Road and adjacent to the Buchanan site. T1-B assumes the line is routed along the high ridge on the eastern segment of Sonoita Hills. T1-C assumes the line is routed along SR 83. T1-D assumes the line is routed south down Papago Springs Road and west of the Buchanan site. The evaluation of 69kV alternatives focuses primarily on cost and environmental factors, as each offers near identical technical performance and reliability.

115/138kV Supply Options (T3)

There are parallel 115kV and 138kV transmission line that traverse the V-7 feeder and the Ranch that could be used to supply portions of or all load on the V-7 feeder. A new 138/25kV or 115/25kV substation could be built below the V-7 intersection along SR 82 near Whetstone, but the line is too close to the Huachuca substation to provide any meaningful support (most of the feeder is located west of the intersection). A dedicated 25kV line that would operate in parallel to the existing 24.9kV line along SR 82 and/or Elgin Road would be needed to unload the V-7 feeder.

Alternate options could include new 115kV or 138kV substations that cross the Ranch along SSVEC's existing easement. A new 69kV line would then be constructed along the easement, following the same corridor previously proposed for the Sonoita 69kV line. A new 69/25kV substation also would be needed, either at the Buchanon or Sonoita site. This option would reduce the length of new 69kV transmission along the Ranch easement by about 8-10 miles. Variations of the southern option include constructing a new 138/115/24.9kV or 138/115/69kV substation along the northern Ranch boundary. SSVEC does not have an easement along the northern border of the Ranch.

46kV Transmission Supply (T4)

TEP owns a 54-mile radial transmission line that provides back-up power to the Fort Huachuca Military base. The line diagonally traverses the V-7 feeder and Ranch (see Attachment 1). If firm transmission capacity is available and TEP agrees to provide transmission service to SSVEC[21], a new substation would be located at the intersection of the 46kV line and V-7 feeder along Elgin Road. Because a new substation would cost well over one million dollars, TEP would need to agree to provide firm capacity for at least five to 10 years to avoid a stranding of the investment – SSVEC does not own or operate any 46kV equipment; hence substation equipment would be "one-of-a-kind" and could not be used elsewhere on its system. Further, SSVEC would need to purchase spares or arrange for back-up of any equipment operating at 46kV. The intersection of TEP's 46kV line and SSVEC's V-7 feeder on the Elgin Road - where the new substation would be constructed is shown in Figure 20.

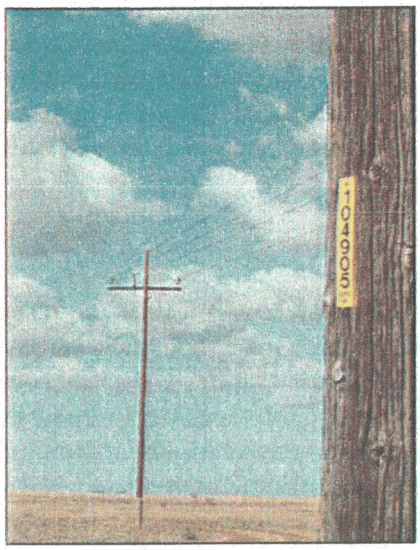
The 46kV line owned by TEP appears reasonably well-maintained; however, NCI did not review any TEP records or inspect the entire length of the line. Such a review would be recommended if SSVEC were to enter into a transmission service agreement with TEP.

---

[21] A minimum of 3 MW of firm capacity would be needed to unload the V-7 feeder to acceptable levels.

However, TEP recently notified SSVEC that it is unable to provide firm transmission capacity to serve SSVEC load.[22]

Figure 20: TEP 46kV Transmission Line



Underground Transmission (T5)

Underground transmission is an option that applies to any of the transmission and distribution alternatives cited above. The primary advantage of underground transmission is improved aesthetics. However, there are significant trade-offs with underground transmission: first, it is far more costly, with a cost ratio of between five and ten to one versus conventional overhead construction; second, significant excavation and trenching is needed to accommodate concrete encased duct bank systems; third, the life of underground cables generally is lower than overhead lines, and once the cables are determined to be unreliable or obsolete, the cost of replacement is extremely high compared to overhead lines. Because of the much higher cost, utilities usually will install underground transmission lines only in urban areas where overhead construction is impractical or where ROWs are unable to accommodate overhead lines.

---

[22] Previously, SSVEC formally submitted a request to TEP to determine the availability of firm transmission service. While awaiting TEP's response, NCI investigated the viability of a new 46/24.9kV substation to serve V-7 feeder load. TEP responded late in our study that firm transmission capacity was unavailable. TEP also indicated in its response that it was precluded from providing service as it would violate TEP's two county bonding authority.

Demand Side Management & Incentive Rates

Demand side management includes energy efficiency, demand reduction and other measures designed to reduce load in lieu of construction of new facilities to meet capacity requirements. Historically, DSM benefits are at the power supply level and usually are not relied upon to defer construction of transmission and distribution facilities. However, a few utilities have begun to develop programs designed to defer the construction of new transmission and distribution (T&D) facilities.[23]

Targeted DSM (DS1)

An energy efficiency and distributed resource program targeted to customers located on the V-7 feeder has the potential to defer capacity upgrades if the level of firm demand reduction is coincident with the feeder peak load intervals, is sustainable over time and customers are willing to participate in the program. Customer participation typically is a function of the level of incentives provided versus the inconvenience of participation or disinterest. Our experience with similar programs indicates customer willingness to participate is perhaps the greatest challenge. The level of participation declines as the perceived cost or value of the program is diminished, or where customers are inconvenienced by program measures.

Storage Electric Heating (DS2)

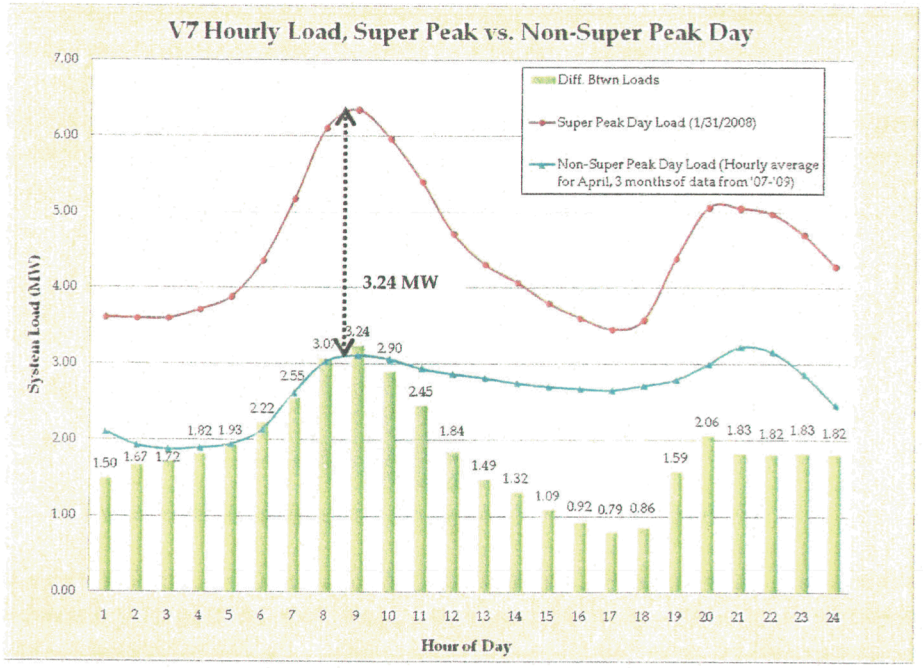
Utilities for several years have marketed electric storage heating devices to reduce peak demand and energy consumption during the highest cost hours. The operating mode of these devices is straightforward. Electric storage heaters contain high density bricks or ceramics that thermally store electric heat produced during off-peak, low-cost hours. A time of use meter or timer sends a signal to the storage heating devices to ensure devices do not charge during the peak cost hours. The thermal stored energy is discharged during high cost hours via use of small internal fans that circulate and heat ambient air through small opening in the bricks to vents located on the front of the heating enclosure. Customers achieve savings by charging the heaters only during low cost hours.

---

[23] For example, Consolidated Edison Company of New York recently implemented a Targeted DSM program designed to defer transmission, distribution and substation facilities. The program has been in place since 2004 and has successfully deferred some faculties. A premium is paid to contractors and customers to implement DSM measures in areas where T&D upgrades are proposed in the short –term; above payments made for DSM in areas of the system not subject to T&D constraints. Distributed generation qualifies for the program, but none have been installed due to timing considerations, physical assurance requirements and cost.

The amount of existing electric heating load can be estimated by comparing daily load profiles for peak winter days to non-heating days – the difference is likely due to electric heating load, with some additional peak loading created by lighting, small motor and pumping load. Figure 21 illustrates this differential, which indicates incremental loads of about 3 MW on peak load days. A portion of this load likely is eligible for conversion to storage systems.[24]

Figure 21: Peak and Off-Peak Daily Load Profile



Incentive Rate Options (DS3)

Incentive rates encourage customers to use less energy during peak cost hours or change usage patterns by shifting electric usage from high cost to low cost hours. A time-of-use (TOU) rate is established and marketed by utilities to most, if not all customer classes. The electric storage heating options described above is one form of an incentive rate option. For options that do not control usage, the price differential between the on and off peak hours must be sufficiently high to motivate customers to *significantly* reduce usage during peak hours to defer V-7 system upgrades. Currently, SSVEC offers a TOU rate with an on peak rate of about 14 cents and on off-peak rate of about 7 cents per kilowatt-hour.

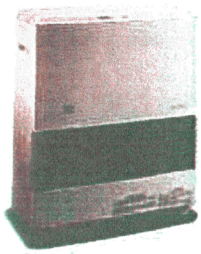
---

[24] Customer appliance survey data is not available to identify the number of space electric heating units.

Space Heating/Fuel Switching (DS4)

The highest electric demands on the V-7 feeder occur in morning and early evening hours on the coldest winter days. Figure 14, which is provided above, presents normalized daily load shapes on the 20 days with the highest daily peak demand over the past three years. These shapes strongly suggest the peaks are driven by electric space heating. The difference in load between non-heating days strongly suggests the higher load is due to electric space heating demand. The large percentage of residential and small commercial customers (over 80 percent) served by V-7) yields average coincident heating load of 2 to 3 kW per customer. An aggressive conversion of electric heating system to propane or kerosene could reduce load during the hours of highest demand.[25] A typical direct venting modular heating unit appears in Figure 22.

Figure 22: Modular Space Heating Unit



Monitor GF 1800 Modular Propane Heating System (11,000 to 16,000 BTU)

For the program to be successful, significant conversion of existing systems would be needed over the short-term; strong incentives and an aggressive marketing campaign would be needed to reduce demand in amounts sufficient to defer system upgrades. Assuming an average of 2 kW of coincident demand and a reduction in 200kW is needed to avoid feeder overloads, about 100 customers would need to participate in the first year for this option to be viable. Each successive year would require 50 to 75 participants to offset load growth. Program costs include incentives designed to offset the cost of modular heating systems and dismantling of electric heating controls. The program could be structured similar to the targeted DSM programs described above, which includes incentives based on the value of T&D deferrals.

---

[25] A gas pipeline passes through Sonoita, but does not supply local distribution company (LDC) loads. NCI did not investigate use of natural gas as an alternative fuel due to the long distances needed to reach sparse, rural customers located among the many miles of line along V-7. Also, heat pump systems could be viable, but not analyzed in detail due to the higher cost of piping and venting systems. Such systems likely would be suitable for customers who are willing or able to accommodate heat pumps.

Composite DSM/Demand Management (D5)

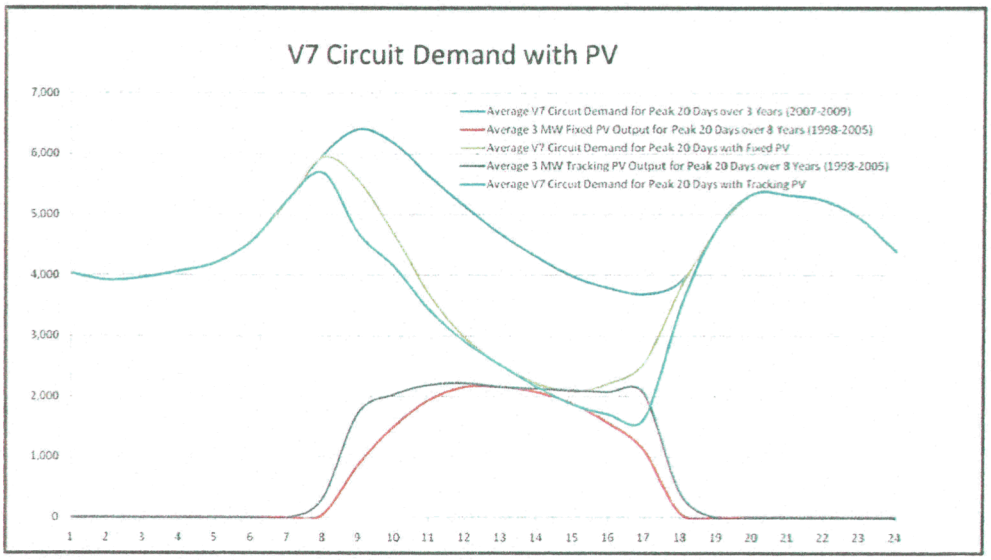
This option includes combinations of the above four alternatives, as the contribution of any single option would likely be insufficient to meet capacity deficits. For example, the amount of lighting demand may be too small to have a major impact on demand, but nonetheless may be cost-effective. When energy efficiency is combined with incentive rates and fuel conversions, there may be greater amounts of capacity reduction, and in sufficient quantities to defer capacity need dates.

Distributed Resources and Renewable Energy

Solar Photovoltaic (R1)

The high solar insolation levels in southern Arizona suggest photovoltaic (PV) could be a suitable alternative, particularly in areas where peaks occur during the hours of maximum PV output; that is, mid-day. As noted, the V-7 feeder peaks during morning and early evening hours. Figure 23 presents PV output profiles for fixed and rotating axis PV systems. There is minimal coincidence with fixed axis systems, but rotating axis' show higher coincidence.

Figure 23: PV Peak Day Output Profile



Eligible PV systems include rooftop and central system arrays. Because most residential rooftop systems can only accommodate fixed axis systems, central systems are likely the only feasible alternative (such systems could be customer or utility-owned). A typical 200kW PV central array is presented in Figure 24.

Figure 24: Photovoltaic (Utility Scale)

Source: Trigen web site[26]
Concentrated Solar Power (R2)

Similar to PV, the high solar insolation levels in southern Arizona suggests another promising renewable technology, Concentrated Solar Power (CSP), might be a suitable alternative to improve V-7 performance and meet capacity deficits. Concentrated Solar Power systems have been constructed in other parts of the southwest and California. One of the advantages of CSP versus PV is the ability to store thermal heat accumulated in non-peaks hours and then release the thermal energy to generate electricity when needed; e.g., to reduce peak loads. Typically, high density molten salt is used to store the thermal energy. The thermal discharge duration also is sufficiently long (several hours) to reduce feeder or substation demand during peak and shoulder hours, or when clouds intermittently appear and reduce thermal charging, a key advantage over PV systems which has no storage capability.

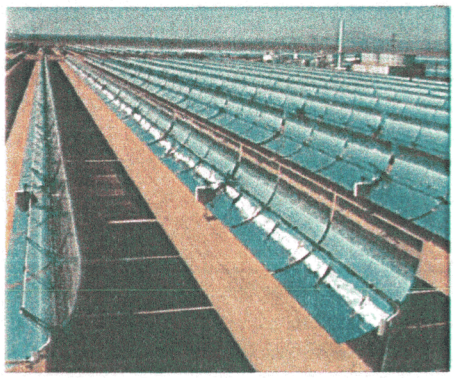
There are four basic CSP technologies: Parabolic Trough, Power Tower, Solar Dish and the Linear/Fresnel Lens. The Parabolic Trough is the most advanced CSP technology and the only one with commercial deployment. It is technically viable, and field performance has been proven. However, trough systems require extremely flat land (less than one percent slope). It is difficult to maintain this over a large area. Typical land requirements are five to ten acres per MW.

Figure 25 illustrates parabolic trough technology.

---

[26] IKEA AFG Arena, St. Gallen (Switzerland); Installed power 202.4 kWp.

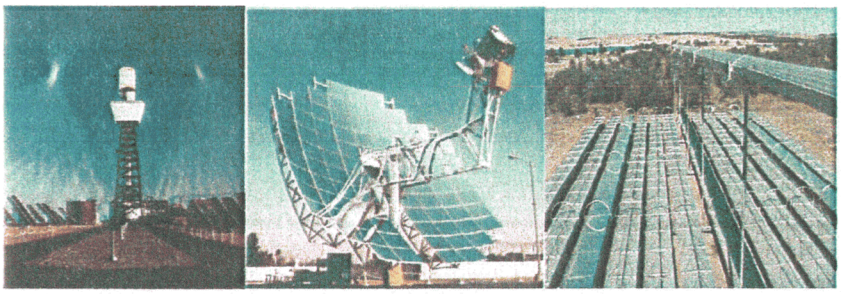
Figure 25: Parabolic Trough



The other three CSP technologies are not commercially proven and are at the demonstration stage (see Figure 26). However, these technologies do have advantages and disadvantages when compared with trough systems.

Figure 26: CSP Technologies

Power Tower **Solar Dish** **Linear/Fresnel Lens**



The Power Tower system also requires extremely flat land (less than one percent slope) and large water intake. The two axis tracking for heliostats requires more complex controls than the trough's single axis system. However, higher temperature working fluid (~1000°F) than trough and Dish engines allows for higher efficiencies. Large plant sizes can allow for economies of scale to reduce costs; however, this is not as feasible for Dish engine systems.

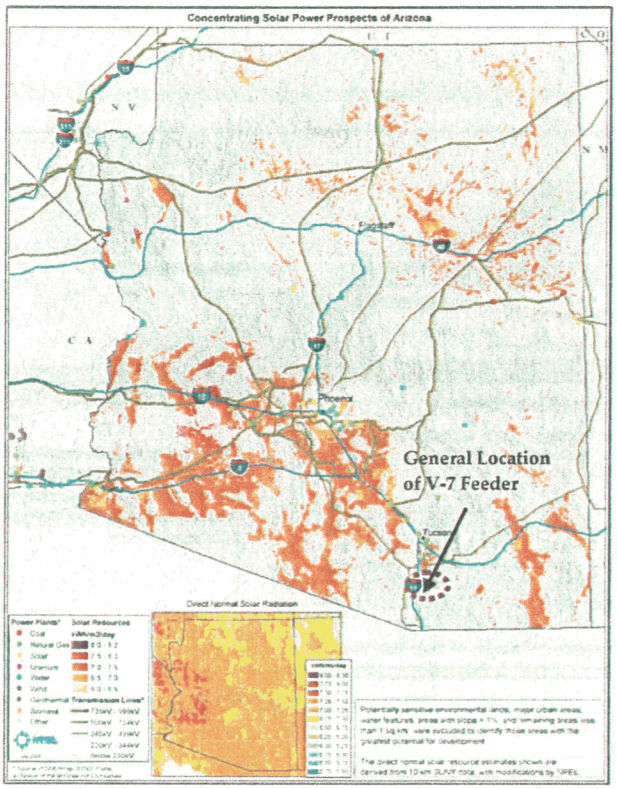
The Solar Dish system does not require extremely flat land and no water is required. However, it also requires a two axis tracking requires more complex controls than trough's single axis system. Initial capital costs are estimated at $6,000/kW. This is significantly higher than trough systems. Table 6 provides a technology summary for CSP systems.

Table 6: CSP Technology Summary

Issue	Parabolic Trough	Solar Dish	Power Tower	Linear Fresnel Concentrator
Technology Maturity	Market Entry	Demonstration	Demonstration	Demonstration
Current U.S. Commercial Deployment	419 MW	0 MW	0 MW	0 MW
Projects in U.S. Pipeline	Abengoa is developing a 280 MW plant with molten salt storage	Stirling Energy Systems is developing 1750 MW in So. Cal.	BrightSource has PPA's with PG&E & SCE	Ausra is developing a 177 MW plant in California
Driving Technology Issue	Molten salt storage has just gone commercial	Minimal performance data	Performance data and storage	Performance data and storage
Learning Curve Driver	Plant scale Installed base	Manufacturing scale up	Plant scale Installed base	Plant scale Installed base
Driving Economic Issue	LCOE higher than competing renewable and traditional technologies	Lack of commercial deployment	Lack of commercial deployment	Lack of commercial deployment

The National Renewable Energy Laboratories (NREL) have produced maps where central CSP is most desirable; that is, where average sloping is less than one percent. Figure 27 highlights the areas in Arizona where sloping can best accommodate central CSP. Notably, it appears to exclude most of the service territory fed by the V-7 feeder. A similar NREL map for areas with slopes of three percent or less show a slight increase within the service territory served by V-7 that is suitable for central CSP. There also may be local areas with favorable sloping that could accommodate smaller CSP; however, the smaller systems are less cost effective, both due to loss of economy of scale and the need to interconnect remote load via new distribution lines.

Figure 27: CSP Potential (Arizona)



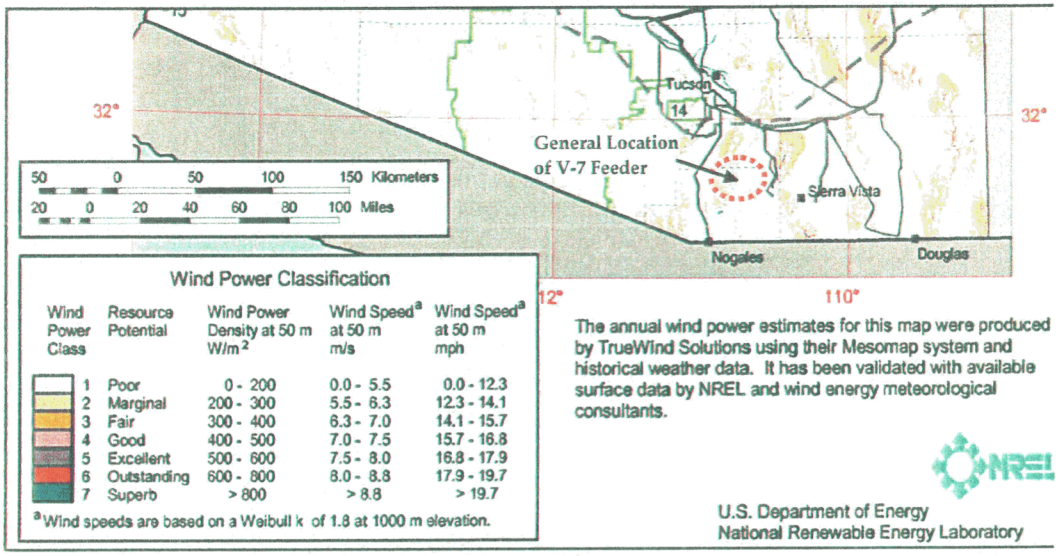
Wind Generation (R3)

Wind generation has grown considerably in areas of the U.S and worldwide with high average wind speeds and land suitable for siting wind towers. In West Texas alone, over 3000 MW of wind generation has been installed. Several large wind farms have operated for over a decade in California. Many large wind farms have been proposed in regions with high average wind profiles along coastal and mountainous regions in the eastern U.S.

As shown on Figure 28, the average wind profile for southern Arizona generally is on the lower end of the wind power classification scale, with ratings of mostly 1 and 2. Most of the V-7 feeder is located in a Class 1 area, which is defined as having poor wind resource potential. There may be pockets where local wind profiles may be higher grade, but likely insufficient to provide significant wind potential. Further, most wind projects are assigned minimal or no firm capacity credits due to the highly intermittent nature of wind – a brief drop-off in wind speed can cause unit shut-down or reduced output, with resultant loss of

feeder capacity. Accordingly, NCI did not further analyze the capability of wind to reduce V-7 feeder loadings to meet current and future capacity requirements.

Figure 28: Southern Arizona Average Wind Profile



Web Source: http://www.windpoweringamerica.gov/pdfs/wind_maps/az_50m.pdf

Energy Storage (R4)

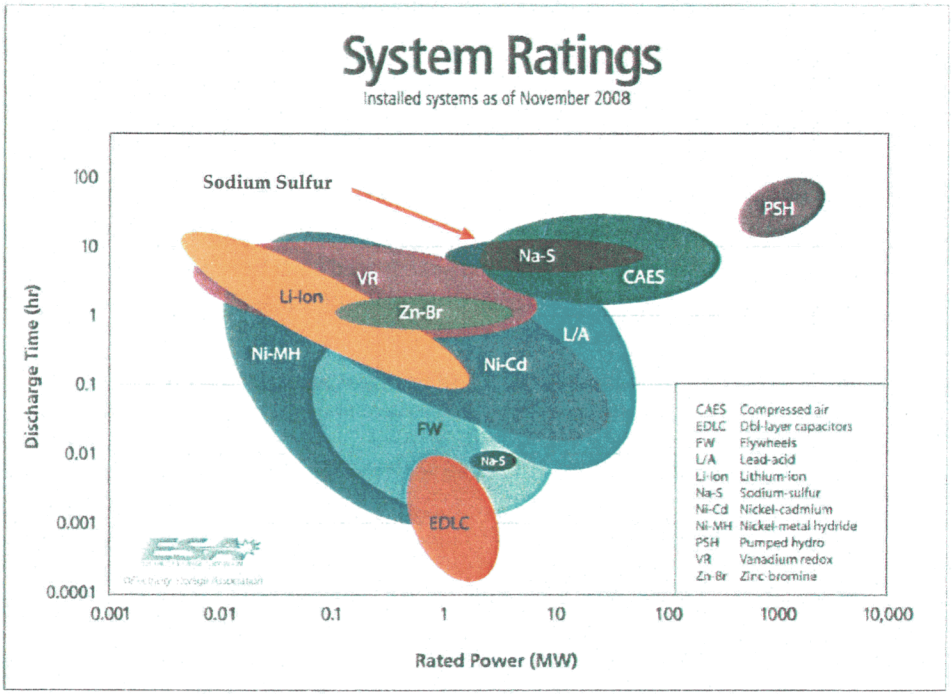
Electric energy storage systems have the potential to reduce feeder peak load by charging and storing electric energy during off-peak hours when load are low; and then discharging the device during high load, on-peak hours. Although various forms of battery storage systems have been commercially available for many years, energy storage systems of sufficient size, capability and cost for electric utility applications have only recently started to appear on utility grids; and *many of these have been pilot or demonstration projects.*[27]

Advances in battery technology have led to lower cost, more reliability and higher density battery systems suitable for utility applications, ranging from flywheel systems for fast

[27] Utilities for many decades have employed hydro-electric storage systems, commonly referred to as pumped storage hydro, to store energy via elevated ponds when energy production costs are low, and then discharging the water through hydroelectric turbine-generators during the day when prices are much higher. Most pumped storage systems are very large and designed to support the interconnected electric power grid. Pumped storage hydro is not deemed to be an option for V-7 feeder loading mitigation due to the absence of a suitable site, environmental impacts and very high cost.

response load following that can store energy for up to 15 minutes to sodium sulfur systems (NaS) that can provide continuous output for up to four (or more) hours. Lead acid (PbA) battery technology is proven, but requires frequent replacement if used for daily cycling. Lithium Ion battery systems (the technology used in cell phones, IPod's and computers) show significant promise, but are still in the pilot phase for utility application. Further, discharge durations are typically about one hour, too short to provide meaningful demand reduction. A summary of battery discharge duration interval and capacity ratings is displayed in Figure 29.

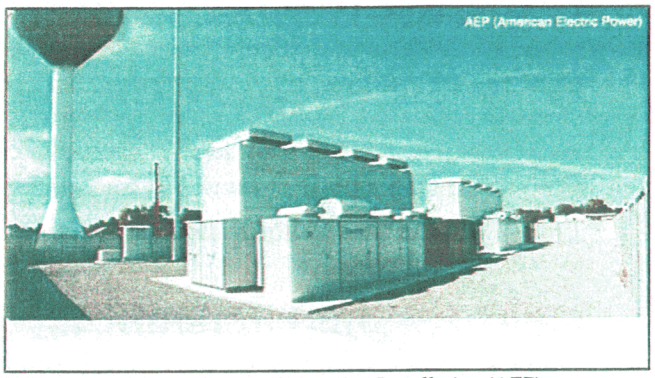
Figure 29: Energy Storage Device Attributes



Source: Energy Storage Association Web Site

Of the technologies considered, sodium sulfur appears best suited for meeting V-7 capacity needs, as the storage capacity and discharge hours conform to feeder peak load intervals. Sodium sulfur batteries have been used domestically to support or defer distribution upgrades at a cost of about $3000/kW. American Electric Power (AEP) is among the leaders in the U.S. in applying NaS to T&D systems. Utilities in Japan have successfully applied NaS systems for several years, with over 50 installations. A typical substation application appears in Figure 30. Notably, NaS battery availability currently is limited due to a high order back-log (up to one year or longer)

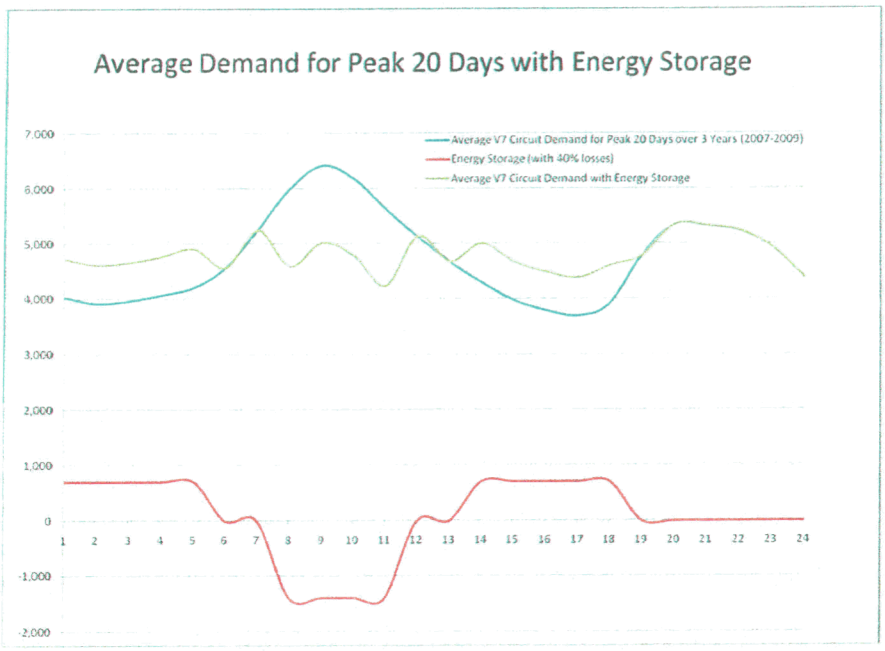
Figure 30: NaS Energy Storage System (2 MW)



Source: *NGK Insulators, Ltd*, Reference Substation Installation (AEP)

The cost of energy storage is relatively high at $3000/kW. Further, the charge and discharge profiles of energy storage devices will need to be carefully managed by automated control and communication systems that will operate these devices based on demand thresholds and devices attributes. Figure 31 illustrates a typical charge/discharge profile for the 20 days with the highest peak demand over the past three years.

Figure 31: 1000 kW NaS Energy Storage Output Profile

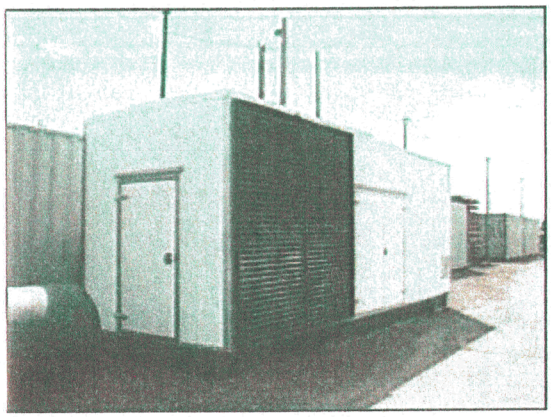


Distributed Generation (R5)

Distributed generation connected to the V-7 feeder would reduce effective loads during those hours in which it operates. The number of operating hours would be limited to the highest load hours or when it might be needed to meet feeder peak demands or stabilize voltages. Operation in a stand-alone, islanded mode is not considered, although SSVEC could consider the merits of stand-alone operation in the event of a loss of source supply from the Huachuca substation.[28]

The generator set-up would include multiple trailer or ground mounted diesel units burning low-sulfur distillate oil, or natural gas depending on the availability of local gas supply.[29] The preferred location would be the Sonoita substation site. This site is desirable for locating DG – for the same reasons as a new 69/25kV Substation - as it is centrally located (from an electrical standpoint), within a mixed light industrial/commercial area, easily screened, and on land that SSVEC currently owns. The units could readily interconnect to three-phase V-7 distribution lines located adjacent to or close to the site. A padmount transformer rated 1500 to 2500 kilovolt amperes (kVa) would be needed to step up the 480 volt output to the 24,900 volt V-7 feeder.

Figure 32: Typical 1000kW Diesel Generator



Description: Cummins 1000 kW Diesel Generator, 1503.6 Amp @ 277/480 Volt, Three Phase, 60 Hz

---

[28] A stand-alone operating mode, separated from the power grid, is sometimes referred to as a Microgrid. However, operating as microgrid mode would require further study to assess feeder protection and coordination, and methods for isolating loads that otherwise could not be served by DG due to generating capability limits; that is, when load is greater than the rating of the generator.

[29] The generator would also have to meet EPA emission standards, which suppliers acknowledge in product specifications.

A fuel tank sized to hold 5000 to 10000 gallons would also be needed, with an impermeable berm or oil retention facilities capable of holding the full contents in the event of a spill. Up to four units rated 500kW each would be installed at the Sonoita site. Generator redundancy is *essential*, as it provides operating flexibility and ensures sufficient firm capacity is available in the event one of the units is out of service or does not start when called upon. Each unit would be equipped with sound enclosures to minimize disruption to nearby customers.

The technical potential of customer-owned DG, other than PV and small back-up systems (e.g., portable emergency generators), is limited. Most V-7 customers are residential and small commercial, and unlikely to install DG in amounts sufficient to reliably reduce feeder demand. Utilities that have promoted customer-owned DG to defer distribution upgrades have seen minimal acceptance and very few installations. Among other reasons, programs introduced in the U.S. have seen limited success due to a physical assurance requirement adopted by electric utilities.[30] Table 7 provides cost estimates for DG options.

Table 7: Cost Estimate – DG Options

	Cost (2009 $Million)				
Unit Type	2-500 kW Units ($000)	Site Costs ($000)	Interconnection ($000)	Total Cost ($000)	Total Cost ($/kW)
Diesel	$400	$100	$100	$600	$600
Natural Gas	$500	$100*	$100	$700	$700

* Includes cost of fencing, screening, enclosures, and oil retention facilities

[30] Physical assurance is a requirement that customers that own generation guarantee the generators will operate when needed, and agree to allow the utility to interrupt an equal amount of customer load in the event the generator is not started or unable to operate.

NAVIGANT
CONSULTING

Exhibit 2

Supply Alternatives

Category	Alternative Description
Distribution	
D1: Reinforce Existing System	Optimize capacity and performance of existing system via load balancing, voltage regulation, power factor correction
D2: Reconductor 25kV Line (4/O to 795 ACSR)	Replace about 25 miles of conductor along SR 82 and Elgin Road from Huachuca substation to Sonoita
D3: Install New 25kV Feeder from Huachuca: Split V-7	Construct 25 miles of double circuit 25kV distribution along SR 82 and Elgin Road from Huachuca substation to Sonoita
D4: Create Tie to Foreign Source (13.8kV)	Extend UniSource 13.8kV line to Patagonia; install 13.8/24.9kV step up transformer and transfer about 1 MW of load
D5: Distribution Static Var Compensation	Install distribution class SVC at a location to be determined to improve voltage stability and power quality
Transmission	
T1: New 69kV line & Sonoita Substation on Ranch ROW	Original SSVEC proposal. Tap 69kV SSVEC transmission line south of Whetstone; construction about 25 miles of new 69kV along southern border
T2: New 69kV line & Sonoita Substation on SR 82 ROW	Construct 25 miles of double circuit 69kV transmission & 25kV distribution along SR 82 and Elgin Rd from Huachuca to Sonoita
T3: Tap 138 or 115kV Transmission Lines	Install new 138/69kV substation where 138kV line crosses Ranch border and a new 69/25kV sub in Sonoita; construct 15 miles of 69kV on southern border.
T4: TEP 46kV Transmission Supply	Tap TEP 46kV lines and construct new 46/25kV substation along Routes 82 east of Sonoita
T5: Underground Transmission Cable	Consider constructing underground transmission cable for T1 through T3 alternatives
Demand-Side Management	
DS1: Targeted DSM	Aggressively pursue energy efficiency and load management alternatives for residential, commercial and industrial customers served by the V-7 feeder
DS2: Electric Storage Heating	Aggressively pursue conversion of existing electric space heating for residential and commercial customers served by the V-7 feeder
DS3: Incentive Rate Option	Adopt time-of-use pricing to incentivize customers to reduce or shift peak demand usage to off-peak hours
DS4: Space Heating/Fuel Switching	Develop program to convert existing electric space heating systems for residential and commercial customer to alternate fuels
DS5: Combination of above	Combinations of Alternatives DS1 through DS4
Renewables & DG	
R1: Solar Photovoltaic	Promote programs to install PV on rooftops and ground-based systems for customers served by V-7; includes large utility-owned PV
R2: Concentrated Solar Power (CSP)	Develop single or distributed CSP systems on suitable sites near the V-7 primary lines; includes ground-based and distributed CSP
R3: Wind Generation	Develop utility-owned or third-party wind farm on suitable sites near the V-7 primary lines
R4: Energy Storage	Develop utility-owned or third-party energy storage systems; most likely at Sonoita substation site
R5: Distributed Generation	Install utility-owned diesel or natural gas DG; most likely at Sonoita substation site

Assessment of Supply Alternatives

Evaluation Methodology

In the following section, a screening analysis identifies options among the above alternatives deemed to be *technically* feasible. Options that meet screening criteria were then analyzed in greater detail from a technical, economic and environmental perspective.

Alternatives considered for meeting long-term electrical demand include demand and supply-side options. Supply-side options include expanding or adding new line or substation capacity, whereas demand-side options include conservation and DSM. We also investigated the implications and viability of a status quo option, which assumes no additional station or feeder capacity; but relies, instead, on other mitigation measures to resolve reliability issues and free up capacity to meet future demand.

NCI performed life-cycle economic analyses of the alternatives using economic and financial data commonly used by electric cooperatives. Alternative supply options considered include upgraded distribution lines, new transmission line and substations, renewable energy, fossil-fuel generation, and targeted DSM. Each alternative and resulting business case was assessed using an evaluation framework comparable with other capital projects. This approach ensures project ranking and evaluation factors were applied consistently among alternatives. In particular, the ability of each option to meet minimum criteria with regard to level of "firm, reliable" capacity over time was a key factor in the evaluation of alternatives; DSM and renewable options should provide the same degree of firm capability as T&D supply so as not to favor one concept over others.

Screening Criterion

A screening analysis was performed to limit more detailed evaluation and feasibility analyses to options that are viable from a technical and economic perspective. The following criterion was applied to identify options that are deemed to be potentially viable solutions.

- All solutions should be able to meet capacity and performance requirements over a 20-year study horizon. Key performance requirements include primary voltages no greater than 126 volts and no less than 114 volts. Solutions also should not exceed continuous normal or allowable equipment overloads. The lower voltage threshold assumes transformer taps can be set maintain service level voltages to 114 volts.

- Any individual component or program where several measures are considered should be able to meet capacity needs for at least five years; for example, DSM options should be able to defer capacity upgrades for at least three to five years (to provide sufficient time to implement other solutions – i.e., a hybrid option - before capacity shortages occur).
- All solutions that include installation of physical assets should have a minimum life of 20 years; this criterion does not apply to options where normal replacement of parts or other equipment is less than 20 years.
- All solutions must utilize technology that is commonly available and deemed to be mature; that is, the technology has advanced beyond the pilot or demonstration phase.
- All DG and renewable energy solutions should be able to meet capacity and performance requirements without exceeding feeder loads as measured at the Huachuca substation. Generally, this means the total rated *output* of these options should not exceed load at any hour of the days. It excludes options where output production can be adjusted via local or remote controls.
- All solutions should have the same level of effective firm capacity as conventional feeder expansion or upgrade options. Generally, the net availability should exceed 99.9 percent.
- Fossil fuel options cannot exceed or violate state of federal emission standards, where applicable.
- All solutions must have a reasonable likelihood of receiving regulatory approval, with sufficient economic justification to support the option.
- Options that have essentially the same or lower performance and environmental impacts than other similar alternatives, but at considerably higher cost will be excluded.

Alternatives that did not meet one or more of the above criterion are listed below, along with the reasons or rationale applied to eliminate the option from further considerations.

(1) Distribution

- Reinforce Existing System (D1) – The existing system has performance problems and capacity needs that cannot be solved by relatively minor upgrades and adjustments to the existing system. The capacity limits of the existing V-7 feeder will not materially increase with minor load balancing. Further, substation transformer capacity is near or at nameplate ratings and will need to be upgraded.
- Reconductor V-7 Line (D2) – The minor reduction in line impedance achieved by reconductoring (mostly reduced line resistance as opposed to reactance), does not

materially improve voltage performance, nor does it provide an measurable increase in capacity. Also, substation transformer capacity is near or at nameplate ratings and will need to be upgraded. The cost and time needed to obtain easement rights also presents major challenges.

» Static Var Compensation (D5) – The performance problems on the V-7 feeder are not likely to be corrected by SVC, which can stabilize voltages and sags caused by large motor starts or reactive power deficits, neither of which are predominant issues on V-7. Also, SVC provides no measurable capacity support.

(2) Transmission

» 138/115kV Transmission Supply Option (T3) – While technically feasible, the cost of higher voltage transmission tap is not justified given the amount of load served, and the need to use rights-of-way proposed for 69kV options or acquire new rights-of-way.

» TEP 46kV Supply (T4) – Preliminary power flow studies indicate that the line could not serve V-7 load while supplying the entire Fort Huachuca load due to low voltages along the line (some of which were as low as 0.80 per unit). The cost of up to 54 miles of 46kV upgrade likely would be twice the cost of other feasible options.

» Underground Transmission (T5) – While technically feasible, undergrounding the proposed 69-kV transmission line would likely cost $40 to $50 million (or greater), well above those of other options. Similar construction in rural areas generally is undertaken by utilities, as regulatory agencies generally will not approve much higher cost options absent strong justification and potential for setting precedents that other customers would likely ask for as well. Such justification does not appear to exist for this project.

(3) Demand Side Management and Incentive Rates

» Targeted DSM (DS1) – While aggressive DSM may be cost-effective and provide benefits independent of area capacity needs, even large increases above current programs levels is insufficient to materially defer the date for additional feeder and station capacity. Because the additional amount of DSM that could be achieved is uncertain, at best, it is not advisable to defer new capacity for the one of few years the need date could be extended.

» Incentive Rates (DS3) – Incentive rates, regardless of the rate differential, is very unlikely to have a measurable impact on peak usage. Industry studies indicate on versus off-peak ratio of two and three to one have a very minor impact on customer electric usage. SSVEC's current TOU rates, which have a two to one price differential has limited interest and participation for customers served by the V-7 feeder.

However, incentive rates would be used for electric storage heating options that passed the screening process.

(4) Renewable Generation and Distributed Generation

- Photovoltaic (R1) – Both rooftop-mounted and ground-based PV is insufficient to defer capacity due to the limited amount of firm capacity coincident with the early morning peaks. At minimum, five to six MW's would be needed to provide sufficient offsets under favorable conditions. However, the intermittent nature of PV does not match other supply options from a firm capacity standpoint. Further, the amount of PV operating at full output may exceed actual feeder loads, thereby violating screening criterion.
- Concentrated Solar Power (R2) – The absence of suitable flat sites for parabolic trough CSP and the high cost of these devices (coupled with high cost of remote and multiple interconnections) exclude CSP from further consideration. Further, most CSP is large – greater than 10MW – and would not be suitable for a distribution feeder. Other promising CSP technology that less slope dependent may be viable once they have achieved commercial status; however, all other technologies are still at the pilot or demonstration phase.
- Wind (R3) – Wind profile data for southeastern Arizona suggests wind generation opportunities are very limited, with insufficient firm capacity (near zero) to meet capacity deficits. Among other concerns, the highly intermittent nature of wind does not match other supply options from a firm capacity standpoint. Further, the amount of PV operating at full output may exceed actual feeder loads, thereby violating screening criterion.
- Energy Storage (R4) – The limited number of installations beyond the demonstration or pilot phase, and the few suppliers of sodium sulfur energy storage systems preclude this option as a commercially available, mature technology.

The screening analysis identified the following alternatives as potentially viable solutions. Each is analyzed in detail in the technical, economic and environmental assessment sections that follow.

- New 69kV supply (Sonoita & Buchanan substations, and double circuit) – T1 & T2.
- Fuel switching (Electric storage or fuel conversion) – DS2 & DS4.
- Fossil-fuel distributed generation – R5.

Although the foreign attachment alternative (UniSource 13.8kV/25kV tie) would be viable if studies indicated there was sufficient capacity and voltages were within limits; however, TEP

notified SSVEC in a letter dated December 22, 2009 that it could not serve SSVEC load from the 13.8kV feeder originating in Nogales.

Technical Evaluation of Feasible Alternatives

The following summarizes alternatives from a technical perspective, including an assessment of how each option impacts the area's reliability. In addition, the ability of each option to address reliability criterion is assessed. Each option is evaluated based on the assumption that each must achieve minimum design and planning criteria to be viable.

Table 8: New 69kV Supply Options

Sonoita: New 69kV Supply & Substation (Sonoita) Voltage Drop and Losses at Peak (5656 MW)							
		Highest Voltage Drop			Losses		
Case	System Load(kW)	Phase A (V)	Phase B (V)	Phase C (V)	Net Losses (kW)	(% of Total Load)	Total Load + Losses
Existing	5656	113	115	119	1648	29.1	7304
New 69kVa	5656	117	115	119	562	9.9	6218
New 69kV	5656	117	115	119	565	10.0	6221

Attachment 2 presents one-page summaries of each of the alternatives that were selected from the screening analysis. The summaries provide a brief description of the proposed solution, total cost, implementation timeframe, years the solution is viable, and advantages and disadvantages of each option.

Distribution Options

Most of the distribution options do not materially improve feeder performance or reduce feeder loading sufficiently to defer the need dates for capacity upgrades. For example, installing a dedicated 25kV feeder to Sonoita is expensive, visually similar to 69kV transmission and requires new ROWs where prescriptive rights prohibit upgrades in line capacity. Each also would require a new transformer with a higher capacity rating at the Huachuca substation.

Distributed Generation (Diesel or Natural Gas)

The injection of DG output on the V-7 feeder essentially reduces the effective loading on the circuit. The decrease in feeder loads also reduces substation transformer loading, improves feeder voltages and reduces losses. Table 9 presents the impacts of DG on V-7 feeder performance in increments of 500kW up to a total of 2000kW. The impact of increasing amounts of DG located in Sonoita on line end voltages is nominal. However, the reduction on

losses at peak is substantial: losses as a percent of feeder peak demand drops from 30 percent to 17 percent if 2000kW is installed. Viewed from a capability standpoint, the net effective capacity of 2000kW of DG is actually 2746kW, an increase in net unit rating by about 35 percent.

Table 9: DG Feeder Impacts

Sonoita: DG Voltage drop and Losses at Peak (5656 MW) + DG							
	System Losses	Highest Voltage Drop				Losses	Load + Losses – DG
DG (KW)	Regained	Phase A (V)	Phase B (V)	Phase C (V)	Net Losses (kW)	(% of Total Load)	(kW)
0	---	113	115	119	1683	29.8	7339
500	227	114	115	119	1456	25.7	6612
1000	437	116	115	119	1246	22	5902
1500	602	116	115	120	1081	19.1	5237
2000	746	117	115	119	937	16.6	4593

Long-Term Performance of Feasible Supply Options

All 69kV transmission and substation options provide robust capacity support over 20 years (and longer), and improve power quality and feeder performance. For DG options, up to 2 MW will be sufficient to maintain voltages within acceptable levels; however, an additional 2 MW's is needed over the longer term. Figure 33 presents transmission and distributed generation performance for 2029. Results indicate all options meet voltage performance thresholds (under the assumption that 4 MW of DG or load reduction is achieved in 2029). The transmission option has lower losses, but comparable voltage performance.

Figure 33: Alternative Performance (2029)

2029 Peak Forecasted Loads Voltage Drop and Loss Comparison 2MW & 4MW DG and 69-kV Option							
		Highest Voltage Drop			Losses		
2029 Forecasted Load (Low, Base, High) kW	DG (KW)	Phase A (V)	Phase B (V)	Phase C (V)	Net Losses (kW)	(% of Total Load)	Load + Losses – DG (kW)
DG & Energy Storage							
7197	2000	112	113	118	1543	21	6740
	4000	115	113	118	927	13	4124
7922	2000	107	112	117	1907	24	7829
	4000	115	112	118	1142	14	5064
8723	2000	103	110	117	2165	25	8888
	4000	113	111	118	1456	17	6179
69-kV Option							
7197	---	116	113	118	691	10	7888
7922	---	115	112	117	732	9	8654
8723	---	114	111	117	780	9	9503

Results presented above also indicate Phase A and B voltages are below acceptable levels in year 2029, and these would need to be resolved for whichever solution is selected.

Reliability Considerations

As noted previously, most outages impact less than 10 customers. Hence, none of the supply options cited above are likely to significantly improve V-7 feeder reliability – the 69kV supply options provide the greatest reliability benefit, as the separation of one feeder into four would reduce customer interruptions and average outage hours by up to 30 percent. Accordingly, reliability should not be viewed as a primary factor in the evaluation of alternatives. The exception would be a status quo option that does address projected capacity deficits. Any material increase in feeder loading without reinforcement or demand reduction likely would cause major outages from feeder protective relaying phase trips caused by overloads or line burn-down.

As noted in the Operations and Maintenance section that follows, the impact of recloser operations on DG and energy storage must be addressed if these strategies are pursued. The loss of generation under peak load conditions could cause lengthy outages to many or all

customers on the V-7 feeder. Remote SCADA would be needed to limit the impact of temporary interruptions caused by recloser operations. Given the potential of these types of outages, the DG options could be deemed less reliable than transmission supply options.

Operations and Maintenance

As noted throughout this report, additional station capacity is needed to cover the long term. For the 69kV option, SSVEC operating and maintenance staff are very familiar with single-pole construction with off-road access; hence, we do not anticipate any inordinate demand on resources or technical support capability. Similarly, the new Sonoita substation is comparable to other SSVEC substations, and would not create any undue maintenance or staffing impacts.

For DG (diesel), SSVEC personnel would need supplemental training, as they are not trained to operate and maintain generation equipment, or fuel handling facilities. Additional staff may be required and these costs are reflected in the economic analysis. A high level of maintenance on these options would be essential, as SSVEC's customers would rely on the availability of this generation to meet capacity requirements: In short, the units must be available when called upon to avoid capacity shortages and attendant lengthy outages.

The DG option also would require monitoring and control systems to enable control center personnel to operate these units when needed. Sophisticated control strategies and equipment also may be needed to automatically start (and shut off) the units when loads exceed pre-set thresholds or when contingencies or outages occur. It is important to note that a key shortcoming of all generation options is that these devices are designed to shut down for momentary or sustained circuit interruptions. If the Huachuca substation recloser were to operate (and successfully reclose) during peak load hours, there could be insufficient capacity with resultant overloads until the units were restarted. Control center personnel would need to intentional isolate or trip line sections until the generators were back on line. Accordingly, remote SCADA operating capability of line switches would need to be installed; the cost of additional SCADA control is added to the cost of these options.

Fuel Conversion and Storage

Reduction of electric space heating load via fuel conversions or by converting existing baseboard systems to electric storage can be an effective option if SSVEC can achieve sufficient participation levels and implement processes to minimize the potential for customer bypass or override of these systems. On-going performance evaluation and assessment would be essential, and program adjustments would need to be made, where needed. The cost of ongoing program administration, marketing and evaluation is included in the economic evaluation. A survey of customers served by V-7 is recommended to determine the

number and type of space heating load, program design, and level and type of incentives needed to ensure sufficient participation.

To meet capacity requirements, a feeder peak target of 5000 kW, net of losses, was chosen to determine the minimum number of units for conversion. Significantly, the number of units in 2010 exceeds 100; hence, an aggressive program would be needed to achieve this target. Table 10 identifies the number of units that would need to be replaced by year.

Table 10: Space Heating and Electric Storage Conversions

Year	Capacity Reduction (kW)	Units Replaced (Cumulative)
2010	602	135
2019	1593	357
2029	2922	655

In later years, a large number of units would need to be converted to meet capacity reduction targets. In the last year, about 25 percent of the total customers served (prior to new customers added to the system) would need to own eligible space heating units and agree to participate in the program.

Economic Evaluation

A 20-year economic analysis was performed for the feasible alternatives outlined above. The economic analysis considers capital, energy, operations and maintenance, loss impacts and other specific costs needed for the option to remain viable over time. Capital costs of the feasible alternatives are summarized below in Table 11. The cost of the transmission options generally conform to prior estimates prepared by SSVEC, whereas the cost of the DG and conversion options, including incentive payments, were derived by NCI. All data used to derive energy and demand cost savings was based on SSVEC rate schedules, actual costs for demand and energy, and 2010 budget projection for demand and energy supply, and energy delivery charges. The specific cost of each alternative varies over time as facilities are added or incentives paid for DSM options.

Table 11: Capital Costs

Alternative Investment Cost	Cost	Units
69kV to Sonoita: SIDB Route	$15000	($000)
69kV to Sonoita: SR 82	19000	($000)
DG – Diesel	$600	$/kW
DG – Permitting	$250	($000)
Electric Heating Program Set Up	$250	($000)
Storage/Propane Unit	$1800	($)

Base Case Studies

Table 12 summarizes the results of the economic comparison studies of those options deemed to be most feasible. Results indicate reduction in peak electric heating use produces the lowest costs when evaluated over 20 years. Reduction in electric heating use assumes SSVEC customers would agree to permanently convert existing electric heating systems to alternate systems such as modular propane units or electric storage heating. Installation of diesel generation also represents a lower cost option.

Table 12: Economic Comparison of Feasible Alternatives

Alternative	Capital Investment	Fuel and O&M	Line Loss Savings	Total NPV
New 69kV to Sonoita (T1)	$13,424	$231	$879	$ 12,776
New 69kV to Sonoita (T2)	$17,004	$288	$879	$16,413
DG – Diesel (R5)	$2,277	$3,892	$418	$5,751
Electric Heating Conversion (DS4)	$1,386	$1,428	$460	$2,355
Electric Storage Heating (DS2)	$1,788	$ 350	$77	$2,061

Notes:
(1) All results in thousands of dollars (net present value)

Although economic results appear favorable, the viability of electric heating options is at best uncertain, as the level of incentive and marketing efforts that would be sufficient to motivate customers is unknown. The willingness of customers to remove existing heating systems and replace them with alternate systems has not been established. Further, there is uncertainty as to whether there are a sufficient number of eligible heating systems to reliably meet feeder demand and mitigate performance issues. For example, customers that use heat pump would not be eligible for either fuel switching or storage heating. Further, both DG and fuel switching options do not materially reduce momentary interruptions and voltages sags, nor do they address power quality issues; including those created by high load imbalances and possible circuit resonance.

Sensitivity Analysis

The primary sensitivity analysis focuses on load growth, as it has the greatest impact on DG and DSM options. In particular, the number of units and operating hours would increase significantly if growth were higher; conversely, the number of units and operating hour would decline if loads are lower. These findings suggest DG has greater flexibility and uncertainty than transmission/substation options, the latter of which is robust under all growth scenarios. The impact of load growth on fuel switching and conversion could have similar impacts, as a high growth scenario might exhaust the availability of eligible (or participating) customers.

Preferred Alternative(s)

The preferred alternative on the basis of economics alone is demand reduction, achieved by the expedited conversion of electric space heating with alternate fuels. A close alternative is the installation of diesel generators in Sonoita. Each of these options involves important trade-offs. The fuel switching option is speculative at this time, and SSVEC would need to implement, market and deliver a program that would achieve demand reduction in amounts sufficient to improve feeder performance and defer capacity upgrades for several years. The diesel option closely follows electric heating conversion options, and is more predictable with regard to certainty of capacity and performance benefits.

The preferred alternative based on feeder performance and firm capacity requirements is the construction of new 69kV line along the Ranch where SSVEC has easement rights.

Timing and Implementation

The six-month public review of alternatives outlined herein suggests the installation of longer term options could create short-term capacity constraints. Action needs to be taken *immediately* by SSVEC to avoid equipment overloads. Accordingly, the impact of new service applications onV-7 and Huachuca substation loading should be carefully evaluated.

The availability of diesel generation should not be a factor, as many devices are available for immediate purchase. However, if an air quality permit is needed for diesel generation, then sufficient lead time is needed to ensure devices are available for the next peak season.

The timing of fuel switching or storage heating could be an important factor, as a relatively high participation level likely is needed to achieve sufficient peak capacity reductions. 100 or more participants likely would be needed by 2010 for the program meet capacity needs.

Regulatory and Legal Considerations

The primary regulatory and permitting issues are likely to apply for the DG option. The size of the diesel indicates an air quality permit would be needed. The permitting process requires estimates of emissions for each unit (presented in the next section of this report). The length of time needed to obtain approval based on the size and operating is not known; however, any significant delays would cause V-7 performance to degrade with potential equipment overload. In addition, local permits likely would be required, and SSVEC would likely have to demonstrate that acceptable noise abatement systems would be installed. Area residents and businesses also could pursue separate legal action which also could delay construction.

For the electric storage heating option, SSVEC may need ACC approval for new time of use rates and program incentives. They would also need to confirm that program approval is not required by the ACC.

For the transmission construction option, the most significant factor is the need to obtain easements for the T2 option. Easements would need to be obtained along virtually the entire length of SR 82 and the Lower Elgin Road, a potentially lengthy (and costly) process. If condemnation is required, the additional time required for legal proceedings and fair value determination could delay construction for up to a year (or longer). Similar to DG permitting issues, any significant delays would cause V-7 performance to degrade with potential equipment overload.

Environmental Factors and Site Selection

This section highlights our investigation of environmental impacts associated with the development of the proposed alternatives, including the Sonoita 69kV line routing and substation options. To facilitate reference, the transmission line route option being proposed by SSVEC, which runs from a new substation site in the Sonoita area, across the Ranch to an interconnection east of State Highway 90 and north of Huachuca City is referred to herein as T1: New 69kV line & Sonoita Substation on Ranch ROW. Four viable subroute options (T1-A through T1-D) are also discussed in this section. Attachment 1 shows the general project area, including the transmission supply alternatives T1-A through T1-D, in addition to other alternatives evaluated in prior sections of the report.

The Visual Resources and Aesthetic analysis focuses on an evaluation of the Transmission Supply Alternatives. The Cultural and Historical Resources and Biological Resources evaluations focused primarily on Transmission Supply Alternatives –T1 and proposed new substation at the Sonoita Substation site. Potential construction related air emissions from the Transmission Supply Alternatives as well as potential air permitting issues associated with Supply Alternative R5: Distributed Generation is also discussed. This section also includes a discussion of the potential EMF impacts associated with the applicable supply alternatives.

The analysis of environmental impacts was completed at the feasibility level only and does not provide results or data in sufficient detail to complete any necessary environmental or permitting processes. This section includes an identification of potential feasible mitigation measures that would generally be sufficient to reduce substantial impacts associated with supply alternative being considered. This section does not evaluate individual project specific impacts for a particular alternative against specific environmental significance criteria and propose specific mitigation measures for each measured impact. Site-specific analysis of potential environmental impacts associated with the alternative ultimately selected would likely be required in order to determine the most appropriate mitigation strategies.

Visual Impacts and Aesthetics

NCI retained Environmental Vision, a visual resources impact and assessment firm, to assess the relative visual impact and evaluate visual resource constraints associated with alternatives being considered to improve the electric supply and performance of SSVEC's Huachuca V-7 feeder (see Exhibit 2). This section outlines the general physical characteristics and constraints associated with applicable alternatives. Visual mitigation strategies designed to generally address potential visual impacts are also provided.

This evaluation was based on review of available technical data including project maps, topographic and aerial maps, public planning documents, and geographic information system (GIS) data. In addition, a site reconnaissance of the general area of the Transmission Supply Alternatives was conducted on November 19, 2009, to observe general existing visual conditions. This section outlines the technical approach and methods employed for the evaluation and an overview of the visual setting in the project area. It includes a discussion of the physical characteristics, visual resources constraints and potential aesthetic impacts issues associated with each of the supply alternatives. A discussion of applicable aesthetic mitigation strategies and findings and conclusions is also included.

Of all delivery options, the Transmission Supply Alternatives have the greatest impact from a visual standpoint, in large part because several traverse ROWs where few or no other lines exist. However, one option, T4: 46 kV Supply Options, which involves an interconnect to TEP's 46kV line has virtually no impact from a transmission routing standpoint, as a new 46/24.9kV substation would be needed adjacent to Elgin Road but no additional sub-transmission line would need to be constructed.

Technical Approach and Methods

Visual or aesthetic resources are generally defined as the natural and cultural features of the landscape that can be seen. The combination of landform, water, and vegetation patterns represents the natural landscape that defines an area's visual character, whereas cultural features include built elements such as buildings, roads, and other structures that reflect human modifications to the landscape. These natural and built landscape features—or visual resources—contribute to the public's experience and appreciation of the environment. Depending on the extent to which a project's presence would alter the perceived visual character and quality of the environment, visual or aesthetic impacts may occur. As described below, several key factors provide the framework for evaluating relative visual constraints associated with the Supply Alternatives being considered.

The general area from which an object or project is visible or can be seen is defined as the viewshed. The existing physical and visual characteristics of the project's landscape setting provide a basis for evaluating project-related change within the viewshed. Viewing distance is a key factor that influences the level of project visibility. For visual resources assessment purposes, the viewshed area can be broken down into distance zones of foreground, middleground, and background. The foreground, defined as the zone within a half-mile from the viewer, is the area from which landscape detail is most noticeable and objects generally appear most prominent. This evaluation is focused on foreground areas, where visual change is typically most noticeable. The middleground is a zone that extends from the foreground up to three to five miles from the viewer, and the background extends from about three to five miles to infinity (Smardon et al., 1986 and U.S. Department of Agriculture, 1973). In instances

where viewing distances are referenced as part of this evaluation, all measurements are approximate.

Viewer sensitivity as well as the relative number of affected viewers are additional factors that influence the magnitude of potential aesthetic impact. Research on the subject suggests that certain activities tend to heighten viewer awareness of visual and scenic resources, while others tend to be distracting (U.S. Department of Transportation, Federal Highway Administration 1988, p. 63). Accordingly, each of the applicable Supply Alternatives being considered was evaluated in terms of its proximity to key visual receptors including (1) state and county scenic routes, (2) existing residential areas and (3) open space and public lands. For purposes of this study, location of sensitive visual receptors within 0.25 mile was employed as the constraint criterion because physical elements such as transmission structures have potential to be noticeable or to appear prominently when seen in the foreground at this distance. An additional factor, the presence of existing distribution or transmission facilities, was also considered pertinent to the evaluation because the presence of these facilities generally decreases the level of incremental change which in turn changes the degree of visual impact as compared with the introduction of similar facilities in landscape settings where existing similar features are not currently present.

One exception to the 0.25-mile distance criterion was applied with respect to the proximity of the Supply Alternatives to visual receptors. A more detailed visual assessment is included for the four applicable transmission supply alternatives, which include route variations in the area surrounding Sonoita Hills and the proposed Sonoita substation (i.e., T1-A through T1-D). In these areas, a proximity of 200 to 300 feet was employed as the evaluation criteria.

Visual Setting Overview

Landscape Context

Located approximately 50 miles southeast of Tucson, Arizona, the general project area straddles Santa Cruz and Cochise Counties. This area is part of a larger physiographic region known as the Mexican Highland, which includes high desert plains situated at between 4,000 and 7,000 feet above sea level and mountains rising to higher elevations (Fenneman, 1931). The general project area lies at an elevation between about 4,200 feet and 4,900 feet above sea level. Mountain ranges surrounding the project area include peaks of up to 9,000 feet. Views from several locations in the general project area include desert grassland plains with distant mountain ranges as a backdrop (Attachment 3 - Photo 1).

The general project area lies within the Mexican Highland Scrub Steppe Province ecoregion (Bailey, 1978), a high desert landscape characterized by light-colored rolling grassy plains

with darker grey-green, scattered scrubby shrub and tree cover (Attachment 3 - Photo 2). It is an arid climate with precipitation limited to summer storms and occasional winter rains. The grasslands generally experience a brief seasonal change to green with rainfall. Groups of mature trees are limited to areas along streambeds and washes, and near developed areas including residences (Attachment 3 - Photo 3). Landscape texture ranges from medium-fine grain in grassland areas to a coarse grain in scrub areas. These characteristics suggest that the **landscape's "visual absorption"** capability, or the ability of the landscape to accept human alteration without a loss of scenic quality character, ranges from low in more level grassland areas where built objects may contrast with the smoother texture to high in scrub areas where the mottled, hilly landscape background has the potential to camouflage built structures. Views within this landscape are typically open and unobstructed; but occasionally enclosed or interrupted by topography, trees and other vegetation or buildings (Attachment 3 - Photo 4).

A roadway network including SR 82, SR 83, and SR 90 connects the area to larger urban centers--Tucson to the north, Nogales to the south on the Mexican border, and Tombstone/Sierra Vista to the east. The project area is sparsely settled with low-density residential structures near the unincorporated towns of Sonoita (Attachment 3 - Photo 4 and 5, Huachuca City; Attachment 3 - Photo 6) and Whetstone - ranching is the predominant land use. Nearby public land includes Bureau of Land Management (BLM) areas, the Coronado National Forest, and the Fort Huachuca military base equipped with ongoing military training facilities and an airstrip. Rural residences, ranch structures including fences, and existing utility lines are among the established built features seen in this landscape setting.

Visual Resources and Potential Receptors

Visual resources and potentially sensitive visual receptors in the general project area include the following:

- Patagonia-Sonoita Scenic Road: A 52 mile scenic road following SR 82 and SR 83 from Nogales to Sonoita to Tucson, running along the riparian basin of the Santa Cruz River (Santa Cruz County, 2004).
- Rural residences: These include residences around the unincorporated communities of Sonoita (Attachment 3 - Photos 3 and 5), Elgin, Whetstone, Huachuca City and locations along the southern edge of the Ranch, near Highway 83.
- Las Cienegas National Conservation Area (LCNCA): A 45,000 acre BLM administered area that stretches across Santa Cruz and Pima Counties. The BLM has numerous policies regarding aesthetics which apply to this area.
- Babacomari Ranch: An approximately 55-square mile privately-owned historic property that straddles Santa Cruz and Cochise Counties. The ranch is largely undeveloped with some rural residences at the eastern and western periphery

(Attachment 3- Photos 2 and 7). Various fencelines and several existing utility lines traverse the ranch property (Attachment 3 - Photo 8).

- Appleton-Whittell Research Ranch: An approximately 4.5-square-mile undeveloped tract of land located south of the Ranch that is managed as cooperatively by groups including the National Audubon Society, U.S. Forest Service, BLM, and the Nature Conservancy. Public access to this area is restricted (Audubon, 2009).
- Fort Huachuca Military Preserve: An approximately 70,000 acre tract of land that is located adjacent and to the south of the Ranch.

Potential Visual Impact Issues and Physical Characteristics of Supply Alternatives

This section evaluates supply alternatives that have potential visual resources issues. All of the supply alternatives being considered were previously identified in Exhibit 2. Attachment 1 is a map of the general project area showing its landscape topography pattern and the location of the transmission supply alternatives. Specific sites for renewable options have not been chosen as the feasibility study did not identify preferred sites. It is assumed that DG options could be located on the Sonoita substation site. Because DSM options do not involve physical improvements to facilities they would not result in any visual effects and, therefore, are not addressed in this evaluation.

Distribution Alternatives

The distribution alternatives require some modifications at existing substations and minor modifications or additions to existing distribution lines. Distribution lines generally utilize wood poles less than 40-feet tall. Because of this, it is expected that the changes proposed by the distribution alternatives would generally be minor and incremental, the visual effects would generally not be particularly noticeable and would range from no change to a minor level of visual change.

D1: Reinforce Existing System

This option utilizes rebuilding of existing distribution lines and does not require new utility structures, therefore there will not be any visual effect associated with this option.

D2: Upgrade Existing Line

This option involves rebuilding of existing distribution lines and replacing a limited number of existing poles with taller poles and replacing existing conductors. Given the minor level of modification to existing elements, the visual effect would not be particularly noticeable.

D3: New Huachuca West Feeder
This option involves some modification to the existing Huachuca West substation as well as replacement of approximately 25 miles of existing distribution line with a double-circuit distribution line on taller poles along SR 82 and Elgin Road. The replacement poles would be 10 to 15 feet taller. Because this option involves a 25-mile route along public roadway corridors, and given that the new poles would be taller and would carry additional conductors, the visual effect would be noticeable.

D4: Foreign Interconnection
This option involves building approximately two miles of new distribution line along SR 82 (registered Arizona Scenic Highway) at the southwest corner of the project area. This option will result in a minor level of visual effect.

Transmission Supply Options

This section evaluates the Transmission Supply Alternatives being considered and identified on Attachment 1 as T1(A-D), T2, T3 and T4. The 69 kV alternative routes (T1A – T1D) and (T2) and 115/138 KV route (T3) each involve establishing a new substation and up to 23 miles of new lines. The new sub-transmission lines would utilize steel poles from 55 to 65 feet tall. T4: 46kV Supply Options would involve establishing a new substation and utilizing existing transmission lines and no new lines would be required. Generally, the Transmission Supply Alternatives would introduce new sub-transmission facilities in areas that include remote rangeland, rural residential areas, and a mixed commercial area.

T1: New 69 kV Supply Options
This alternative involves installing approximately 23 miles of new 69 kV transmission line. This line would run between the proposed Sonoita Substation located approximately 0.5 mile south of the intersection of SR 82 and SR 83 (Attachment 3, Photo 9) and proceed easterly to the City of Huachuca at SR 90 (Attachment 3, Photo 6). This route option runs south and east through rural residential areas of Sonoita. In this area, four route variations (T1-A, T1-B, T1-C and T1-D on Attachment 1) are under consideration for the 69 kV routes within a small portion of this route that encompasses about the first 4.5 miles. Photos 3, 4, 5 and 9 in Attachment 3 provide views in this part of the general project area. The route then runs across and along the largely undeveloped Ranch (Attachment 3, Photos 2, 7 and 8). As outlined below, approximately 7.8 miles of the route is near residential areas, and the majority of it passes through largely unsettled, remote areas of rugged terrain. Approximately 19 miles would involve installing new transmission line in areas where there are no existing distribution or transmission lines.

- Approximately 7.8 miles of this route lies near rural residential areas in Sonoita, the City of Huachuca, and near SR 83 along the Ranch.

- This option passes through or along the edge of approximately 19.3 miles of the Ranch. Most of the route passes along the ranch's southern edge.
- Approximately 1.5 miles of the route is adjacent to the northern edge of the Appleton-Whittell Research Ranch.
- Approximately 4 miles of the route is adjacent to SR 83.
- Another 0.3 mile of the route runs along local roadways.
- Approximately 4-5 miles of the route is adjacent to existing distribution lines.

Variations in Sonoita Area

Table 13 includes an evaluation of visual constraints associated with four route sub-options (T1-A, T1-B, T1-C and T1-D in Attachment 1) located along approximately 4.5 miles at the western end of this Transmission Supply Alternative T1. In comparison to the other variations shown in the table below, the T1 –A route has the least visual constraints due to its relatively lower exposure to residential and roadway views. In addition, most of this route variation follows existing distribution lines which would tend to decrease the degree of noticeable visual change.

Table 13: Visual Constraints of T1 Route Options

Option	Close Proximity to Residences (miles off the SIDB)*	Presence of Utility Lines (miles off the SIDB)	Adjacent to SR 83 (miles off the SIDB)
T1-A	1.75	3.0	1.5
T1-B	2.5	2.5	1.75
T1-C	1.75	3.0	4.5
T1-D	3.0	2.5	0

T2: 69 kV Line Supply Options

This alternative involves installing approximately 23 miles of new 69 kV sub-transmission line running from the new Sonoita Substation to the existing Huachuca West Substation on SR 82 approximately 0.3 mile east of SR 90. The line runs north along Lower Elgin Road and then follows SR 82 through the Rain Valley to the north of the Mustang Mountains and into Whetstone. As outlined below, this route option passes near more residential areas than the T1 and the T1A through D options. However this entire route is adjacent to existing distribution lines where utility poles are established features in the landscape.

- Approximately 11.1 miles of the route passes within 0.25 miles of rural residential areas in Sonoita, Elgin, and Whetstone.

- Approximately 4 miles of the route runs through or along side the LCNCA.
- Approximately 11.7 miles is adjacent to SRs 82 and 83.
- Approximately 8 miles runs along local roadways.
- The entire route is adjacent to existing distribution lines.

T3: SWP 138 kV/115 kV Transmission Supply

This Transmission Supply Alternative would utilize a portion of the SWTC line that runs from SR 82 near Granite Peak Road southeast through a portion of the Mustang Mountains and across the Ranch. It would involve installing a new substation at the SWTC 138kV line just north of the Ranch property boundary and installing a new 69 kV sub-transmission line south across the Ranch. At the southern Ranch boundary the T3 Supply Alternative would follow the T1 route west to the proposed Sonoita Substation location. This option is similar to the 69 kV T1 or T2 options described previously but includes a shorter distance of new transmission line. A new substation along SR 82 could be visible from the roadway whereas, because of the remote area, a substation near the Ranch would generally be less visible from public viewing locations.

T4: New 46 Line Tap (TEP) and Substation

This Transmission Supply Alternative involves building a new substation only and does not require any new utility line. Utilizing a portion of the TEP right-of-way from Lower Elgin Road to the southern border of the Ranch, a new substation would be installed along Elgin Road near Wildlife Lane. Modifications to the existing 46 kV line would be minor and not would result in noticeable landscape effects. The proposed new substation would be a noticeable new element in the landscape. Aesthetic issues regarding the substation include the following:

- The substation lies within 0.25 mile of 2 rural residences on Elgin Road.
- It is within 0.25 mile of the LCNCA.

Demand-Side Management

These Supply Alternatives, identified as DS1 to DS5 in Exhibit 2, do not involve improvements to physical facilities and, therefore, they would not result in visual impacts.

Renewables and Distributed Generation Options

Four different Supply Alternatives are evaluated below. Although none involve site-specific locations, one of the alternatives (R5) could be developed at the proposed Sonoita Substation site or a comparable site in the general area.

R1: Solar Photovoltaic
The Solar Photovoltaic option could involve roof-top-mounted panels on scattered-sites or larger centralized facilities. Depending on the specific site locations and/or type of panel, this option could be visible and to varying degrees could become a source of glare. Therefore, this option has the potential to have a minor level of visual effects.

R2: Concentrated Solar Power
This option involves a centralized facility with an array of reflectors focused on a tall collector tower. Depending on the specific location of the site, reflective panels could be a source of glare and the tower could appear prominent from adjacent public roadways, residential areas, or public open space. This option has the potential to result in minor to substantial levels of visual effect.

R3: Wind Generation
This option was deemed not feasible in the early stages of the assessment of alternatives and therefore, excluded from this evaluation.

R4: Energy Storage
This option involves installing equipment enclosure structures at an existing or new substation site. This type of facility could be visible from nearby locations at the new Sonoita Substation site or comparable locations. However, the facility's appearance would be compatible with the visual character of a surrounding largely commercial and light industrial setting. With aesthetic mitigation including landscaping, the visual impact would be minor.

R5: Distributed Generation
This option involves installing low-profile equipment enclosure structures at an existing or new substation site, this type of facility could be visible from nearby locations at the new Sonoita Substation site or comparable locations. However, the facility's appearance would be compatible with the visual character of a surrounding largely commercial and light industrial setting. With aesthetic mitigation including landscaping, the visual impact would be minor.

Visual Mitigation Strategies

This section outlines a set of mitigation measures designed to reduce potential visual impacts and aesthetic effects associated with those Supply Alternatives that have potential visual resources issues, as discussed in the above section. Because aesthetic mitigation treatments will need to address particular landscape settings and viewing conditions, site-specific analysis of potential visual impacts could be required in order to determine the most appropriate visual mitigation strategies. For example, aesthetic mitigation could be required for a new substation situated within proximity to a public roadway, or a minimum setback

could be appropriate for new poles located near existing residences. Site-specific conditions may also require focused analysis including visual simulation or landscape mitigation studies. Mitigation measures will also need to address the specific physical characteristics of the selected supply alternative. The mitigation measures identified below are independent of those which may have already been proposed by SSVEC. Therefore, mitigation measures provided herein may be the same as or similar to those already proposed or normally implemented as a part of SSVEC operations.

Construction (C)

» **C1:** Where new poles or substation facilities are installed or where other visible ground disturbance occurs, construction practices should include earth re-contouring and revegetation/landscape replacement to restore the appearance of disturbed areas.

Utility Lines (UL)

» **UL1:** Use of non-reflective finishes and appropriate pole color should be employed to minimize the project's visual contrast with the surrounding desert landscape.

» **UL2:** Non-specular and non-reflective conductors and insulators should be installed to reduce their potential visibility.

» **UL3:** Installation of narrow-profile mono-poles with smaller arms should be considered to reduce potential visibility of structures.

» **UL4:** In locations where residential views are affected, new poles should be carefully sited so as to reduce their visibility. This measure could include consulting with affected residents on pole placement.

» **UL5:** Where new transmission lines are installed adjacent to existing distribution lines, consideration should be given to underbuilding the transmission structures in order to reduce the total number of utility poles seen within the viewshed.

» **UL6:** In cases where new transmission lines are installed adjacent to distribution lines in particularly sensitive residential areas, undergrounding of distribution lines should be considered in order to reduce the overall height of poles.

» **UL7:** In cases where new structures are installed on or near public lands (i.e. BLM land, public open space), consultation should take place with jurisdiction staff regarding aesthetic design considerations including color and structure placement.

» **UL8:** Installation of landscape screening at select locations should be considered to reduce the visibility of new poles with respect to sensitive views from residential or public open-space/recreation areas.

» **UL9:** In locations where the visual effect of poles is greatest, consideration should be given to installing taller poles so as to achieve longer conductor spans.

Substations (S)

Note: The following mitigation measures may pertain to both substations and renewable and distributed generation options.

» **S1:** Non-reflective finishes should be used for equipment that is visible to the public in order to reduce potential glare effects, including non-specular components in substations.

» **S2:** Decorative perimeter walls or other architectural enclosure elements should be considered in order to screen facilities.

» **S3:** Installation of landscaping should be considered in order to screen facilities from residential and roadway views.

» **S4:** In cases where new facilities are installed on or near public lands (i.e. BLM land, public open space), consultation should take place with jurisdiction staff regarding aesthetic design considerations including color and structure placement.

Summary and Conclusions

As outlined in the evaluation above, varying types and levels of visual constraints are associated with the alternatives being considered. Overall, due to their proximity to public roadways, three options- T2, T3 and D3 could result in noticeable visual change that would be seen by the greatest number of viewers in the project area. Several options including D1 and the demand-side options would result in virtually no effect on existing visual resources or public views. A second group of options including D2, D4, R4 and R5 could involve a minor level of visual change. Depending on site locations, the solar renewable options R1 and R2 could result in a minor to substantial level of visual effect. Finally, the 69 kV Transmission Supply options (T1-A through T1-D) would represent the most substantial degree of visible change because each of these options would introduce more than 20 miles of new transmission line and a new substation facility into the landscape setting. In comparison to the T1-A through T1-D options, a greater portion of the T2 option would be visible from residential areas; however, because the T2 option lies along an existing utility line for almost its entire length, its potential visual effects would be less noticeable than the T1 route which involves the introduction of a new utility line along portions of alignments where none currently exists; however, the virtual absence of residential customers on major sections of the T1 route suggests fewer people would see the line on the southern section of the SDIB. With respect to the four possible variations at the western end of the T1 route option, T1-A would

appear to be the least aesthetically constrained due to its relatively lower exposure to residential and roadway viewers.

Table 14 summarizes relative visual constraints associated with the various options under consideration. The table also includes corresponding applicable mitigation strategies. Importantly, as outlined above in the discussion of aesthetic mitigation measures could, to varying degrees, reduce the potential adverse effects associated with the identified visual constraints. Provided that appropriate site-specific aesthetic mitigation measures are incorporated into final design and implementation and based on the evaluation results summarized in Table 14, all of the options are considered feasible from a visual resources standpoint.

Table 14: Aesthetic Evaluation Summary

Options and Physical Characteristics	*Visual Constraints (Mitigation Strategies)*
Distribution	
D1: Reinforce Existing System Minor modifications to an existing distribution line.	No visual impacts. (N.A.)
D2: Upgrade Existing Line Replaces conductors and a limited number of existing poles with taller poles on an existing distribution line.	Minor changes to existing visual setting. (Mitigation: U1 through U4.)
D3: New Huachuca West Feeder Replaces 25 miles of existing distribution line with taller, double-circuit poles and conductors.	Minor but noticeable change to existing visual setting. (Mitigation: U1 through U4, and U7 and U8.)
D4: Foreign Interconnection Approximately 2 miles of new distribution line.	Minor changes to existing visual setting. (Mitigation: U1 through U4, and U8.)
Transmission	
T1: New 69 KV Supply Options along Ranch Corridor (T1A-D,) New substation and approximately 22 miles of new transmission line, line mostly through remote areas and some residential areas.	New line would mostly be in remote areas with limited visibility to the public. Noticeable visual change to some residential viewers and travelers along highways and local roads. Approximately 8 miles of the route are near residential areas and 19 miles of the 22-mile route will be in areas where there are no adjacent existing distribution or transmission lines. (Mitigation: UL1 through UL8 and S1 through S4.)
T2: New 69 kV Supply Option along Elgin Road and SR 82 New substation and approximately 23 miles of new line. Line is sited entirely along side existing distribution lines.	Noticeable visual change affects greatest number of residential viewers and travelers along highways. However, visual effect would be decreased somewhat because this route is located entirely along existing distribution lines, and could be combined with the existing lines. Approximately 11 miles of the route are near residential areas and 12 miles of the 23-mile route follow highways. May also require additional consideration regarding LCNCA (BLM).

Options and Physical Characteristics	*Visual Constraints (Mitigation Strategies)*
	(Mitigation: UL1 through UL8 and S1 through S4.)
T3: SWP 138 kV/115 kV Lines Could involve a new substation or a new 69kV line and/or reinforcement of an existing distribution line. Part of the 69 kV line would be located within the existing 115/138 kV corridor and part in areas with no existing transmission lines.	The existing transmission corridor and possible substation locations are in remote areas with few public viewing locations. The new substation and transmission line may be visible from roadways. The new 69kV line would generally be sited in areas where no distribution line currently exists. Changes would be noticeable. (Mitigation: UL1 through UL8 and S1 through S4.)
T4: New TEP 46/25 kV Substation New substation located along SR 82 in a residential area adjacent to LCNCA.	New substation could be noticeable to small number of residential viewers and travelers on a highway. Option may require additional consideration regarding LCNCA (BLM). (Mitigation: S1 through S4.)

Options and Physical Characteristics	*Visual Constraints (Mitigation Strategies)*
Demand Side	
No options involve changes in physical facilities.	No visual impacts. N.A.
Renewables and Distributed Generation	
R1: Solar Photovoltaic Dispersed-site rooftop locations or large-site, centralized solar cell facility.	Potential source of glare from panels. Because of lower profile, this option could be less noticeable than the other solar option. (Mitigation: S1 through S4).
R2: Solar Central Storage Large-site reflector array and tall tower.	Potential source of glare from mirrors. Central tower may be noticeable and prominent from public viewing locations. Depending on the specific site location, this option could be the more visible of the two solar options. (Mitigation: S1 through S4.)
R4: Energy Storage Equipment enclosures at existing or new substation facilities.	May involve new substation facility. Facility could be visible from public locations. With mitigations, visual impact could be minor. (Mitigation: S1 through S4.)
R5: Diesel Generation Low-profile equipment enclosures at existing or new substation facilities.	May involve new substation facility. Facility could be visible from public locations. With mitigations, visual impact could be minor. (Mitigation: S1 through S4.)

Cultural and Historical Resources

NCI retained Pacific Legacy, Inc., a cultural resources management firm, to complete a cultural resources evaluation of the general area of Transmission Supply Alternatives. To initiate the investigation, a record search was conducted at the Archaeological Records Collections Division of the Arizona State Museum (ASM), Tucson through the AZSITE data base system of Arizona's Cultural Resource Inventory. The record search was completed for

an area including one-half mile on either side of the proposed T1 route. In addition, the record search included a one-half mile radius at both endpoints of the proposed T1 route (i.e., at the proposed Sonoita Substation location on the west and the interconnection to an existing SSVEC 69kV transmission line to the east). In addition, an Arizona Antiquities Act Blanket Permit and a Records Management and Repository Agreement was obtained through the ASM at the University of Arizona, Tucson which is required to conduct record searches and surveys within Arizona.

Record Search Results

Fifteen previously recorded archaeological resources and 11 previous cultural resource investigations were identified within one-half mile of the proposed T1 route. The results of the record search are summarized below. Maps depicting the project centerline, the record search limits and the nature and locations of the previously identified sites and investigations are not included in this report due to their confidential nature. Archaeological and other heritage resources can be damaged or destroyed through uncontrolled public disclosure of information regarding their locations. Information regarding the location, character or ownership of a historic resource is exempt from the Freedom of Information Act pursuant to 16 U.S.C. 470w-3 (National Historic Preservation Act) and 16 United States Code § 470hh (Archaeological Resources Protection Act).

Previously Recorded Sites

The 15 previously recorded sites consist of prehistoric resources (village sites with house pit depressions, architectural remains, cairns and artifact scatters) and historic resources (railroad grades, old road segments, adobe structure foundations, fort remnants and artifact scatters). Only three of the sites (AZ EE:4:43, AZ EE:6:63 and AZ EE:7:175) are located near the proposed T1 route. A brief summary of these three sites is provided below. A brief summary of the remaining 12 sites is included in Attachment 4.

AZ EE:4:43(ASM) - A railroad grade with features representing the New Mexico and Arizona Railroad which was constructed by the Atchison Topeka and Santa Fe Railroad and built between 1881-1882 and abandoned in 1966. The Arizona State Historic Preservation Office (SHPO) determined the site eligible for listing on the National Register of Historic Places (NRHP) under Criterion A (association with events that have made a significant contribution to the broad patterns of our history); however, some segments of the railroad have been determined to represent non-contributing elements (Purcell 2006-991.ASM; Railey and Yost 2003-910.ASM).

AZ EE:6:63(ASM) - A linear site consisting of in-use and abandoned segments of State Route 83 and associated features, most of which appear to represent intact 1920s rural highway

segments. The site has been recommended as eligible for listing on the NRHP (Wright 1996-354.ASM).

AZ EE:7:175(ASM) - Segments of historic road representing parts of original State Route 90 which was built prior to 1940 and reconstructed in 1960s. The road segments have been recommended as potentially eligible for listing on the NRHP (Wright 1992-268.ASM). The segment of the site within the 2004 Rowe survey was reported as no longer existing and likely destroyed during installation of a telephone conduit and road maintenance activities (Rowe 2004-656.AMS).

Previous Investigations

There have been 11 previous archaeological studies within a half mile radius of the proposed T1 route. Only four of these studies (1996-354.ASM, 1999-337.ASM, 2004-656.ASM and 2006-991.ASM) overlaps with the proposed T1 route. A brief summary of these four studies is provided below. A brief summary of the remaining seven studies is included in Attachment 4. In addition to the studies identified by AZSITE, SSVEC retained Tierra Right of Way Services to complete a cultural resources survey of the proposed T1 route (Tierra, 2009).

1996-354.ASM
This linear survey of 40.4 miles of the State Route 83 right-of-way was conducted by Thomas Wright at the request of the ADOT prior to highway maintenance activities. Sixteen resources were identified including Site AZ EE 6:63 within the proposed project area which was recommended as eligible for the NRHP. The area covered by this study overlaps with the proposed T1 route.

1999-337.ASM
SWCA, Inc. conducted this archaeological survey for the Arizona Electric Power Cooperative, Inc. in advance of routine maintenance along an existing transmission line. Five newly identified and 22 previously recorded sites were identified, including Site AZ EE:7:263 within the proposed project area which was recommended as potentially eligible for the NRHP pending further study. The area covered by this study overlaps with the proposed T1 route.

2004-656.ASM
TRC Environmental Corporation conducted a linear survey of 24.5 miles along portions of State Routes 80, 90 and Interstate 10 prior to the installation of a fiber optic line. Five sites were identified, including AZ EE:7:175 within the proposed project area. However, the segment of AZ EE:7:175 within their project area was found to have been destroyed and no longer exists, apparently from installation of a telephone conduit and road maintenance activity. The area covered by this study overlaps with the proposed T1 route.

2006-991.ASM

A 406 acre survey for a proposed material source pit was conducted by David Purcell of DMG Four Corners Research, Inc. during which eight sites were identified including three within the proposed project area. The portion of Site AZ EE:4:43 within their survey was recommended as a non-contributing portion to the NRHP eligibility of the site. Site AZ EE:7:342 was recommended as eligible to the NRHP and Site AZ EE:7:343 was recommended as not eligible to the NRHP. The area covered by this study overlaps with the proposed T1 route.

Recommendations/Proposed Mitigation

The record search results from the ASM revealed three previously recorded sites within the area of the proposed T1 route. Twelve additional sites are located within a half mile of the proposed T1 route.

Accordingly, an archaeological survey of the proposed project area will be necessary should the project move forward. This archaeological survey should be completed for either the T1 route or any other alternative route that is ultimately selected for construction. If previously identified or newly identified resources are identified within the project area, they will need to be avoided if possible. Any holes necessary for pole installation should be placed to avoid digging within previously recorded or newly identified sites (resulting from the future archaeological survey). Any subsurface construction in the recorded or newly identified sites would be considered an impact to an archaeological site. This would require site evaluation prior to the impact, and if the site is determined eligible for the NRHP data recovery would also need to take place prior to construction.

Architectural resources have not been addressed in this report; however, it may be necessary to assess the visual impact of the project on NRHP sites and architectural resources of local interest. Changes to the visual setting of a NRHP eligible property is considered an impact. If there are existing visual impacts (e.g., existing power lines, highways and other visible constructions) a debatable premise is that the visual setting has already been compromised. The ASM policy for surveys of 640 acres or ten or more linear miles requires a research design or plan that is will review prior to fieldwork. In addition to a current blanket permit and records management/repository agreement (with appropriate maps of the project area), a Notice of Intent to conduct a survey on state lands (i.e., SR ROWs) must be submitted to the ASM. The ASM charges records management fees by per person field days and by the number of site records submitted to cover the cost of project processing and management. Additionally, if lands to be surveyed lie within areas with federal jurisdiction, SSVEC will need to submit and obtain approval for the appropriate special use permits prior to conducting surveys (i.e., BLM or Forest Service lands). The SHPO should also be contacted to inform them of the project.

Biological Impacts

NCI retained Harris Environmental Group, a biological resources management firm, to complete a biological resources evaluation of the general area of Transmission Supply Alternatives. A site visit of the general project area and proposed T1 route was conducted on November 19, 2009. The proposed transmission line route is located in portions of Santa Cruz and Cochise counties, Arizona.

The purpose of the site visit and biological resources evaluation were (1) to determine whether landscape characteristics, including wetlands, that occur with the proposed project area support special status species, and (2) to predict the likely effect of the proposed sub-transmission project on the species. A special-status species is defined as plants and animals that are legally protected under federal, state and/or local management agencies.

Information Reviewed

A list of federally-listed threatened or endangered species for Santa Cruz and Cochise counties was obtained from the U.S. Fish and Wildlife Service (USFWS) and was reviewed to determine if any of the species have the potential to occur within one mile of the proposed T1 route (USFWS, 2009). In addition, the Arizona Game and Fish Department's (AGFD) Online Environmental Review Tool was queried to determine whether any state listed threatened or endangered species or critical habitats have been documented within three miles of the proposed T1 route (AGFD, 2009). A literature search was also conducted for available biological resource studies or information for the general area. Copies of the USFWS and AGFD species lists are included as Attachment 5.

The potential for each special status species to occur in the general area was determined by comparing landscape characteristics in the area with the habitats known to be used by federally-listed species, AGFD listed-species, and all birds protected by the U.S. Migratory Bird Treaty Act. Based on the species list obtained from USFWS, no federally-listed species or their habitats have been identified to occur within the general area of the proposed T1 route. Habitat suitability requirements were based on qualitative comparisons between the habitat requirements of the species and biotic communities found in the general area.

Based on the results of the AGFD On-line Environmental Review Tool, eight out of 10 Arizona Wildlife of Special Concern that have been documented as occurring within three miles of the proposed T1 route do not have the potential to occur within the general area because habitat requirements necessary to support these species were lacking. For example, the general area does not have perennial water to support fish or amphibian species nor caves or mine adits to support bat species. The remaining two species , Baird's sparrow (*Ammodramus bairdii*) and

Sprague's pipit (*Antus spragueii*), both live in grassland habitat which does occur in the general area; these bird species have been documented as occurring within three miles of the proposed T1 route.

Existing Biological and Wetland Resources

Attachment 1 illustrates that a portion of the proposed T1 route follows the southern border of the Ranch property and crosses several ephemeral washes that flow north into the Babacomari River, including Turkey Creek. The Babacomari River is a large tributary of the San Pedro River, which is considered a Waters of the U.S. according to the U.S. Army Corp of Engineers. The San Pedro River, Babacomari River, and Turkey Creek are considered areas of high biological diversity.

Approximately nine miles northeast of the proposed T1 route, the Babacomari River converges with the San Pedro River, a major migratory bird flyway. Within one mile of the proposed T1 route, two raptor species have been documented as nesting and roosting along the Babacomari River - the Northern gray hawk (*Asturina nitida maxima)*, listed as an Arizona Wildlife of Special Concern, and Swainson's hawk (*Buteo swainsonii*), a Bureau of Land Management Sensitive Species (Nelson, 2009).

Vegetation in the project area is typical of Semidesert grassland community in the Warm-Temperate Grassland subdivision (Brown, 1994). Dominant overstory species along the proposed route were predominantly velvet mesquite (*Prosopis velutina)*, soaptree yucca (*Yucca elata)*, and oak trees (*Quercus* sp.) within the upland areas. Vegetation within the wetland areas consisted of mature Fremont's cottonwood (*Populus fremontii)*, Arizona ash (*Fraxinus velutina)*, and willows (*Salix* sp.). Construction of the T1 route of any other alternative route that is ultimately selected for construction will create ground disturbance. Plants in the general area that could be impacted include velvet mesquite and native grasses. However, regardless of the transmission line ultimately constructed, it is anticipated that only a few trees will be removed and most vegetative clearing will consist of limb pruning.

The San Rafael Valley is located in southern Arizona along the International Boundary about 75 miles southeast of Tucson. It is bounded on the east by the Huachuca Mountains and on the west by the Patagonia Mountains. Elevations in the San Rafael Valley area range from over 8,400 feet above mean sea level in the Huachuca Mountains to less than 4,620 feet above mean sea level at the International Boundary. The Valley contains a surface-water divide that separates the drainage into two watersheds, the Santa Cruz River and San Pedro River. The majority of the Valley is drained by the Santa Cruz River which flows south into Mexico, then flows north into Arizona near Nogales. The Santa Cruz River enters the Tucson Active Management Area at the point where it crosses the International Boundary ADWR 2009).

A small area in eastern San Rafael Valley drains south into the Mexican portion of the San Pedro River watershed. The San Pedro River flows north and crosses the International Boundary into the United States about 30 miles east of the San Rafael Valley (ADWR, 2009).

Portions of the Patagonia-Santa Rita Linkage and Tumacacori-Santa Rita Linkage wildlife corridors are located within the San Rafael Valley (Corridor Design, 2009). The latter corridor encompasses Cienega Creek and Sonoita Creek. These two linkages are home to far-ranging mammals such as black bear (*Ursus americanus*), mountain lion (*Puma concolor*), jaguar (*Panthera onca*), ocelot (*Leopardis pardalis*), and Mexican gray wolf (*Canis lupus baileyi*). These animals move long distances to gain access to suitable foraging or breeding sites, and benefit significantly from corridors that link large areas of habitat (Turner et al., 1995). Other mammal species that occur within these linkages and require movement to different parts of their range include badger (*Taxidea taxus*), coues' white-tailed deer (*Odocoileus virginianus couesi*), and mule deer (*Odocoileus hemionus*) (Corridor Design, 2009). Approximately 4.5 miles of the western portion of proposed transmission line crosses through these two corridors.

The valley is renowned for its wintering raptors. According to the Southeastern Arizona Bird Observatory, it is not uncommon to see over 100 birds of prey, sometimes up to12 species within a day's drive. Regularly seen raptors include: ferruginous hawk (*Buteo regalis*), great horned owl (*Bubo virginianus*), northern harrier (*Circus cyaneus*), Harris's Hawk (*Parabuteo unicinctus*), prairie falcon (*Falco mexicanus*), bald and golden eagles (*Haliaeetus leucocephalus* and *Aquila chrysaetos*), and a rainbow of subspecies and color morphs of red-tailed hawk (*Buteo jamaicensis*).

Potential Impacts

The potential for the proposed T1 route to impact migrations paths and movement of wildlife within the wildlife corridors was considered. There have been other recent evaluations of existing bridges, underpasses, overpasses, and culverts along highways as potential structures for animals to cross (Beier et al, 2008). Results of these evaluations were that housing and residential developments, major fences, habitat fragmentation and artificial night lighting can impede animal movement. Construction and operation of the proposed transmission line does not require additional roads, fencing, barriers, or artificial night lights that would affect wildlife movement. Based on both on consideration of the related studies and professional judgment, we do not believe that the proposed transmission line will affect wildlife species that utilize the Patagonia – Santa Rita wildlife corridor or Tumacacori – Santa Rita wildlife corridor.

Raptors are protected under the U.S. Migratory Bird Treaty Act (MBTA) of 1918 (16 USC 703-7 12). The area is a major flyway for several species that breed and winter in the valley. Raptors are drawn to transmission power poles because they offer a high place to perch, roost,

nest, and hunt. However, the large wing spans of raptors make them vulnerable to injury by bridging phase conductors. Inclement weather creates an additional safety hazard because strong winds can move the power lines and the birds, so the likelihood of a bird touching a live wire and being electrocuted increases. Large species and immature raptors are most at risk.

The proposed T1 route also has the potential to increase predation of songbirds and other sensitive species by raptors and Corvid species (i.e., ravens, crows and magpies); especially in areas where few elevated perches exist. Towers may increase hunting efficiency (e.g., greater chance of prey detection and attack success) of avian predators because the elevated perches provide increased visibility of the surrounding area (Craighead and Craighead, 1956; Worley, 1984; Sonerud, 1992; APLIC, 1996; Leyhe and Ritchison, 2004).

The proposed T1 route also has the potential to impact grassland habitat because habitat will be removed by the construction of the line. However, impact should be minimal because a permanent ROWroad will not be installed, the footprint of the individual poles will be small, and disturbed areas will be reseeded with native grasses. In addition, the amount of grassland habitat to be disturbed is minimal compared to the availability of grassland habitat surrounding the project area.

Recommended Mitigation

With the successful implementation of the following mitigation measures, it is not expected that that construction of the proposed T1 route or any of the other transmission alternatives routes being considered in the general area would have a significant impact to biological resources or special status species. The mitigation measures identified below are independent of those which may have already been proposed by SSVEC. Therefore, mitigation measures provided herein may be the same as or similar to those already proposed or normally implemented as a part of SSVEC operations.

- Install raptor-proof structures on all existing and new transmission poles.
- Install appropriate perch-deterrents that target avian species known to exist in the area. Any perch-deterrent design considered should be evaluated for effectiveness under experimental settings before installation (Lammers, 2007). Insulate electrical lines. This can increase the safety for members of the cat family, raccoons and other wildlife whose curiosity and foraging habits draw them to climb power poles and other electrical facilities.
- Use covered wire for all new pole-mounted electrical equipment.
- Avoid impacting ephemeral washes that flow into Waters of the US, specifically tributaries of the Babacomari River, such as Turkey Creek.

- Limit the grading of undisturbed lands so as not to impact potential habitat for sensitive biological resources.
- Limit the location of staging areas to already disturbed areas. Staging areas should be located outside of riparian habitat, regardless if the area is disturbed.
- Avoid construction near the Babacomari River and Turkey Creek during spring months when raptors and migratory passerines are breeding.
- Restore degraded and disturbed construction areas (including staging areas) by re-seeding with a native plant seed mix. To limit the impact to native vegetation, the AGFD Heritage Data Management System includes recommendations that all degraded and disturbed lands be restored to their natural state (i.e., reseed with a native grass seed mix).

Emissions & Noise

The only options that materially increase emission are distributed generation options utilizing fossil fuel and electric space heating conversion. Also, energy storage may either increase or decrease emission depending on the on and off-peak marginal generation that is operating during charge and discharge cycles. Because of energy storage charging efficiency (typically 80 to 90 percent) and the potential for off-peak to burn fossil fuels (e.g., coal at the margin) versus natural or oil on peak, net emissions can increase.

Diesel generators without noise abatement systems can create site boundary noise of up to 100 decibels (db), well above the 50 db to 70 db allowable levels. Noise abatement would be required if diesel generators are installed at Sonoita. Options include sound attenuating enclosures or barriers, exhaust silencers, vibration isolation, and cooling air attenuation; or a combination of the above. In addition, sound attenuation increase with distance, with sound decreasing by about 6 db for every doubling of distance from the generator. The cost of the generator and site improvements are increased to cover the cost of sound abatement systems. Typically, an acoustic engineering firm (or offered by large equipment suppliers) to determine the optimal solution for a specific site.

Emissions Output – Distributed Generation Options

Table 15 lists expected DG emissions for the diesel generator option the level of emissions over 10-year intervals. The data conforms to application requirements outlined in the Arizona Department of Environmental Quality (ADEQ) Air Quality permit application process for diesel generators rated about 600 horsepower. The hours for each interval are based on the minimum run hours needed to meet capacity targets (as opposed to an assumption the generators would run all hours of the year).

Table 15: DG Fossil Fuel Emissions Projections (Diesel)

Pollutant (a)	Maximum Capacity (b) (horsepower)	Emission Factor (c) (pounds per hour)	Emissions (b×c) (pounds per hour)	Emissions (2010) Hours = 36 (tons/year)	Emissions (2019) Hours = 430 (tons/year)	Emissions (2029) Hours = 1789 (tons/year)
Carbon Monoxide	2682	0.0055	14.8	0.27	3.19	13.25
Nitrogen Oxide	2682	0.024	64.4	1.18	13.91	57.83
Sulfur Oxide	2682	0.00647	17.4	0.32	3.75	15.59
Volatile Organic Carbon	2682	0.000705	1.9	0.03	0.41	1.70
Particulate Matter	2682	0.0007	1.9	0.03	0.41	1.69

Source: http://www.azdeq.gov/environ/air/permits/class.html

Construction Impacts for Transmission Alternatives

Construction of a transmission line and substation, regardless of the alternative ultimately selected, would result in temporary and short-term construction related air emissions. Emissions during construction would be caused by exhaust from construction equipment, delivery vehicles and worker travel as well as fugitive dust from windblown erosion and the movement of vehicles on the construction site. Temporary construction emission levels are not quantified in this report. Prior to any construction activities, construction emissions levels should be quantified to confirm that they are below threshold levels imposed by applicable regulatory agencies.

Mitigation measures that could be used to minimize dust emissions during construction could include (but are not limited to):

- Using low emitting diesel engines and ultra-low diesel fuel;
- Regular preventive maintenance; and
- Various fugitive dust mitigation measures (examples include water or chemical dust suppression, limiting traffic speeds, replanting vegetation in disturbed areas).

Renewable & Distributed Generation Options

Renewable & Distributed Generation Supply Alternative (R5) involves the use of Diesel Generation on the Sonoita Substation Site. The diesel generation could involve the use of

multiple trailer or ground mounted diesel units burning low-sulfur distillate oil, or natural gas depending on the availability of local gas supply.

The Air Quality Division of the ADEQ issues air quality permits to industries and facilities that emit regulated pollutants to ensure that these emissions do not harm public health or cause significant deterioration in areas that presently have clean air. If the combined generator capacity) in Horsepower (HP) of all generators located at a facility is greater than 3,000 HP, then a project is not eligible for coverage under the ADEQ General Permit and must instead obtain an Individual Permit.

The proposed diesel generators would be housed within sound retardant enclosures; however no noise analysis or background noise study was conducted as part of this report. Additional analysis may need to be completed to ensure that noise generated by the diesel generators meets applicable Santa Cruz County noise requirements.

Electromagnetic Fields

Operating power lines, such as the energized components of electrical motors, home wiring, lighting, and all other electrical appliances, produce EMF, also commonly referred to as electromagnetic field. Electric fields around transmission lines are produced by electrical charges on the energized conductor. Electric field strength is directly proportional to the line's voltage; that is, increased voltage produces a stronger electric field. At a given distance from the transmission line conductor, the electric field is inversely proportional to the distance from the conductors, so that the electric field strength declines as the distance from the conductor increases. The strength of the electric field is measured in units of kilovolts per meter (kV/m). The electric field around a transmission line remains steady and is not affected by the common daily and seasonal fluctuations in usage of electricity by customers.

Magnetic fields around transmission lines are produced by the level of current flow through the conductors, measured in terms of amperes. The magnetic field strength is also directly proportional to the current; that is, increased amperes produce a stronger magnetic field. The magnetic field is inversely proportional to the distance from the conductors, and thus, like the electric field, the magnetic field strength declines as the distance from the conductor increases. Magnetic fields are expressed in units of milligauss (mG). The amperes and, therefore the magnetic field around a transmission line, fluctuate daily and seasonally as the usage of electricity varies.

EMF Research and Applicable Regulations

Considerable research has been conducted over the last 30 years on the possible biological effects and human health effects from EMF. This research has produced many studies that offer no uniform conclusions about whether long-term exposure to EMF is harmful or not.

No federal regulations have been established specifying environmental limits on the strengths of EMF from power lines. However, the federal government continues to conduct and encourage research necessary for an appropriate policy on EMF. While several states (including Florida and New York) have opted for design-driven regulations that ensuring that fields from new lines are generally similar to those from existing lines, other states, including Arizona have chosen not to specify maximum acceptable levels of EMF.

EMF Levels for Feasible Supply Alternatives

EMF levels for each of the feasible alternatives was determined and compared among key supply alternatives. Table 16 summarizes electric and magnetic field levels for three alternatives for the 2009 actual and 2029 projected peak load. The 69kV option produced the lowest EMF levels due to the lower phase currents compared to the existing line or lower voltage supply alternatives

Table 16: EMF Levels

EMF Summary at 2009 Peak Load and 2029 Forecasted Peak Load Study Cases: V-7 Feeder without system Upgrades Proposed transmission Line (Single Circuit Segment) Proposed Transmission Line (Double Circuit Segment w/ V-7 Under Build)						
Distance from the center of Structure (Perpendicular to the Line)	V-7 Feeder with Existing		69-kV Proposed Sub-Transmission Line Single Circuit Segment		V-7 Feeder/ Proposed Sub-Transmission Line Double Circuit Segment	
	2009 Peak Load	2029 Forecasted Load	2010 Peak Load	2029 Forecasted Load	2011 Peak Load	2029 Forecasted Load
Electric Field kV/m						
30ft	0.08	0.08	0.25	0.25	0.13	0.13
0	0.04	0.04	0.28	0.28	0.09	0.09
30ft ‡	0.06	0.06	0.22	0.22	0.06	0.06
Magnetic Field mG						
30ft	17.3	27.5	2.1	2.6	4.1	5.1
0	23.0	36.8	3.6	4.5	5.8	7.1
30ft ‡	13.0	22.3	2.2	2.8	4.1	5.1

‡ 30 ft distance in the opposite direction as the original 30 ft assessment

The above estimates are comparable, or in some cases below readings encountered in residences, where readings of 2 mG to 10 mG are produced by normal household appliances

and wiring. Some appliances and household articles that operate sporadically or have occasional use such as microwaves and electric blankets can produce EMF that exceeds over 100 mG depending on the location of occupants.

Public Health Studies

Studies completed over a decade ago indicated the possibility of a correlation between electric line location and cancer. However, these studies showed a relatively weak correlation with many inconsistencies and questionable epidemiological methods. Among other deficiencies, the earlier studies indicated low EMF levels would produce higher cancer rates than lines with higher EMF levels; other studies showed minimal or negative correlation. Subsequent studies by independent experts have failed to demonstrate a direct correlation. Notably, the EMF levels produced by in-home appliances and low voltage electrical wiring often produces higher EMF levels than higher voltages distribution lines (which are usually located distance from residential premises).

State and national health agencies have not produced findings that support a conclusion that power lines present a public health hazard. Some state commissions and utilities have adopted a "**prudence avoidance**" approach, where utilities are advised to locate lines away from schools and heavily populated areas, where practicable. Other techniques for reducing EMF include frequent transposing of phase conductors, and increasing line height. Some have advised utilities to locate lines underground; however, underground lines require supplemental shielding to avoid increasing EMF levels since the cables, although buried, typically would be closer to residences and walkways with attendant higher EMF levels.

Other Environmental Issues

General Land & Permit Issues

SSVEC has an existing grant of easement for those portions of the proposed T1 route that cross the Ranch property. The grant is confidential between the subject parties and was not reviewed as part of this assessment. In addition and as discussed elsewhere in this report, SSVEC also has prescriptive rights through other portions of the general area for their existing distribution system. Regardless of the Transmission Supply Alternative that may be ultimately constructed, SSVEC would be required to obtain additional easements across public and private ROWs. An evaluation of the land ownership and the cost of additional easements was not conducted as part of this assessment. The status of obtaining other required easements in the general area is not known.

SSVCEC currently owns the currently vacant Sonoita and Buchanan sites (Attachment 1). Both sites have been considered for the construction of a substation. SSVEC recently

reconsidered plans to develop a substation on the residentially zoned Buchanan site in lieu of building the substation on the commercially zoned Sonoita Site.

A number of permits could be required for construction of a transmission line in the general area. Depending on the route ultimately selected, these permits or authorizations could potentially include:

- Arizona State Lands Department - for crossing state land
- ADEQ, Air Division – for temporary construction impacts
- ADOT – for highway crossings
- Santa Cruz and Cochise County – for road crossings
- BLM – for crossing of the LCNCA

The requirements of each permit were not individually analyzed.

Permits and regulatory issues associated with Renewable & Distributed Generation Supply Alternative R5: Diesel Generation are discussed above in the Emissions/Noise Section.

Summary

The V-7 feeder is a very long circuit that is nearing or at capacity limits. It requires a significant number of regulators operating in tandem to maintain voltages within acceptable limits. Reliability is below that of other SSVEC feeders, but not unusually low, as SSVEC has implemented effective reliability improvement measures; however, the number of momentary interruptions appears to be high, in large part because of the very long lines. There is evidence the feeder may be experiencing other voltage anomalies that require resolution. In summary, the V-7 feeder cannot accommodate material increases in load without overloads or unacceptable voltage impacts, or both. Immediate action is necessary to address V-7 capacity and performance issues.

Several alternatives are feasible to resolve capacity and performance issues from a technical perspective. Most transmission options are technically viable, except for use of TEP's 46kV line to serve V-7 load, which appears to have insufficient capacity to serve incremental SSVEC load. The transmission supply options provide the highest level of firm capability compared to other feasible options, as the availability of new transmission lines tend to be higher than distributed generation options. Distributed generation options must be carefully maintained and complex control strategies, communication systems would be needed to ensure the units operate when needed.

The investigation of environmental issues indicates the new 69kV line along new and existing ROWs along the Ranch has the greatest impact of the options considered. If the 69kV line and new substation at Sonoita are built as previously proposed by SSVEC, modest mitigation efforts are needed to address biological, cultural, and archeological issues. The visual impact of a new line is the most significant, and efforts should be made by SSVEC to minimize visual impact if the line is constructed. These would include low-profile line design, selection of construction materials that blend with the landscape.

Most renewable energy options, including wind and solar photovoltaic, did not provide sufficient coincident peak load reduction to be feasible – the V-7 feeder peak occurs during cold winter mornings when the sun is low on the horizon. Concentrated solar power could provide a solution, but would be very expensive and have potentially undesirable visual impacts; it also requires significant land, which may be difficult to obtain in quantities sufficient to construct devices large enough to reduce peak demand. The other renewable energy options provide minimal voltage support, and do not improve power quality and reliability. Energy storage systems show much promise and efforts are underway on a national scale to advance the technology and reduce cost, but are still in the early stages of development. Storage also would require complex monitoring and control schemes to ensure

sufficient storage was available and dispatched in a manner that will reduce loads over the full duration of the daily peak.

The lowest cost alternative is the targeted conversion of customer space heating systems, followed by the installation of oil or gas-fired diesel generators in Sonoita. However, there are clear trade-offs and concerns with the lower cost options. For targeted fuel conversions, the number of eligible customers and level of incentive needed to ensure sufficient participation levels has not been established. Such a program would need to be expedited, as the V-7 feeder has reached capacity limits. Further, the conversion program would only reduce feeder loading – voltage regulation and power quality issues would need to be addressed to ensure customers receive a level of service comparable to other feeders on SSVEC's system.

Other options that would have environmental impacts is the installation of generators at Sonoita and the conversion of existing electric space heating units to alternate fuels. If the amount of generation installed were to exceed state thresholds, an air quality permit likely would be needed. The EMF levels associated with existing lines versus options considered indicate each of the proposed upgrades or load management options will likely produce lower EMF levels than existing facilities. The absence of EMF standards does not enable a determination as to which alternatives are preferred from an EMF standpoint.

The preferred alternative based on feeder performance and firm capacity requirements is the construction of new 69kV line along the Ranch where SSVEC has easement rights.

NAVIGANT
CONSULTING

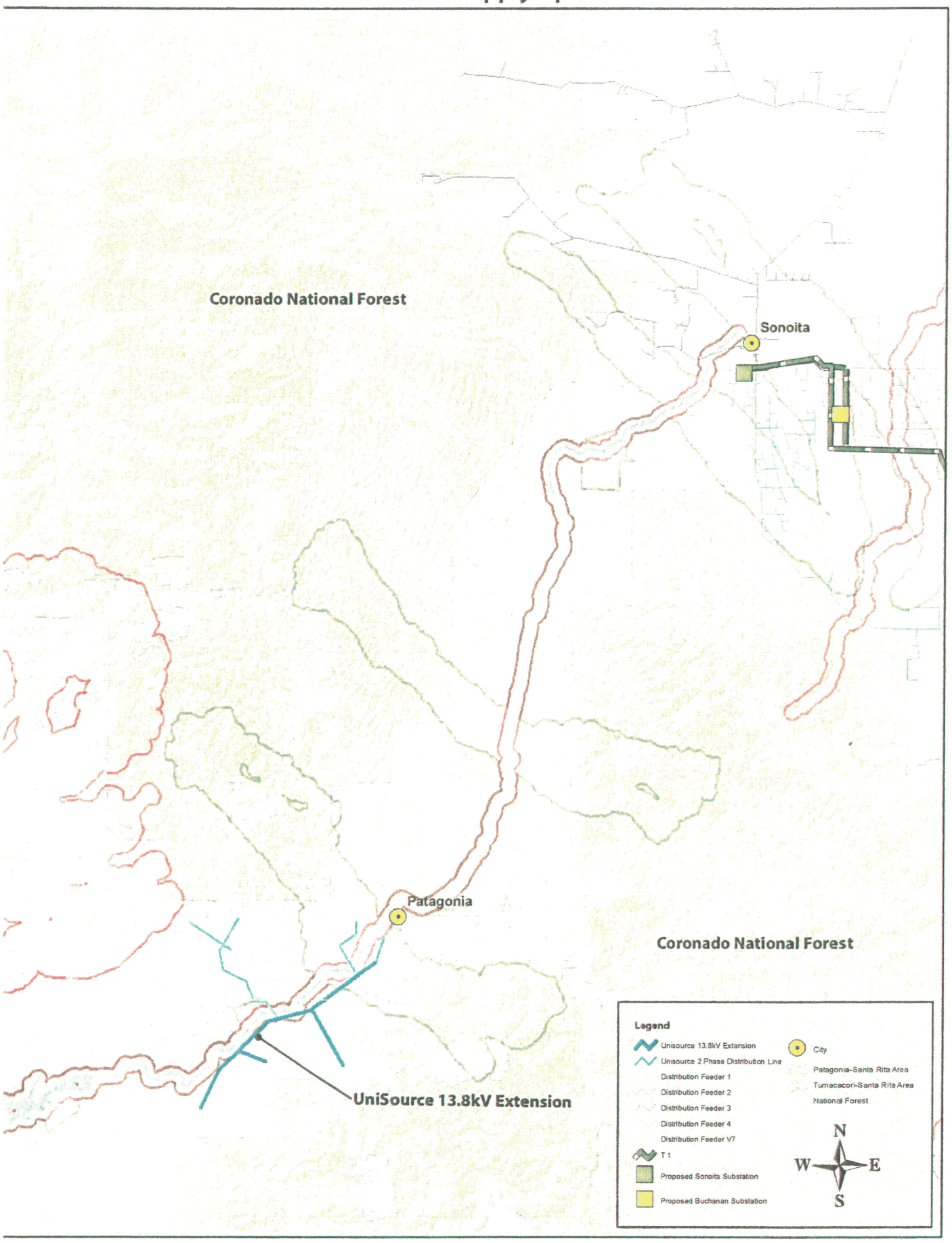
Attachment 1: Proposed Routing & Locations of Supply Alternatives

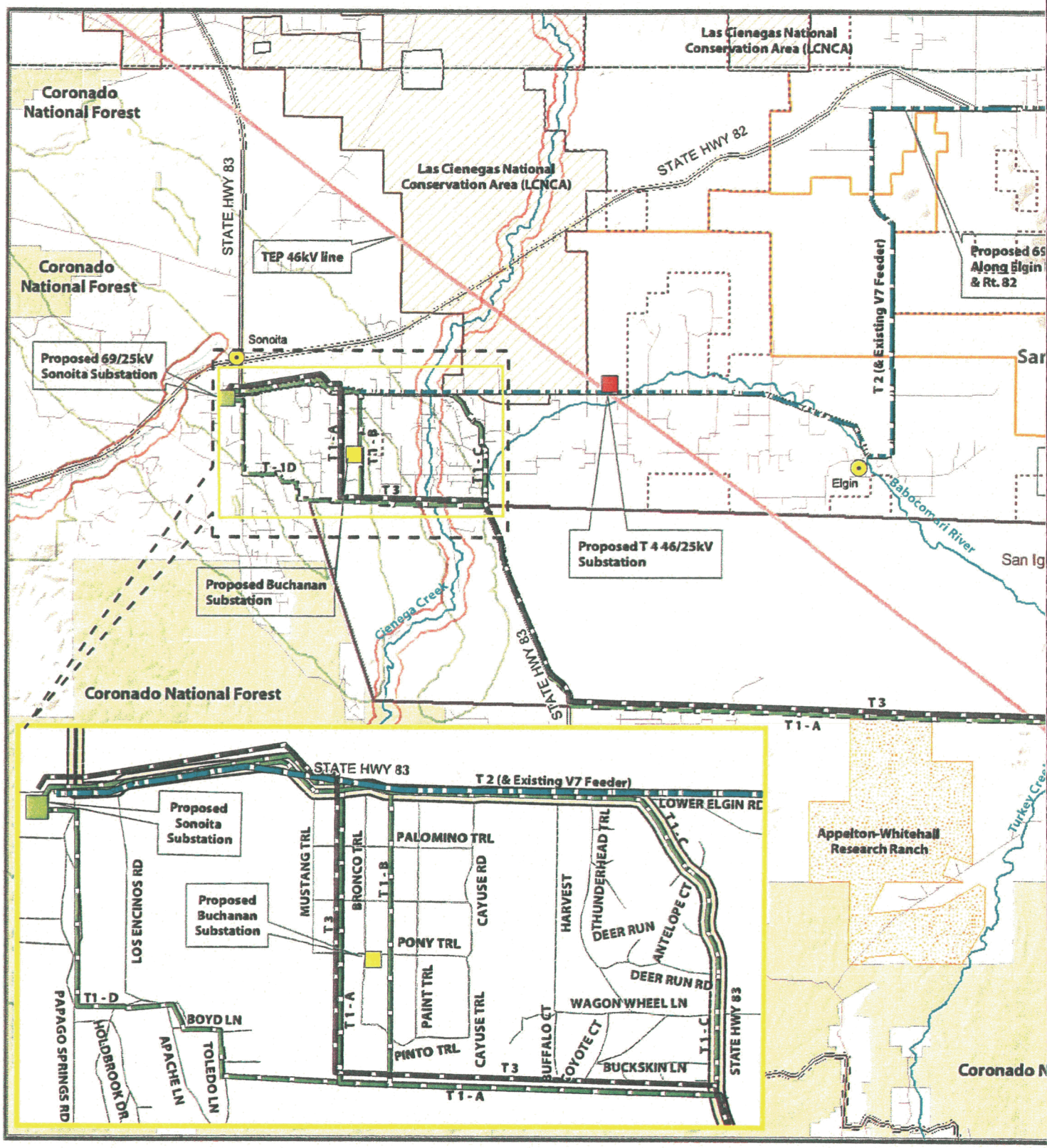
Navigant Consulting, Inc.
December 2009

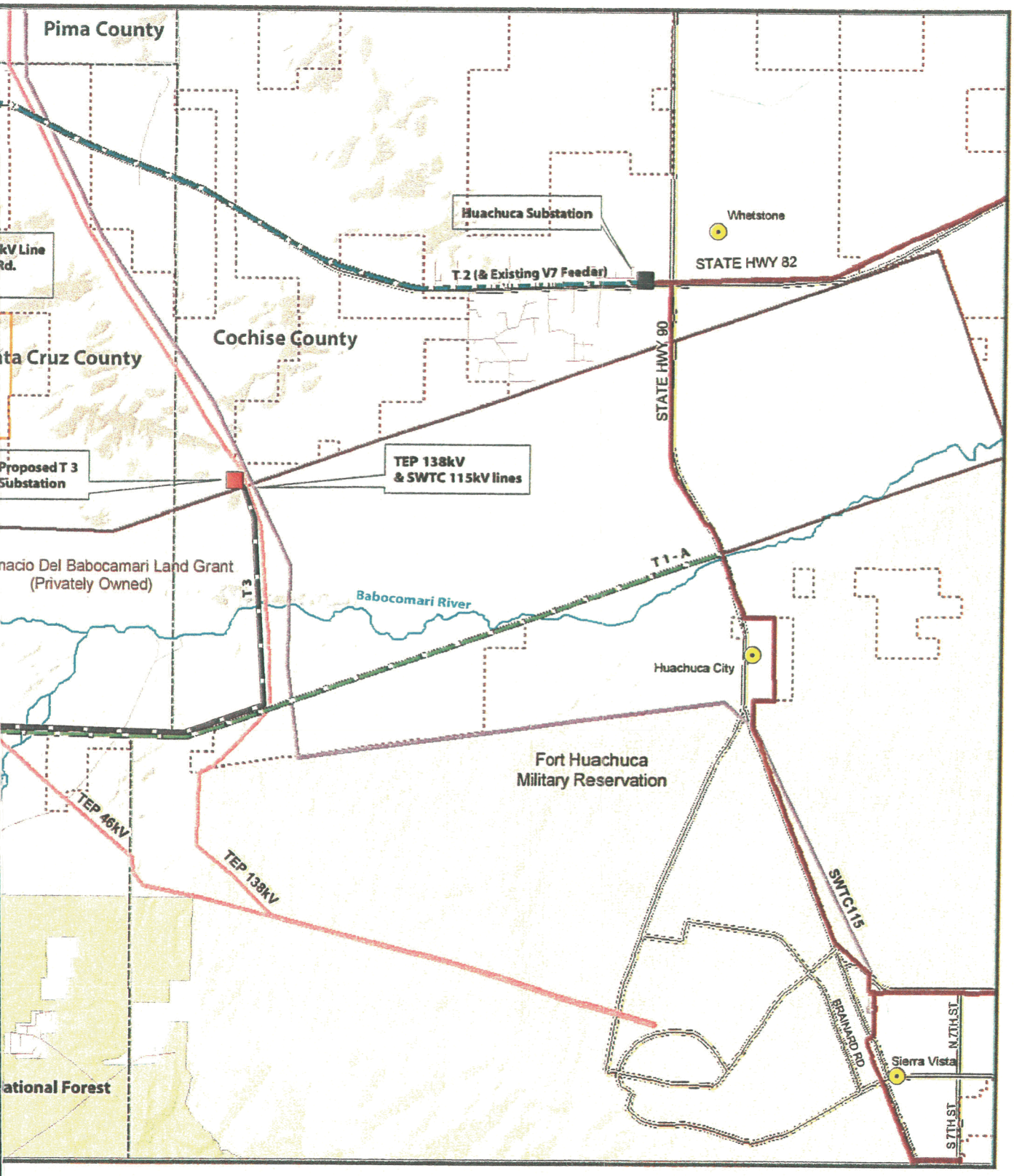
NAVIGANT
CONSULTING

Navigant Consulting, Inc.
December 2009

Independent Feasibility Study of Electric Supply Alternatives - Transmission Supply Options




Las Cienegas National Conservation Area (LCNCA)
Coronado National Forest
STATE HWY 83
STATE HWY 82
TEP 46kV line
Proposed 69/25kV Sonoita Substation
Sonoita
T 2 (& Existing V7 Feeder)
Elgin
Babocomari River
Proposed T 4 46/25kV Substation
Proposed Buchanan Substation
Cienega Creek
T1 - A
T1 - B
T1 - C
T1 - D
T3
Appelton-Whitehall Research Ranch
Proposed Sonoita Substation
LOWER ELGIN RD
PALOMINO TRL
MUSTANG TRL
BRONCO TRL
CAYUSE RD
HARVEST
THUNDERHEAD TRL
DEER RUN
ANTELOPE CT
DEER RUN RD
WAGON WHEEL LN
PONY TRL
PAINT TRL
PINTO TRL
CAYUSE TRL
BUFFALO CT
COYOTE CT
BUCKSKIN LN
LOS ENCINOS RD
PAPAGO SPRINGS RD
HOLDBROOK DR
APACHE LN
TOLEDO LN
BOYD LN
Legend
N
W
E
S
SSVEC Huachuca West Substation
Proposed Sonoita Substation
Proposed Buchanan Substation
Proposed T3 Substation
Proposed T 4 Substation
T 1
T 2 (& Existing V7 Feeder)
T 3
Existing SSVEC Transmission Line
Southwest Transmission Cooperative
Tucson Electric Power Co.
SSVEC Distribution Feeder
Appelton Research Ranch
StateLndTrust
LCNCA
Babocamari
Tumacacori-Santa Rita Area
Patagonia-Santa Rita Area
City
County Boundary
Highways
Sonoita Parcel Boundary
Watercourse



Independent Feasibility Study of Electric Supply Alternatives Transmission Supply Options

0 1 2 3 4 5 Miles

Scale - 1:95,000

1 in = 1 miles

NAVIGANT
CONSULTING

Attachment 2: Summary of Technically Feasible Supply Alternatives

Category	Transmission Supply
Description of Solution	**Option T1**: Construct New 69 kilovolt (kV) Line & Sonoita substation along the San Ignacio Del Babocomari Ranch ROW (Original SSVEC proposal). Tap 69kV SSVEC transmission line south of Whetstone; construct about 25 miles of new 69kV along southern border and along State Route (SR) R 82. Single pole, vertical construction with single-circuit construction along most of the ROW. Alternatives considered include four options for routing line through Sonoita Hills subdivision. (T1-A, T1-B, T1-C and T1-D in Attachment 1).
Project or Solution Cost	Approximately $14 million.
Length of Time Needed to Implement the Solution	Approximately 12 - 18 months for design, equipment procurement and construction.
Length of Time Option Provides a Solution for Deficiencies	30 years (or longer).
Advantages of Proposed Solution	» Provides highest level of firm capacity over 20 years » Solves most, if not all current V-7 deficiencies » Provides greatest improvement on voltage and reliability performance » May provide a solution to V-7 voltage anomalies » Reduces losses to lowest level of all solutions » Most robust option to meet unexpected changes in load » Sonoita substation in ideal location to unload and reconfigure existing feeders » Existing ROW can be used to route 69kV line Relatively minor biological and cultural impacts with cost-effective mitigation available » Right-of-way is adjacent to existing telecommunication ROW » Major sections of line not visible to public
Disadvantages of Proposed Solution	» High construction costs compared to other options » Sections of line on ROW's that are visible to customers (and where lines presently do not exist)

NAVIGANT
CONSULTING

Category	Transmission Supply
Description of Solution	**Option T2**: Construct New 69kV Line & Sonoita Substation. Tap 69kV SSVEC transmission line at Sonoita Substation; construct about 25 miles of new 69/25kV double circuit line along southern border and along Route 82. Single pole, vertical construction with double-circuit construction along the entire route.
Project or Solution Cost	Approximately $19 million.
Length of Time Needed to Implement the Solution	Approximately 16 - 24 months for design, equipment procurement and construction.
Length of Time Option Provides a Solution for Deficiencies	30 years (or longer).
Advantages of Proposed Solution	» Provides highest level of firm capacity over 20 years » Solves most, if not all current V-7 deficiencies (same as T1) » Provides greatest improvement on voltage and reliability performance (same as T1) » May provide a solution to V-7 voltage anomalies » Reduces losses to lowest level of all solutions (same as T1) » Most robust option to meet unexpected changes in load (same as T1) » Sonoita substation in ideal location to unload and reconfigure existing feeders (same as T1) » Relatively minor biological and cultural impacts with cost-effective mitigation available
Disadvantages of Proposed Solution	» Highest construction costs compared to other options » Need to obtain numerous new easements at potentially high cost and lengthy delays if condemnation is required » All sections of line on **ROW's** that are visible to customers » Construction challenges: line workers may need to work line hot » Lower reliability than T1 due to common mode outages

Category	Electric Storage Heating
Description of Solution	**Option DS2**: Aggressively pursue conversion of existing electric space heating for residential and commercial customers served by the V-7 feeder to electric storage heating. Customers would be offered incentives to replace existing space heating systems with new storage units. SSVEC would apply existing or develop new time-of-use (TOU) rates as an incentive for customers to convert existing systems. The storage units would charge during off-peak late evening and early morning hours. A minimum of 4 to 6kW per household or business would be required to justify conversion.
Project or Solution Cost	Approximately $2.5 million over 20 years.
Length of Time Needed to Implement the Solution	Approximately 12 - 18 months for appliance survey, program development and marketing, and initial customer sign-up.
Length of Time Option Provides a Solution for Deficiencies	Unknown until appliance survey is completed and customer participation level is determined.
Advantages of Proposed Solution	» Lowest cost of all solutions » Potentially avoids new construction for many years
Disadvantages of Proposed Solution	» Number of eligible heating customers unknown, including number of customers with heat pumps » Willingness of customers to participate at penetration levels high enough to meet capacity and performance requirements highly uncertain » Performance and reliability will continue to degrade to unacceptable levels if customer participation is low » New transmission may be needed if program results are lower than anticipated » Regulatory approval may be needed to authorize program incentives and TOU rates » Storage turn-on and turn-off intervals need to be carefully cycled to avoid high shoulder peaks » High penetration of electric storage may create shoulder of off-hour peaks » Length of shut-down hours may be unreasonably long as V-7 loads grow to higher levels » Off-peak losses increase due to simultaneous charging of storage units

NAVIGANT
CONSULTING

Category	Electric Heating Fuel Conversion
Description of Solution	**Option DS4**: Aggressively pursue conversion of existing electric space heating for residential and commercial customers served by the V-7 feeder to use alternate fuels. Customers would be offered incentives to replace existing space heating systems with modular propane or kerosene systems. SSVEC would offset the cost of conversion as an incentive for customers to convert existing systems. A minimum of 4 to 6kW per household or business would be required to justify conversion.
Project or Solution Cost	Approximately $2.5 million over 20 years.
Length of Time Needed to Implement the Solution	Approximately 12 - 18 months for appliance survey, program development and marketing, and initial customer sign-up.
Length of Time Option Provides a Solution for Deficiencies	Unknown until appliance survey is completed and customer participation level is determined.
Advantages of Proposed Solution	» Lowest cost of all solutions (Same as DS2) » Potentially avoids new construction for many years
Disadvantages of Proposed Solution	» Number of eligible heating customers unknown, including number of customers with heat pumps » Willingness of customers to participate at penetration levels high enough to meet capacity and performance requirements highly uncertain » Performance and reliability will continue to degrade to unacceptable levels if customer participation is low » New transmission may be needed if program results are lower than anticipated » Burning propane or kerosene will create local fossil fuel emissions » Current high fuel cost provides minimal savings compared to average retail electric rates » Customers may override systems and use electric heating for reasons of cost or convenience

NAVIGANT
CONSULTING

Category	Distributed Generation - Diesel
Description of Solution	**Option R5**: Install 2-1000kW or 4-500kW trailer or ground-mounted diesel generating units at the Sonoita substation site. Interconnect to adjacent 24.5kV distribution lines. Site improvements include fuel storage and handling systems, impenetrable berm or oil retention facility, screening and noise abatement. Also, step-up transformer and protective devices would be needed. After 10 to 15 years, increase site generation by 2000kW for a total of 4000 kW. Include SCADA and communication controls to enable remote operation by control center personnel.
Project or Solution Cost	Approximately $5.8 million over 20 years.
Length of Time Needed to Implement the Solution	Approximately 6 - 12 months depending on length of air quality permitting process
Length of Time Option Provides a Solution for Deficiencies	Up to 20 years, provided generation is permitted and allowed to operate up to 2000 hours in year 20
Advantages of Proposed Solution	» Low capital or lease cost » Sonoita site available to accommodate generation » Potentially avoids new line construction for many years
Disadvantages of Proposed Solution	» Uncertainty of air quality (or other state/local) permit requirements and operating limitations » Less reliability firm capacity than transmission options » SSVEC personnel not trained to operate and maintain fossil fuel generation » Does not materially improve feeder reliability and limited voltage support » Uncertainty as to whether unit output will reduce purchase power demand charges » Subject to fuel cost increases » Creates local fossil fuel emissions & noise » Operating hours increase significantly in later years » Minimal loss improvement in earlier years

Comparison of Feasible Supply Alternatives

Description of Solution	Solution Cost	Length of Time Needed to Implement the Solution	Length of Time Option Provides a Solution	Advantages of Proposed Solution	Disadvantages of Proposed Solution
Option T1: Construct New 69 kilovolt (kV) Line & Sonoita substation along the San Ignacio Del Babocomari Ranch, and new 69/25kV substation at Sonoita site	$14 Million	Approximately 12 - 18 months for design, equipment procurement and construction	30 years (or longer)	• Provides highest level of firm capacity over 20 years • Provides greatest improvement for voltage and reliability performance • Lowest losses of all solutions	• High construction costs compared to other options • New sections of line on some sections of ROW's are visible to customers
Option T2: Construct New 69kV Line & Sonoita Substation. Tap 69kV SSVEC transmission line at Huachuca West Substation; construct about 25 miles of new 69/25kV double circuit line along Route 82 and Elgin Road	$19 million	Approximately 16 - 24 months for design, equipment procurement and construction	30 years (or longer)	• Provides highest level of firm capacity over 20 years • Provides greatest improvement for voltage and reliability performance • Lowest losses of all solutions	• Highest construction costs compared to other options • Need to obtain numerous new & costly easements • All sections of line on ROW's are visible to customers
Option DS2: Convert electric space heating for residential and commercial customers. Customers would be offered incentives to replace existing space heating systems with new storage units.	$2.5 million	Approximately 12 - 18 months for appliance survey, program development and marketing, and initial customer sign-up	Unknown until appliance survey is completed and customer participation level is determined	• Lowest cost of all solutions • Potentially avoids new construction for many years	• Number of eligible heating customers unknown • Customer willingness to participate is uncertain • Performance and reliability will continue to degrade to if customer participation is low
Option DS4: Convert electric space heating for residential and commercial customers to use alternate fuels. Customers would be offered incentives to replace existing space heating systems with propane or kerosene units.	$2.5 million	Approximately 12 - 18 months for appliance survey, program development and marketing, and initial customer sign-up	Unknown until appliance survey is completed and customer participation level is determined	• Lowest cost of all solutions • Potentially avoids new construction for many years	• Number of eligible heating customers unknown • Customer willingness to participate is uncertain • Performance and reliability will continue to degrade to if customer participation is low
Option R5: Install 2-1000kW or 4-500kW diesel generating units at the Sonoita substation site. Interconnect to 24.9kV distribution lines. Includes fuel storage and handling systems, oil retention facility, screening and noise abatement.	$5.8 million	Approximately 6 - 12 months depending on length of air quality permitting process	Up to 20 years, provided generation is allowed to operate up to 2000 hours in year 20	• Low capital or lease cost • Sonoita site available to accommodate generation • Potentially avoids new line construction for many years	• Uncertainty of air quality or other permit requirements • Less reliable firm capacity than transmission options • Does not materially improve feeder reliability and voltage

NAVIGANT
CONSULTING

Attachment 4: Photographs

Navigant Consulting, Inc.
December 2009

Photo 1: View from Lower Elgin Road showing typical landscape character of project area.

Photo 2: View from Babocomari Ranch.

Photo 3: View from SR-83 in Sonoita with hillside rural residences.

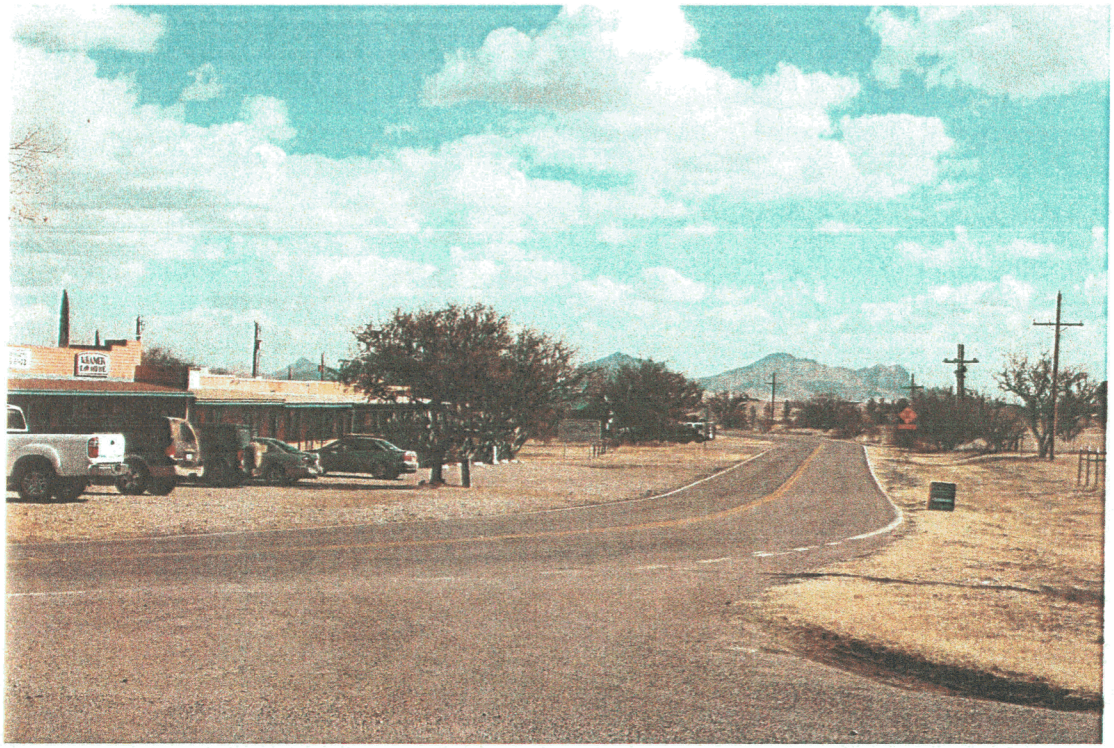


Photo 4: View along SR-83 with commercial development in Sonoita.

Photo 5: View from Broncho Trail near Pony Trail with rural residences near the proposed and undeveloped Buchanan Substation site.

Photo 6: View along SR-90 in Huachuca City.

Photo 7: View of Babacomari Ranch with rural residence.

Photo 8: View from Babacomari Ranch with existing transmission lines and wood support structures.

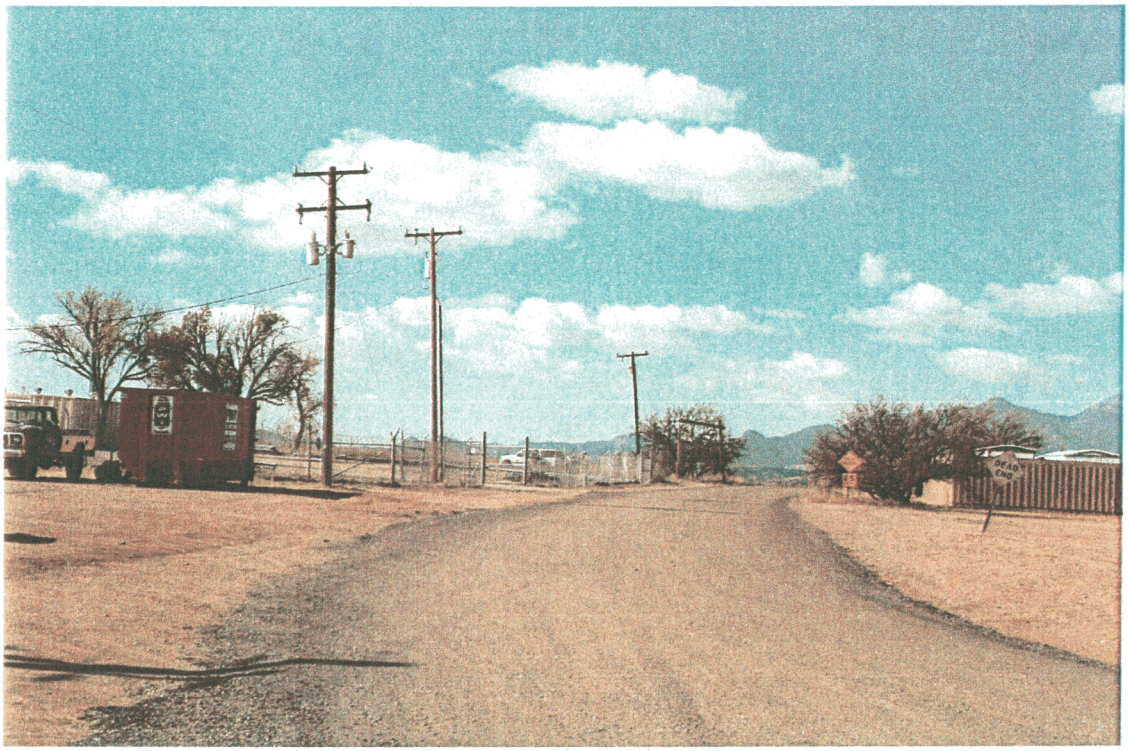


Photo 9: View toward new Sonoita Substation site from Old Sonoita Highway at SR-83.

NAVIGANT
CONSULTING

Attachment 4: Previously Recorded Archaeological Sites and Studies in the General Area

Navigant Consulting, Inc.
December 2009

Summary of previously recorded sites within a half mile radius of the proposed T1 route:

AZ EE:6:43(ASM) - This site consists of historic road segments dating to pre-1958 and paralleling State Route 82. Stone (1992-153.ASM) states that it is considered to be potentially eligible for inclusion in the NRHP; however, later annotations in the report mention that it is no longer considered a site. Railey and Yost (2003-910.ASM) identified the road segments within their project area and agreed with earlier recommendations that it is potentially eligible for the NRHP under Criterion D (that have yielded, or may be likely to yield, information important in prehistory or history).

AZ EE:7:176(ASM) - The site consists of segments of an historic road that represent parts of the original State Route 90 which was built prior to 1940 and reconstructed in 1960s. The road segments have been recommended as potentially eligible for listing on the NRHP (Wright 1992-268.ASM). Sites AZ EE:7:175 and AZ EE:7:176 appear to represent segments of the same historic era road grade.

AZ EE:7:261(ASM) – This is a prehistoric site with architectural remains. It includes cobble alignments, approximately 15 house pit depressions, pottery, groundstone and flaked stone artifacts. Portions of the site were excavated in 1996 by Allen Denoyer prior to the land owners' development of the parcel (Heckman and Denoyer 1996). There is no information regarding the NRHP eligibility of the site.

AZ EE:7:263(ASM) – The site consists of three small rock features of unknown age and function. They represent small rock piles without associated artifacts which could be either prehistoric or historic in origin. Kayser and Serrano (1999-337.ASM) recommended that they be considered potentially eligible for the NRHP under Criterion D pending further study.

AZ EE:7:1(ASM) – This site was recorded in 1937 and described as a village (Babacomari Village) with probable shallow pit houses, with abundant ceramics (Gila polychrome, red-on-brown plain ware and an unidentified polychrome) and groundstone. There is no information regarding the NRHP eligibility of the site.

AZ EE:7:2(ASM) – This site was recorded in 1937 and described as a village with a walled enclosure (possible corral of adobe) with fairly abundant pottery (Gila Polychrome and red-on-brown) and flaked stone artifacts. There is no information regarding the NRHP eligibility of the site.

AZ EE:7:3(ASM) – This site recorded in 1937 is described as being covered with overburden and likely secondarily deposited. Pottery is not very abundant, but shells and a possible bison

1988-79.ASM
This project consisted of a 2.5 acre survey by John Douglas for a property development. No sites were identified but isolates consisting of eight flakes and two cores were noted.

1992-153.ASM
This five mile linear survey was conducted by Lyle Stone for the ADOT for a highway maintenance project. Two sites and four isolates were identified including Sites AZ EE:6:43 and AZ EE:6:44 both of which are within the proposed project area and were considered to be potentially eligible for inclusion in the NRHP pending evaluation. As previously noted, the report was later annotated to state that Site AZ EE:6:43 is no longer considered a site.

1992-268.ASM
This linear survey of 24 miles of the State Route 90 right-of-way was conducted by Thomas Wright for the ADOT in advance of a highway widening project. Six archaeological sites were identified including one within the proposed project area, Site AZ EE:7:175, which was considered potentially NRHP eligible.

1993-74.ASM
This project consists of a linear survey of 12.3 miles along State Route 82 conducted by Lyle Stone for the ADOT for a proposed pavement preservation undertaking. Two historic sites were identified but not within the proposed project area.

2001-39.ASM
This 96 acre survey was conducted by Laurens Hammack for FNF Construction, Inc. for the expansion of an existing materials source and related access roads. No resources were identified during the survey.

2003-910.ASM
TRC Environmental Corporation conducted a 489 mile long linear survey for a proposed fiber optic line across Arizona and New Mexico. A total of 95 sites were identified along the survey within Arizona including two sites in the proposed project area (AZ EE:4:43 and AZ EE:6:43) both of which were recommended as eligible or potentially eligible for the NRHP.

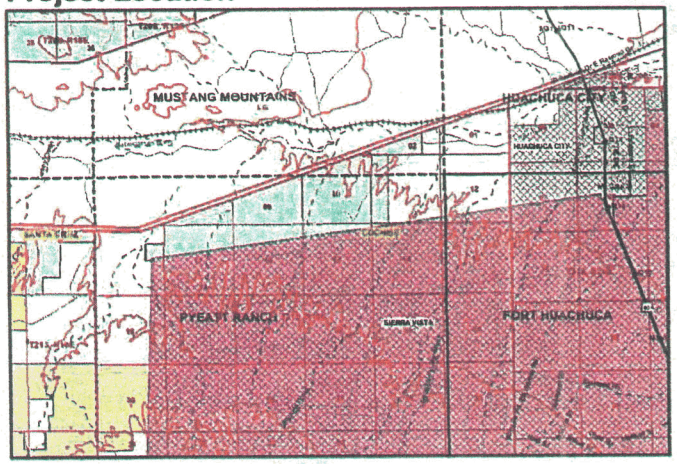
NAVIGANT
CONSULTING

Attachment 5: Arizona Game and Fish Department's (AGFD) and U.S. Fish and Wildlife Service (USFWS) - Species List

Navigant Consulting, Inc.
December 2009

Arizona's On-line Environmental Review Tool
Search ID: 20091120010672
Project Name: Sonoita Reliability Project-east
Date: 11/20/2009 9:50:43 AM

Project Location



Project Name: Sonoita Reliability Project-east
Submitted By: Robin Llewellyn
On behalf of: CONSULTING
Project Search ID: 20091120010672
Date: 11/20/2009 9:50:37 AM
Project Category: Energy Storage/Production/Transfer,Energy Transfer,Power line/electric line (new)
Project Coordinates (UTM Zone 12-NAD 83): 554630.024, 3499076.389 meter
Project Length: 14017.526 meter
County: COCHISE,SANTA CRUZ
USGS 7.5 Minute Quadrangle ID: 1890
Quadrangle Name: MUSTANG MOUNTAINS
Project locality is currently being scoped

Location Accuracy Disclaimer

Project locations are assumed to be both precise and accurate for the purposes of environmental review. The creator/owner of the Project Review Receipt is solely responsible for the project location and thus the correctness of the Project Review Receipt content.

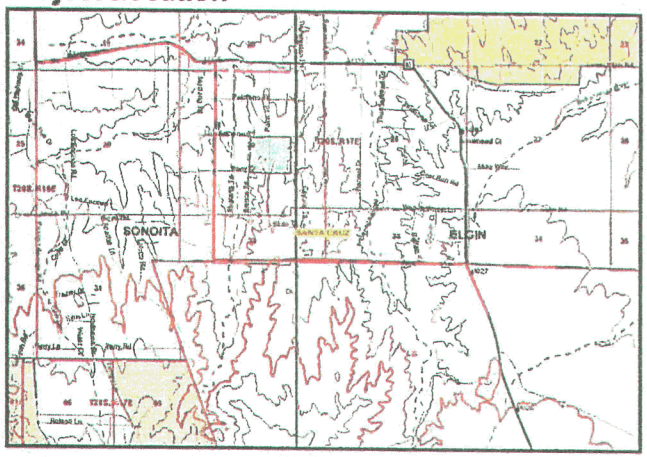
The Department appreciates the opportunity to provide in-depth comments and project review when additional information or environmental documentation becomes available.

Special Status Species Occurrences/Critical Habitat/Tribal Lands within 3 miles of Project Vicinity:

Name	Common Name	ESA	USFS	BLM	State
Agosia chrysogaster chrysogaster	Gila Longfin Dace	SC		S	
Ammodramus bairdii	Baird's Sparrow	SC		S	WSC
Anthus spragueii	Sprague's Pipit				WSC
Asclepias uncialis	Greene Milkweed	SC	S		
Buteo nitidus maxima	Northern Gray Hawk	SC	S	S	WSC
Buteo swainsoni	Swainson's Hawk			S	
CH for Gila intermedia	Designated Critical Habitat for Gila chub				
Catostomus clarkii	Desert Sucker	SC		S	
Catostomus insignis	Sonora Sucker	SC		S	
Coccyzus americanus	Yellow-billed Cuckoo (Western U.S. DPS)	C			WSC
Cyprinodon macularius	Desert Pupfish	LE			WSC
Erigeron arisolius			S		
Gila intermedia	Gila Chub	LE	S		WSC
Hedeoma dentatum	Mock-pennyroyal		S		
Lilaeopsis schaffneriana var. recurva	Huachuca Water Umbel	LE			HS
Lithobates chiricahuensis	Chiricahua Leopard Frog	LT	S		WSC
Myotis velifer	Cave Myotis	SC			
Pectis imberbis	Beardless Chinch Weed	SC	S		
Rana yavapaiensis	Lowland Leopard Frog	SC	S	S	WSC
Spiranthes delitescens	Madrean Ladies'-tresses	LE			HS
Sympetrum signiferum	Spot-winged Meadowhawk		S		
Talinum humile	Pinos Altos Flame Flower	SC	S		SR
Thamnophis eques megalops	Brown Gartersnake	C	S		WSC

Arizona's On-line Environmental Review Tool
Search ID: 20091118010624
Project Name: Sonoita Reliability Project
Date: 11/18/2009 11:29:27 AM

Project Location



Project Name: Sonoita Reliability Project
Submitted By: Robin Llewellyn
On behalf of: CONSULTING
Project Search ID: 20091118010624
Date: 11/18/2009 11:29:20 AM
Project Category: Energy Storage/Production/Transfer,Energy Transfer,Power line/electric line (new)
Project Coordinates (UTM Zone 12-NAD 83): 531859.006, 3507310.531 meter
Project Length: 7742.726 meter
County: SANTA CRUZ
USGS 7.5 Minute Quadrangle ID: 1894
Quadrangle Name: SONOITA
Project locality is not anticipated to change

Location Accuracy Disclaimer

Project locations are assumed to be both precise and accurate for the purposes of environmental review. The creator/owner of the Project Review Receipt is solely responsible for the project location and thus the correctness of the Project Review Receipt content.

The Department appreciates the opportunity to provide in-depth comments and project review when additional information or environmental documentation becomes available.

Special Status Species Occurrences/Critical Habitat/Tribal Lands within 3 miles of Project Vicinity:

Name	Common Name	ESA	USFS	BLM	State
Ammodramus bairdii	Baird's Sparrow	SC		S	WSC
Anthus spragueii	Sprague's Pipit				WSC
Asclepias uncialis	Greene Milkweed	SC	S		
CH for Lilaeopsis schaffneriana var. recurva	Designated Critical Habitat for Huachuca water umbel				
Choeronycteris mexicana	Mexican Long-tongued Bat	SC		S	WSC
Hedeoma dentatum	Mock-pennyroyal		S		
Heterotheca rutteri	Huachuca Golden Aster	SC	S	S	
Lampropeltis getula nigrita	Western Black Kingsnake		S		
Lilaeopsis schaffneriana var. recurva	Huachuca Water Umbel	LE			HS
Patagonia - Santa Rita Linkage Design	Wildlife Corridor				
Santa Rita - Tumacacori Linkage Design	Wildlife Corridor				
Sigmodon ochrognathus	Yellow-nosed Cotton Rat	SC			
Talinum humile	Pinos Altos Flame Flower	SC	S		SR
Talinum marginatum	Tepic Flame Flower	SC	S		SR

Cochise County

COMMON NAME	SCIENTIFIC NAME	STATUS	DESCRIPTION	COUNTY	ELEVATION	HABITAT	COMMENTS
Beautiful shiner	*Cyprinella formosa*	Threatened	Small (2.5 inches) shiny minnow, very similar to red shiner. Males colorful during breeding (yellow-orange or orange on caudal and lower fins, bluish body).	Cochise	< 4,500 ft	Small to medium sized streams and ponds with sand, gravel, and rock bottoms.	Virtually extirpated in the United States, with the exception of a few populations on San Bernardino National Wildlife Refuge. Same critical habitat as Yaqui Chub and Catfish (see 49 FR 34490, 08-31-84).
Canelo Hills ladies' tresses	*Spiranthes delitescens*	Endangered	Slender, erect member of the orchid family (Orchidaceae). Flower stalk 20 inches tall, may contain 40 white flowers spirally arranged on the flowering stalk.	Cochise, Santa Cruz	~ 5,000 ft	Finely grained, highly organic, saturated soils of cienegas.	Found in the San Pedro watershed. Potential habitat occurs in Sonora, Mexico, but no populations have been found.
Chiricahua leopard frog	*Lithobates [Rana] chiricahuensis*	Threatened	Cream colored tubercles (spots) on a dark background on the rear of the thigh, dorsolateral folds that are interrupted and deflected medially, and a call given out of water distinguish this spotted frog from other leopard frogs.	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Navajo, Pima, Santa Cruz, Yavapai	3,300-8,900 ft	Streams, rivers, backwaters, ponds, and stock tanks that are mostly free from introduced fish, crayfish, and bullfrogs.	Require permanent or nearly permanent water sources. Populations north of the Gila River may be a closely-related, but distinct, undescribed species. A special rule allows take of frogs due to operation and maintenance of livestock tanks on State and private lands.
Cochise pincushion cactus	*Coryphantha robbinsorum*	Threatened	A small unbranched cactus with no central spines and 11-17 white radial spines. The bell-shaped flowers are borne on the ends of tubercles (protrusions). Flowers: bell shaped, pale yellow-green. Fruits: orange-red to red.	Cochise	> 4,200 ft	Semidesert grassland with small shrubs, agave, other cacti, and grama grass.	Grows on gray limestone hills. Species also occurs in Sonora, Mexico

COMMON NAME	SCIENTIFIC NAME	STATUS	DESCRIPTION	COUNTY	ELEVATION	HABITAT	COMMENTS
Desert pupfish	*Cyprinodon macularius*	Endangered	Small (2 inches) smoothly rounded body shape with narrow vertical bars on the sides. Breeding males blue on head and sides with yellow on tail. Females and juveniles tan to olive colored back and silvery sides.	Cochise, Graham, Maricopa, Pima, Pinal, Santa Cruz, Yavapai	< 4,000 ft	Shallow springs, small streams, and marshes. Tolerates saline and warm water.	Two subspecies are recognized: Desert Pupfish (C.m. macularis) and Quitobaquito Pupfish (C.m. eremus). Critical habitat includes Quitobaquito Springs, Pima County, portions of San Felipe Creek, Carrizo Wash, and Fish Creek Wash, Imperial County, California.
Gila chub	*Gila intermedia*	Endangered	Deep compressed body, flat head. Dark olive-gray color above, silver sides. Endemic to Gila River Basin.	Cochise, Gila, Graham, Greenlee, Pima, Pinal, Santa Cruz, Yavapai	2,000-5,500 ft	Pools, springs, cienegas, and streams.	Found on multiple private lands, including the Nature Conservancy and the Audubon Society. Also occurs on Federal and state lands and in Sonora, Mexico. Critical habitat occurs in Cochise, Gila, Graham, Greenlee, Pima, Pinal, Santa Cruz, and Yavapai counties.
Gila topminnow	*Poeciliopsis occidentalis occidentalis*	Endangered	Small (2 inches), guppy-like, live bearing, lacks dark spots on its fins. Breeding males are jet black with yellow fins.	Cochise, Gila, Graham, Maricopa, Pima, Santa Cruz, Yavapai	< 4,500 ft	Small streams, springs, and cienegas vegetated shallows.	Species historically also occurred in backwaters of large rivers but is currently isolated to small streams and springs.
Huachuca water umbel	*Lilaeopsis schaffneriana ssp. recurva*	Endangered	Herbaceous, semi-aquatic perennial in the parsley family (Umbelliferae) with slender erect, hollow, leaves that grow from the nodes of creeping rhizomes. Flower: 3 to 10 flowered umbels arise from root nodes.	Cochise, Pima, Santa Cruz	3,500-6,500 ft	Cienegas, perennial low gradient streams, wetlands.	Species also occurs in adjacent Sonora, Mexico, west of the continental divide. Critical habitat in Cochise and Santa Cruz counties (64 FR 37441, July 12, 1999).
Jaguar	*Panthera onca*	Endangered	Largest species of cat native to Southwest. Muscular, with relatively short, massive limbs, and a deep-chested body. Usually cinnamon-buff in color with many black spots. Weights ranges from 90-300 lbs.	Cochise, Santa Cruz, Pima	1,600-9,000 ft	Found in Sonoran desertscrub up through subalpine conifer forest.	Also occurs in New Mexico. A Jaguar conservation team is being formed that is being led by Arizona and New Mexico state entities along with private organizations.

COMMON NAME	SCIENTIFIC NAME	STATUS	DESCRIPTION	COUNTY	ELEVATION	HABITAT	COMMENTS
Lesser long-nosed bat	*Leptonycteris curasoae yerbabuenae*	Endangered	Elongated muzzle, small leaf nose, and long tongue. Yellowish brown or gray above and cinnamon brown below. Tail minute and appears to be lacking. Easily disturbed.	Cochise, Gila, Graham, Greenlee, Maricopa, Pima, Pinal, Santa Cruz, Yuma	1,600-11,500 ft	Desert scrub habitat with agave and columnar cacti present as food plants.	Day roosts in caves and abandoned tunnels. Forages at night on nectar, pollen, and fruit of paniculate agaves and columnar cacti. This species is migratory and is present in Arizona usually from April to September and south of the border the remainder of the year.
Loach minnow	*Tiaroga cobitis*	Threatened	Small (<3 inches) slender, elongated fish, olive colored with dirty white spots at the base of the dorsal and caudal fins. Breeding males vivid red on mouth and base of fins.	Apache, Cochise, Gila, Graham, Greenlee, Navajo, Pinal	< 8,000 ft	Benthic species of small to large perennial streams with swift shallow water over cobble and gravel. Recurrent flooding and natural hydrograph important.	Presently found in Aravaipa Creek, Deer Creek, Turkey Creek, Blue River, Campbell Blue Creek, San Francisco River, Eagle Creek, North Fork of the East Fork Black River, and White River in Arizona, and Dry Blue Creek, Pace Creek, Frieborn Creek, the Tularosa River, West Fork Gila River, and the mainstem upper Gila River in New Mexico. Populations have been recently reintroduced in Hot Springs and Redfield canyons in Cochise and Graham counties; Fossil Creek in Gila County; and Bonita Creek in Graham County Arizona. Critical habitat (72 FR 13356-13422, March 21, 2007) found in Apache, Graham, Greenlee, and Pinal counties, Arizona, as well as portions of the Blue River, San Francisco River, Tularosa River, Negrito Creek, Pace Creek, Dry Blue Creek, Frieborn Creek, Whitewater Creek, Gila River, and its West, Middle, and East Forks in Catron, Grant, and Hidalgo counties in New Mexico.
Mexican spotted owl	*Strix occidentalis lucida*	Threatened	Medium sized with dark eyes and no ear tufts. Brownish and heavily spotted with white or beige.	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai	4,100-9,000 ft	Nests in canyons and dense forests with multi-layered foliage structure.	Generally nest in older forests of mixed conifer or ponderosa pine/gambel oak type, in canyons, and use variety of habitats for foraging. Sites with cool microclimates appear to be of importance or are preferred. Critical habitat was finalized on August 31, 2004 (69 FR 53182) in Arizona in Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Navajo, Pima, Pinal, Santa Cruz, and Yavapai counties.

COMMON NAME	SCIENTIFIC NAME	STATUS	DESCRIPTION	COUNTY	ELEVATION	HABITAT	COMMENTS
New Mexico ridge-nosed rattlesnake	*Crotalus willardi obscurus*	Threatened	Small 12-24 inches, secretive grayish-brown with a distinct ridge on the end of the snout. The dorsal surface has obscure, irregularly spaced white crossbars edged with brown (not a bold pattern).	Cochise	5,000-6,600 ft	Primarily canyon bottoms in pine-oak communities.	The subspecies has been documented in the Peloncillo Mountains in Arizona. There are only three known records from Arizona. Also occurs in Animas Mountains of New Mexico and Sierra San Luis in Sonora/Chihuahua.
Northern aplomado falcon	*Falco femoralis septentrionalis*	Endangered	Rufus underparts, gray back, long banded tail, and a distinct black and white facial pattern. Smaller than peregrine falcon but larger than a kestrel. Breeds between March and June.	Currently extirpated from AZ with unconfirmed sightings occasionally reported in Cochise County.	3,500-9,000 ft	Grassland and savannah	Non-essential experimental population designated in Arizona and New Mexico in 2006. Species formerly nested in southwestern U.S., now rarely occurs. Good habitat has low ground cover and mesquite or yucca for nesting platforms. Pesticide use in Mexico had endangered this species but DDT use is now banned there. Reintroductions are occurring in New Mexico and Texas. One confirmed sighting in AZ occurred in recent years.
Ocelot	*Leopardus (=Felis) pardalis*	Endangered	Medium-sized spotted cat that is yellowish with black streaks and stripes running from front to back. Tail is spotted and about 1/2 the length of head and body. Face is less heavily streaked than the back and sides.	Cochise, Pima, Santa Cruz	< 8,000 ft	Desert scrub in Arizona. Humid tropical and sub-tropical forests, and savannahs in areas south of the U.S.	May persist in partly-cleared forests, second-growth woodland, and abandoned cultivated areas reverted to brush. Universal component is presence of dense cover. Unconfirmed reports of individuals in the southern part of the State continue to be received.
Sonoran tiger salamander	*Ambystoma mavortium stebbinsi*	Endangered	Large, light-colored blotches or reticulations on a dark background. Metamorphosed individuals are 1.8 to 5.9 inches in snout-vent length. Aquatic larvae are uniform dark colored with plume-like gills and developed tail fins.	Cochise, Santa Cruz	4,000-6,300 ft	Stock tanks and impounded cienegas; rodent burrows, rotted logs, and other moist cover sites.	Populations occur within the headwaters of the Santa Cruz and San Pedro Rivers. These include San Rafael Valley and in the foothills of the east slope of the Patagonia and Huachuca Mountains and Fort Huachuca.

COMMON NAME	SCIENTIFIC NAME	STATUS	DESCRIPTION	COUNTY	ELEVATION	HABITAT	COMMENTS
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Small passerine (about 6 inches) grayish-green back and wings, whitish throat, light olive-gray breast and pale yellowish belly. Two wingbars visible. Eye-ring faint or absent.	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma	< 8,500 ft	Cottonwood/willow and tamarisk vegetation communities along rivers and streams.	Migratory riparian-obligate species that occupies breeding habitat from late April to September. Distribution within its range is restricted to riparian corridors. Difficult to distinguish from other members of the Empidonax complex by sight alone. Training seminar required for those conducting flycatcher surveys. Critical habitat was finalized on October 19, 2005 (50 CFR 60886). In Arizona there are critical habitat segments in Apache, Cochise, Gila, Graham, Greenlee, Maricopa, Mohave, Pima, Pinal, and Yavapai counties.
Spikedace	*Meda fulgida*	Threatened	Small (<3 inches) slim fish with silvery sides and "spine" on dorsal fin. Breeding males are a brassy golden color.	Cochise, Gila, Graham, Greenlee, Pinal, Yavapai	< 6,000 ft	Medium to large perennial streams with moderate to swift velocity waters over cobble and gravel substrate. Recurrent flooding and natural hydrograph important to withstand invading exotic species.	Presently found in Aravaipa Creek, Eagle Creek, Verde River, and the Gila River from the San Pedro River to Ashurst-Hayden Dam in Arizona, and the Gila River and its East and West Forks in New Mexico. Populations have been recently reintroduced in Hot Springs and Redfield canyons in Cochise and Graham counties; Fossil Creek in Gila County; and Bonita Creek in Graham County Arizona. Critical habitat (72 FR 13356-13422, March 21, 2007) in Graham, Greenlee, Pinal, and Yavapai counties in Arizona, and in Catron, Grant, and Hidalgo counties in New Mexico.
Yaqui catfish	*Ictalurus pricei*	Threatened	Similar to channel catfish (Ictalurus punctatus) except anal fin base is shorter and the distal margin of the anal fin is broadly rounded with 23-25 soft rays. Body usually profusely speckled.	Cochise	4,000-5,000 ft	Moderate to large streams with slow current over sand and rock bottoms.	Critical habitat includes all aquatic habitats on San Bernadino National Wildlife Refuge.
Yaqui chub	*Gila purpurea*	Endangered	Medium sized minnow (<6 inches) dark colored, lighter below. Dark triangular caudal spot.	Cochise	4,000-6,000 ft	Deep pools of small streams near undercut banks and debris; pools associated with springheads, and artificial ponds.	Introduced populations exist in Leslie Canyon, in San Bernardino National Wildlife Refuge, and ponds and mainstem of West Turkey Creek in the Chiricahua Mountains. Critical habitat includes all aquatic habitats on San Bernardino National Wildlife Refuge.

COMMON NAME	SCIENTIFIC NAME	STATUS	DESCRIPTION	COUNTY	ELEVATION	HABITAT	COMMENTS
Yaqui topminnow	*Poeciliopsis occidentalis sonoriensis*	Endangered	Small (2 inches) guppy-like, live bearing fish (lacking dark spots on fins). Breeding males are jet black with yellow fins.	Cochise	< 4,500 ft	Small to moderate sized streams, springs, and cienegas. Generally found in shallow areas with aquatic vegetations or debris. Tolerates relatively high water temperature and low dissolved oxygen.	Natural and introduced populations occur on San Bernardino National Wildlife Refuge and an introduced population is found in Leslie Canyon. Populations also exist in Mexico.
Arizona treefrog (Huachuca/Canelo DPS)	*Hyla wrightorum*	Candidate	Small (1.8 inches in length) green frog; dark eye stripe extends past shoulder onto the sides of the body, may break into spots or dashes past shoulder, throat on males dusky green or tan; larger tadpoles golden brown above and below with mottled black tails.	Cochise, Santa Cruz	5,000-8,500 ft	Madrean oak woodlands, savannah, pine-oak woodlands, and mixed conifer forests.	Known from less than 20 localities in the Huachuca Mountains and adjacent Canelo Hills. Believed this population is geographically disjunct from the other known locality in the wetlands at Rancho Los Fresnos, Sonora, Mexico.
Huachuca springsnail	*Pyrgulopsis thompsoni*	Candidate	Very small (.06-.12 inches) conical shell. Identification must be verified by characteristics of reproductive organs.	Cochise, Santa Cruz	4,500-7,200 ft	Aquatic areas, small springs with vegetation and slow to moderate flow.	Individuals found on firm substances (roots, wood, and rocks). Other populations found on Fort Huachuca.
Lemmon fleabane	*Erigeron lemmonii*	Candidate	A prostrate perennial in the sunflower family. Stems and leaves are densely hairy. Flowers look like small delicate daisies, with white to light purple outer petals and yellow inner petals.	Cochise	1,500-6,000 ft	Grows in dense clumps in crevices, ledges, and boulders in canyon bottoms in pine-oak woodland.	Found only at one site on Fort Huachuca.
Northern Mexican Gartersnake	*Thamnophis eques megalops*	Candidate	Background color ranges from olive, olive-brown, to olive-gray. Body has three yellow or light colored stripes running down the length of the body, darker towards tail. Species distinguished from other native gartersnakes by the lateral stripes reaching the 3rd and 4th scale rows. Paired black spots extend along dorsolateral fields.	Apache, Cochise,Coconino, Gila, Graham, Navajo, Pima, Pinal, Santa Cruz, Yavapai	130-8,500 ft	Cienegas, stock tanks, large-river riparian woodlands and forests, streamside gallery forests.	Core population areas in the U.S. include mid/upper Verde River drainage, mid/lower Tonto Creek, and the San Rafael Valley and surrounding area. Status on tribal lands unknown. Distributed south into Mexico along the Sierra Madre Occidental and Mexican Plateau. Strongly associated with the presence of a native prey base including leopard frogs and native fish.

COMMON NAME	SCIENTIFIC NAME	STATUS	DESCRIPTION	COUNTY	ELEVATION	HABITAT	COMMENTS
San Bernardino springsnail	*Pyrgulopsis bernardina*	Candidate	Aquatic snail of family Hydrobiidae. Narrow-conic shell; height 1.3-1.7 mm; 3.25-4.0 whorls.	Cochise	3,806 ft	Springs with firm substrate composed of cobble, gravel, woody debris, and aquatic vegetation.	Distribution limited to Snail Spring on Slaughter Ranch in southeastern Arizona.
Yellow-billed cuckoo	*Coccyzus americanus*	Candidate	Medium-sized bird with a slender, long-tailed profile, slightly down-curved bill that is blue-black with yellow on the lower half. Plumage is grayish-brown above and white below, with rufous primary flight feathers.	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma	< 6,500 ft	Large blocks of riparian woodlands (cottonwood, willow, or tamarisk galleries).	Neotropical migrant that winters primarily in South America and breeds primarily in the U.S. (but also in southern Canada and northern Mexico). As a migrant it is rarely detected; can occur outside of riparian areas. Cuckoos are found nesting statewide, mostly below 5,000 feet in central, western, and southeastern Arizona. Concern for cuckoos are primarily focused upon alterations to its nesting and foraging habitat. Nesting cuckoos are associated with relatively dense, wooded, streamside riparian habitat, with varying combinations of Fremont cottonwood, willow, velvet ash, Arizona walnut, mesquite, and tamarisk. Some cuckoos have also been detected nesting in velvet mesquite, netleaf hackberry, Arizona sycamore, Arizona alder, and some exotic neighborhood shade trees.
Ramsey Canyon leopard frog	*Rana subaquavocalis*	Conservation Agreement	Brown or green frog, 2.5 to 4 inches long; rear thigh pattern formed by small, raised cream-colored spots on a dark background; dorsolateral folds are interrupted posteriorly and deflected medially; relatively rough-skinned; knob-like terminal swellings on toes; stocky body proportions.	Cochise	4,924-6,000 ft	Aquatic systems, primarily ponds, in pine-oak and oak woodlands and semi-desert grasslands.	Known from six localities in canyons on the southeastern portion of the Huachuca Mountains (Ash, Miller, Carr, Ramsey, Brown, and Tinker). A Conservation Agreement and Conservation Assessment and Strategy was finalized in August 2007, which renews the former agreement that was signed in 1996.

COMMON NAME	SCIENTIFIC NAME	STATUS	DESCRIPTION	COUNTY	ELEVATION	HABITAT	COMMENTS
American peregrine falcon	*Falco pereginus anatum*	Delisted	A crow-sized falcon with slate blue-gray on the back and wings, and white on the underside; a black head with vertical "bandit's mask" pattern over the eyes; long pointed wings; and a long wailing call made during breeding. Very adept flyers and hunters, reaching diving speeds of 200 mph.	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma	3,500-9,000 ft	Areas with rocky, steep cliffs, primarily near water, where prey (primarily shorebirds, songbirds, and waterfowl) concentrations are high. Nests are found on ledges of cliffs, and sometimes on man-made structures such as office towers and bridge abutments.	Species recovered with over 1,650 breeding birds in the US and Canada.

Santa Cruz County

COMMON NAME	SCIENTIFIC NAME	STATUS	DESCRIPTION	COUNTY	ELEVATION	HABITAT	COMMENTS
Canelo Hills ladies' tresses	*Spiranthes delitescens*	Endangered	Slender, erect member of the orchid family (Orchidaceae). Flower stalk 20 inches tall, may contain 40 white flowers spirally arranged on the flowering stalk.	Cochise, Santa Cruz	~ 5,000 ft	Finely grained, highly organic, saturated soils of cienegas.	Found in the San Pedro watershed. Potential habitat occurs in Sonora, Mexico, but no populations have been found.
Chiricahua leopard frog	*Lithobates [Rana] chiricahuensis*	Threatened	Cream colored tubercles (spots) on a dark background on the rear of the thigh, dorsolateral folds that are interrupted and deflected medially, and a call given out of water distinguish this spotted frog from other leopard frogs.	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Navajo, Pima, Santa Cruz, Yavapai	3,300-8,900 ft	Streams, rivers, backwaters, ponds, and stock tanks that are mostly free from introduced fish, crayfish, and bullfrogs.	Require permanent or nearly permanent water sources. Populations north of the Gila River may be a closely-related, but distinct, undescribed species. A special rule allows take of frogs due to operation and maintenance of livestock tanks on State and private lands.
Desert pupfish	*Cyprinodon macularius*	Endangered	Small (2 inches) smoothly rounded body shape with narrow vertical bars on the sides. Breeding males blue on head and sides with yellow on tail. Females and juveniles tan to olive colored back and silvery sides.	Cochise, Graham, Maricopa, Pima, Pinal, Santa Cruz, Yavapai	< 4,000 ft	Shallow springs, small streams, and marshes. Tolerates saline and warm water.	Two subspecies are recognized: Desert Pupfish (C.m. macularis) and Quitobaquito Pupfish (C.m. eremus). Critical habitat includes Quitobaquito Springs, Pima County, portions of San Felipe Creek, Carrizo Wash, and Fish Creek Wash, Imperial County, California.
Gila chub	*Gila intermedia*	Endangered	Deep compressed body, flat head. Dark olive-gray color above, silver sides. Endemic to Gila River Basin.	Cochise, Gila, Graham, Greenlee, Pima, Pinal, Santa Cruz, Yavapai	2,000-5,500 ft	Pools, springs, cienegas, and streams.	Found on multiple private lands, including the Nature Conservancy and the Audubon Society. Also occurs on Federal and state lands and in Sonora, Mexico. Critical habitat occurs in Cochise, Gila, Graham, Greenlee, Pima, Pinal, Santa Cruz, and Yavapai counties.
Gila topminnow	*Poeciliopsis occidentalis occidentalis*	Endangered	Small (2 inches), guppy-like, live bearing, lacks dark spots on its fins. Breeding males are jet black with yellow fins.	Cochise, Gila, Graham, Maricopa, Pima, Santa Cruz, Yavapai	< 4,500 ft	Small streams, springs, and cienegas vegetated shallows.	Species historically also occurred in backwaters of large rivers but is currently isolated to small streams and springs.

COMMON NAME	SCIENTIFIC NAME	STATUS	DESCRIPTION	COUNTY	ELEVATION	HABITAT	COMMENTS
Huachuca water umbel	*Lilaeopsis schaffneriana ssp. recurva*	Endangered	Herbaceous, semi-aquatic perennial in the parsley family (Umbelliferae) with slender erect, hollow, leaves that grow from the nodes of creeping rhizomes. Flower: 3 to 10 flowered umbels arise from root nodes.	Cochise, Pima, Santa Cruz	3,500-6,500 ft	Cienegas, perennial low gradient streams, wetlands.	Species also occurs in adjacent Sonora, Mexico, west of the continental divide. Critical habitat in Cochise and Santa Cruz counties (64 FR 37441, July 12, 1999).
Jaguar	*Panthera onca*	Endangered	Largest species of cat native to Southwest. Muscular, with relatively short, massive limbs, and a deep-chested body. Usually cinnamon-buff in color with many black spots. Weights ranges from 90-300 lbs.	Cochise, Santa Cruz, Pima	1,600-9,000 ft	Found in Sonoran desertscrub up through subalpine conifer forest.	Also occurs in New Mexico. A Jaguar conservation team is being formed that is being led by Arizona and New Mexico state entities along with private organizations.
Lesser long-nosed bat	*Leptonycteris curasoae yerbabuenae*	Endangered	Elongated muzzle, small leaf nose, and long tongue. Yellowish brown or gray above and cinnamon brown below. Tail minute and appears to be lacking. Easily disturbed.	Cochise, Gila, Graham, Greenlee, Maricopa, Pima, Pinal, Santa Cruz, Yuma	1,600-11,500 ft	Desert scrub habitat with agave and columnar cacti present as food plants.	Day roosts in caves and abandoned tunnels. Forages at night on nectar, pollen, and fruit of paniculate agaves and columnar cacti. This species is migratory and is present in Arizona usually from April to September and south of the border the remainder of the year.
Mexican spotted owl	*Strix occidentalis lucida*	Threatened	Medium sized with dark eyes and no ear tufts. Brownish and heavily spotted with white or beige.	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai	4,100-9,000 ft	Nests in canyons and dense forests with multi-layered foliage structure.	Generally nest in older forests of mixed conifer or ponderosa pine/gambel oak type, in canyons, and use variety of habitats for foraging. Sites with cool microclimates appear to be of importance or are preferred. Critical habitat was finalized on August 31, 2004 (69 FR 53182) in Arizona in Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Navajo, Pima, Pinal, Santa Cruz, and Yavapai counties.
Ocelot	*Leopardus (=Felis) pardalis*	Endangered	Medium-sized spotted cat that is yellowish with black streaks and stripes running from front to back. Tail is spotted and about 1/2 the length of head and body. Face is less heavily streaked than the back and sides.	Cochise, Pima, Santa Cruz	< 8,000 ft	Desert scrub in Arizona. Humid tropical and sub-tropical forests, and savannahs in areas south of the U.S.	May persist in partly-cleared forests, second-growth woodland, and abandoned cultivated areas reverted to brush. Universal component is presence of dense cover. Unconfirmed reports of individuals in the southern part of the State continue to be received.

COMMON NAME	SCIENTIFIC NAME	STATUS	DESCRIPTION	COUNTY	ELEVATION	HABITAT	COMMENTS
Pima pineapple cactus	*Coryphantha scheeri var. robustispina*	Endangered	Hemispherical stems 4-7 inches tall 3-4 inches diameter. Central spine 1 inch long straw colored hooked surrounded by 6-15 radial spines. Flower: yellow, salmon, or rarely white narrow floral tube.	Pima, Santa Cruz	2,300-5,000 ft	Sonoran desertscrub or semi-desert grassland communities.	Occurs in alluvial valleys or on hillsides in rocky to sandy or silty soils. This species can be confused with juvenile barrel cactus (Ferocactus). However, the spines of the later are flattened, in contrast with the round cross-section of the Coryphanta spines. About 80-90% of individuals occur on state or private land.
Sonora chub	*Gila ditaenia*	Threatened	Minnow (<5 inches long) moderately chubby, dark-colored fish with two prominent black lateral bands on the sides and a dark oval spot at the base of the tail. Breeding males have red lower fins and a orange belly.	Santa Cruz	3,900 ft	Perennial and intermittent, small to moderate sized streams with boulders and cliffs.	Critical habitat includes Sycamore Creek (Santa Cruz County) and a 15 meter buffer from the U.S.- Mexico border to approximately 8 km upstream; Yank Spring; lowermost 2 km of Penasco Creek; and lowermost 0.4 km of an unnamed Sycamore Creek tributary. Species extends into Mexico (Altar and Magdalena rivers).
Sonoran tiger salamander	*Ambystoma mavortium stebbinsi*	Endangered	Large, light-colored blotches or reticulations on a dark background. Metamorphosed individuals are 1.8 to 5.9 inches in snout-vent length. Aquatic larvae are uniform dark colored with plume-like gills and developed tail fins.	Cochise, Santa Cruz	4,000-6,300 ft	Stock tanks and impounded cienegas; rodent burrows, rotted logs, and other moist cover sites.	Populations occur within the headwaters of the Santa Cruz and San Pedro Rivers. These include San Rafael Valley and in the foothills of the east slope of the Patagonia and Huachuca Mountains and Fort Huachuca.
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Small passerine (about 6 inches) grayish-green back and wings, whitish throat, light olive-gray breast and pale yellowish belly. Two wingbars visible. Eye-ring faint or absent.	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma	< 8,500 ft	Cottonwood/willow and tamarisk vegetation communities along rivers and streams.	Migratory riparian-obligate species that occupies breeding habitat from late April to September. Distribution within its range is restricted to riparian corridors. Difficult to distinguish from other members of the Empidonax complex by sight alone. Training seminar required for those conducting flycatcher surveys. Critical habitat was finalized on October 19, 2005 (50 CFR 60886). In Arizona there are critical habitat segments in Apache, Cochise, Gila, Graham, Greenlee, Maricopa, Mohave, Pima, Pinal, and Yavapai counties.

COMMON NAME	SCIENTIFIC NAME	STATUS	DESCRIPTION	COUNTY	ELEVATION	HABITAT	COMMENTS
Arizona treefrog (Huachuca/Canelo DPS)	*Hyla wrightorum*	Candidate	Small (1.8 inches in length) green frog; dark eye stripe extends past shoulder onto the sides of the body, may break into spots or dashes past shoulder, throat on males dusky green or tan; larger tadpoles golden brown above and below with mottled black tails.	Cochise, Santa Cruz	5,000-8,500 ft	Madrean oak woodlands, savannah, pine-oak woodlands, and mixed conifer forests.	Known from less than 20 localities in the Huachuca Mountains and adjacent Canelo Hills. Believed this population is geographically disjunct from the other known locality in the wetlands at Rancho Los Fresnos, Sonora, Mexico.
Huachuca springsnail	*Pyrgulopsis thompsoni*	Candidate	Very small (.06-.12 inches) conical shell. Identification must be verified by characteristics of reproductive organs.	Cochise, Santa Cruz	4,500-7,200 ft	Aquatic areas, small springs with vegetation and slow to moderate flow.	Individuals found on firm substances (roots, wood, and rocks). Other populations found on Fort Huachuca.
Northern Mexican Gartersnake	*Thamnophis eques megalops*	Candidate	Background color ranges from olive, olive-brown, to olive-gray. Body has three yellow or light colored stripes running down the length of the body, darker towards tail. Species distinguished from other native gartersnakes by the lateral stripes reaching the 3rd and 4th scale rows. Paired black spots extend along dorsolateral fields.	Apache, Cochise,Coconino, Gila, Graham, Navajo, Pima, Pinal, Santa Cruz, Yavapai	130-8,500 ft	Cienegas, stock tanks, large-river riparian woodlands and forests, streamside gallery forests.	Core population areas in the U.S. include mid/upper Verde River drainage, mid/lower Tonto Creek, and the San Rafael Valley and surrounding area. Status on tribal lands unknown. Distributed south into Mexico along the Sierra Madre Occidental and Mexican Plateau. Strongly associated with the presence of a native prey base including leopard frogs and native fish.
Stephan's riffle beetle	*Heterelmis stephani*	Candidate	Small aquatic beetle, typically less than 0.11 inches in total length.	Santa Cruz	5,100-6,600 ft	Free-flowing springs and seeps, commonly referred to as rheocrenes.	Current distribution is limited to Sylvester Spring. Historically known from Bog Springs, the type locality. Both springs located in Madera Canyon on the Coronado National Forest.

COMMON NAME	SCIENTIFIC NAME	STATUS	DESCRIPTION	COUNTY	ELEVATION	HABITAT	COMMENTS
Yellow-billed cuckoo	*Coccyzus americanus*	Candidate	Medium-sized bird with a slender, long-tailed profile, slightly down-curved bill that is blue-black with yellow on the lower half. Plumage is grayish-brown above and white below, with rufous primary flight feathers.	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma	< 6,500 ft	Large blocks of riparian woodlands (cottonwood, willow, or tamarisk galleries).	Neotropical migrant that winters primarily in South America and breeds primarily in the U.S. (but also in southern Canada and northern Mexico). As a migrant it is rarely detected; can occur outside of riparian areas. Cuckoos are found nesting statewide, mostly below 5,000 feet in central, western, and southeastern Arizona. Concern for cuckoos are primarily focused upon alterations to its nesting and foraging habitat. Nesting cuckoos are associated with relatively dense, wooded, streamside riparian habitat, with varying combinations of Fremont cottonwood, willow, velvet ash, Arizona walnut, mesquite, and tamarisk. Some cuckoos have also been detected nesting in velvet mesquite, netleaf hackberry, Arizona sycamore, Arizona alder, and some exotic neighborhood shade trees.
American peregrine falcon	*Falco peregrinus anatum*	Delisted	A crow-sized falcon with slate blue-gray on the back and wings, and white on the underside; a black head with vertical "bandit's mask" pattern over the eyes; long pointed wings; and a long wailing call made during breeding. Very adept flyers and hunters, reaching diving speeds of 200 mph.	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma	3,500-9,000 ft	Areas with rocky, steep cliffs, primarily near water, where prey (primarily shorebirds, songbirds, and waterfowl) concentrations are high. Nests are found on ledges of cliffs, and sometimes on man-made structures such as office towers and bridge abutments.	Species recovered with over 1,650 breeding birds in the US and Canada.

NAVIGANT
CONSULTING

References

Technical

1. Electric System Long-Range Planning Guide, RUS Standards BULLETIN 1724D-101A
2. General Electric, Voltage Regulator Manuals and Specification Guides
3. U.S. Energy Information Administration (EIA); current prices for natural gas and distillated fuel (December 2009)
4. Arizona Dept. of Commerce 2006 Population Statistics; (http://www.azcommerce.com/econinfo/demographics/Population%20Projections.html)
5. Energy Storage Association; http://www.electricitystorage.org/site/technologies
6. Arizona Department of Environmental Quality (ADEQ), Air Quality Division; http://www.azdeq.gov/environ/air/permits/class.html
7. Cummins Power Generation Products, http://www.cummins.com
8. NGK Limited, Inc., http://www.ngk.co.jp/english/products/power/nas/index.html
9. Gonen, Turan. Electric Power Distribution System Engineering. 2nd ed. Florida: CRC, 2008 (pages 629-700)
10. "Power Factor Correction and Harmonic Resonance: A Volatile Mix". EC&M. Dec. 12, 2009, http://ecmweb.com/powerquality/electric_power_factor_correction_3/
11. McGranaghan, Mark., Scott Peele, and Dan Murray. "Solving Harmonic Resonance Problems on the Medium Voltage System". 19th International Conference on Electricity Distribution. Dec 12, 2009, http://www.cired.be/CIRED07/pdfs/CIRED2007_0737_paper.pdf

Visual

14. Audubon Society. 2009. *Appleton-Whittell Research Ranch. Website.* Online at http://www.audubonresearchranch.org/. Site visited December 10, 2009.
15. Bailey, Robert. 1978. *Description of Ecoregions of the United States.* U.S.D.A. Forest Service.
16. Cochise County. *Babacomari Area Plan.* 2005. Adopted by the Board of supervisors on September 6, 2005. Resolution No. 05-67.

17. Federal Highway Administration. 1988. *Visual Impact Assessment for Highway Projects.* Washington, D.C.: Publication No: FHWA-HI-88-054.

18. Fenneman, Nevin M. 1931. *Physiography of Western United States.* New York: McGraw-Hill Book Company.

19. Santa Cruz County. 2004. *Santa Cruz County Comprehensive Plan.* Adopted by the Board of Supervisors by Resolution Number 2004-11. June 29, 2004.

20. Smardon, R., J. Palmer, and J. P. Felleman (eds). 1986. *Foundations for Visual Project Analysis.* New York.

21. U.S. Department of Agriculture. Forest Service. 1973 *National Forest Landscape Management Volume 1.* Agriculture Handbook Number 434.

22. U.S. Department of Agriculture. Forest Service. 1995. *Landscape Aesthetics: A* Handbook *for Scenery Management.* USDA Agriculture Handbook No. 701.

Cultural/Archeological

23. Brophy, Frank C., 1966. History of the San Ignacio del Babacomari-The Romantic Saga of Four. Original text written in 1966 for Arizona Highways. Website at: http://babacomariranch.com/pages/history.html.

24. Douglas, John, 1987. Letter Report to Mr. David Kincade. Prepared by Anthropological Resource Center, Chochise College, Douglas, Arizona. On file, Arizona State Museum, University of Arizona, Tuscon, #1988-78.ASM.

25. Hammack, Laurens, 2001. *Cultural Resource Inventory, FNF Construction Inc.s' Slaughterhouse Wash Material Source West of Huahuca City, Cochise County, Arizona.* Prepared by Complete Archaeological Services Associates, Cortez, Colorado for FNF Construction Inc., Tempe, Arizona. On file, Arizona State Museum, University of Arizona, Tuscon, #2001-39.ASM.

26. Heckman, Robert and Allen Denoyer, 1996. Arizona State Museum Archaeological Site Card for Site AZ EE:7:261. On file, Arizona State Museum, University of Arizona, Tuscon.

27. Kayser, Andrea and Teresa Serrano, 1999. *A Class III Archaeological Survey of the Arizona Electric Power Cooperative Pantano To Kartchner Transmission Line.* Prepared by SWCA, Inc.,

Tuscon Arizona for AEPCO. Inc., Arizona State Land Department and the Bureau of Land Management. On file, Arizona State Museum, University of Arizona, Tuscon, #1999-337.ASM.

28. Purcell, David, 2006. *A Cultural Resources Survey for a Proposed Material Source Pit on 406 Acres of Private Land on the Babacomari Ranch North of Huachuca City, Cochise County, Arizona (Revised Draft).* Prepared by DMG Four Corners Research, Inc., Flagstaff, Arizona for Carothers Environmental, LLC, Sedona Arizona. On file, Arizona State Museum, University of Arizona, Tuscon, #2006-991.ASM.

29. Railey, Kim and Stephen Yost, 2003. *Cultural Resources Survey of the 360Networks Fiber Optics Line From Mesa, Arizona to El Paso, Texas.* Prepared by TRC Environmental Corporation, Albuquerque, New Mexico for C&S Network Construction, Purcell, Oklahoma (now Mastec North America, Inc.). On file, Arizona State Museum, University of Arizona, Tuscon, #2003-910.ASM.

30. Rowe, Robert, 2004. *A Cultural Resources Inventory of 24.5 Miles Along Portions of State Highways 80, 90, and Interstate 10 in Cochise County, Arizona.* Prepared by TRC Environmental Corporation, Albuquerque, New Mexico for Level-3. On file, Arizona State Museum, University of Arizona, Tuscon, #2004-656.ASM.

31. Stone, Lyle, 1986. *A Cultural Resources Survey for a Proposed Sonoita Rest Room Facility Adjacent to State Route 82 Near Sonoita, Santa Cruz County, Arizona.* Prepared by Archaeological Research Services, Inc., Tempe, Arizona for the Highway Division, Arizona Department of Transportation, Phoenix, Arizona. On file, Arizona State Museum, University of Arizona, Tuscon, #1986-87.ASM.

32. Stone, Lyle, 1992. *A Cultural Resources Survey of an Approximately 5.0 Mile Long Segment of Arizona Department of Transportation Right-of-Way for State Route 82 in the Vicinity of Sonoita, Santa Cruz County, Arizona.* Prepared by Archaeological Research Services, Inc., Tempe, Arizona for the Highway Division, Arizona Department of Transportation, Phoenix, Arizona. On file, Arizona State Museum, University of Arizona, Tuscon, #1992-153.ASM.

33. Stone, Lyle, 1993. *Cultural Resources Survey of a 12.3 Mile Segment of Right-of-Way for State Route 82 East of Sonoita in Northeast Santa Cruz County, Arizona.* Prepared by Archaeological Research Services, Inc., Tempe, Arizona for the Highway Division, Arizona Department of Transportation, Phoenix, Arizona. On file, Arizona State Museum, University of Arizona, Tuscon, #1993-74.ASM.

34. Tierra, 2009. *Class III Cultural Resource Survey of an Overhead 69kV Transmission Power Line Corridor within and South of the San Ignacio del Babocomari Land Grant in Cochise and Santa*

Cruz Counties, Arizona. Prepared by Tierra Right of Way Services, for the Sulphur Springs Valley Electric Cooperative, October 20, 2009. Tierra Archaeological Report No. 2008-83 Part 2 (Revised), Arizona State Museum Accession No. 2008-0411.

35. Wright, Thomas, 1992. *A Cultural Resources Survey of 24 Miles of State Route 90 Right-of-Way Between Interstate 10 and Huachuca City in Cochise County, Arizon.* Prepared by Archaeological Research Services, Inc., Tempe, Arizona for the Highway Division, Arizona Department of Transportation, Phoenix, Arizona. On file, Arizona State Museum, University of Arizona, Tuscon, #1992-268.ASM.

36. Wright, Thomas, 1996 . *A Cultural Resources Survey of State Route 83 Right-of-Way Between Canelo and Interstate 10 (Mileposts 13.5-58.4), in Pima and Santa Cruz Counties, Arizona.* Prepared by Archaeological Research Services, Inc., Tempe, Arizona for the Intermodal Transportation Division, Arizona Department of Transportation, Phoenix, Arizona. On file, Arizona State Museum, University of Arizona, Tuscon, #1996-354.ASM.

Biological

37. ADWR (Arizona Department of Water Resources). 2009. http://www.adwr.state.az.us/azdwr/StatewidePlanning/RuralPrograms/OutsideAMAs_PDFs_for_web/Southeastern_Arizona_Planning_Area/Mexican_Drainage.pdf

38. AGFD (Arizona Game and Fish Department). 2009. On-line Environmental Review Tool Accessed on November 18 and 20, 2009, 2009. http://www.azgfd.gov/hgis/.

39. Beier, P., E. Garding, and D. Majka. 2008. Arizona Missing Linkages: Patagonia – Santa Rita Linkage Design Report to Arizona Game and Fish Department. School of Forestry, Northern Arizona University.

40. Brown, David E. (Ed.). 1994. Biotic communities: southwestern United States and northwestern Mexico. University of Utah Press, Salt Lake City.

41. Corridor Design. 2009. http://corridordesign.org/linkages/arizona

42. Nelson, 2009. Personal communication between R. Lewellyn, Harris Environmental Group and D. Nelson, AGFD Heritage Data Management System, December 4, 2009).

43. Southeastern Arizona Bird Observatory. 2009. http://www.sabo.org/birding/chirsulp.htm#aepco

44. Turner et al. 1995. Preserve Design for maintaining biodiversity in the Sky Island region. *In:* De Bano, Leonard F.,Peter F. Folliott, Alfredo Ortega-Rubio, Gerald J. Gottfried, Robert H. Hamre, and Carleton B. Edminster (tech. cords.). 1995. Biodiversity and Management

of the Madrean Archipelago: the sky islands of southwestern United States and northwestern Mexico. Gen. Tech. Report RM-GTR-264. Ft. Collins, Colorado: U.S Department of Agriculture, Forest Service, Rocky Mountatin Forest and Range Experiment Station. pp. 524-530.

45. USFWS. 2009. Species County List for Santa Cruz and Cochise counties. Online website http://www.fws.gov/southwest/es/arizona/Threatened.htm#CountyList.

Exhibit C

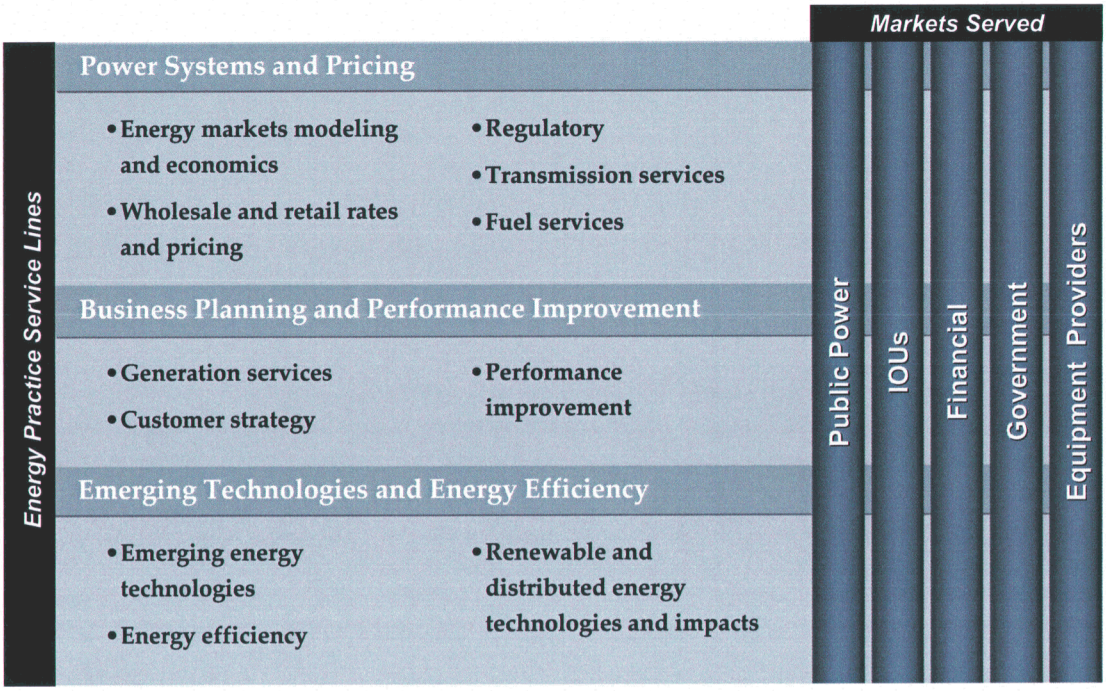
Navigant Consulting Inc. - Experience & Qualifications

Headquartered in Chicago, Navigant Consulting has over 1,800 consultants in offices principally in North America and the U.K. Our services and consulting staff are organized into four areas:

- **Publicly traded since 1996 (NYSE: NCI)**
- **Over 1,800 consultants in 40 offices globally**
- **2008 revenues of $810 million**
- **Revenue 6 year CAGR of 21%**

North American Dispute & Investigative Services	North American Business Consulting	Economic Consulting	International Consulting
Fraud, Forensic & Accounting Investigations	Healthcare	Antitrust	Infrastructure Disputes
Commercial Litigation	Energy	Securities	Financial Services
International Arbitration	Financial Services	Labor	Public Services
Electronic Discovery	Insurance & Claims	Valuation and M&A	Insurance
Government Contracting	Corporate Finance	Forensic & Accounting Investigations	International Arbitration
Construction Disputes		Commercial Lit / Intellectual Property	

Navigant Consulting's Energy Practice is comprised of approximately 180 full-time consultants plus dozens of independent advisors providing existing and prospective owners of energy supply and delivery assets the ability to evaluate, plan, develop, and enhance the operating value of their investments within evolving market and regulatory structures. Our energy consultants offer deep industry knowledge, functional expertise, and a range of services to customer-owned utility systems, investor-owned utility systems, independent fuel and power suppliers, local, state and federal government organizations, and large energy users. The Energy Practice organizes it service lines to serve these market segments, as follows:



Our professional staff includes technology experts, mechanical and electrical engineers, project managers, project developers, technology experts, economists, natural resource scientists, regulatory and public policy strategists, environmental permitting and compliance specialists, air quality modelers, and legislative and regulatory specialists, each of whom combines firsthand industry experience with his or her consulting expertise. Moreover, many of our consultants have held staff or management positions in utilities and diversified energy companies. This pool of talent enables NCI to quickly assemble an interdisciplinary team capable of identifying efficient solutions to project assessment and development issues. And, with our involvement in projects throughout North America, we are able to apply a broad perspective to accomplish the tasks at hand.

Exhibit D

ENVIRONMENTAL
VISION
2550 NINTH STREET
SUITE 205
BERKELEY CA 94710
510.540.4882
FAX 510.540.1154

MARSHA GALE

Managing Principal

Expertise

Visual Analysis and Simulation, Landscape and Site planning, Aesthetic Design, and Graphic Communication Techniques

Qualifications Summary

Over 28 years of professional experience in environmental planning and design including directing visual studies for large scale energy and infrastructure projects. An accomplished landscape planner, with particular expertise in visual resource analysis and aesthetic design.

Ms Gale is highly familiar with state and federal agency methods for visual analysis and has prepared numerous studies that conform to NEPA requirements. She has directed visual studies for projects located throughout California and the western U.S. Previous experience includes infrastructure projects located in CO, ID, OR, NV, AZ and TX. Experience includes international consulting; she has lectured internationally on the subject of visual simulation applications for project planning, design, and environmental assessment.

Academic Background

M.C.P., Master of City & Regional Planning
University of California at Berkeley, 1987

M.L.A., Master of Landscape Architecture
University of California at Berkeley, 1986

B.L.A., Bachelor of Landscape Architecture
University of Illinois at Champaign/Urbana, 1974

Selected Projects

East County Substation and Transmission Line Project
San Diego County, California
Directed visual resource study including landscape mitigation plans and realistic simulations for two substations and a new 15-mile electric transmission line located near the Mexico border, adjacent to federally managed land under the Desert Protection Act.

Jefferson-Martin 230 kV Transmission Project
San Mateo County, California
Directed visual analysis with realistic visual simulations for 18-mile overhead portion of the Jefferson Martin 230kV transmission line. Located in a sensitive and scenic viewshed, the project traverses public watershed land and passes near an existing residential area. Visual assessment addressed new transition station and replacement of existing transmission towers and conductor. Provided expert testimony in CPUC proceedings. Directed design of site-specific aesthetic mitigation for environmental compliance/project implementation.

ENVIRONMENTAL
VISION
2550 NINTH STREET
SUITE 205
BERKELEY CA 94710
510.540.4882
FAX 510.540.1154

Tri-Valley 230kV Transmission Capacity Increase Project
Alameda/Contra Costa County, California
Directed visual analysis with realistic visual simulations for transmission facility improvements including new substation and transition stations and 30 miles of new overhead conductor. Project was constructed and is currently in operation.

Tuscarora Natural Gas Pipeline Project
Nevada, California, Oregon.
Directed visual analysis and computer-generated visual simulations for 230-mile gas pipeline project FERC application. Coordinated state and federal resource (State Lands, Bureau of Land Management) agency input. Directed site-specific visual study with mitigation guidelines for corridor segment located in scenic Spanish Springs valley.

Humboldt Bay Repowering Project
Humboldt County, California.
Directed aesthetic resources evaluation for 160 MW power plant. Directed design of an ecologically appropriate conceptual landscape plan, review of public plans including the local coastal plans and preparation of realistic computer-generated visual simulations.

Turkey Ranch Compressor Station Project
Roseville, California.
Directed visual simulation and landscape mitigation study for the proposed compressor station facility. Simulations were presented as part of the local design review process.

Otay Mesa 230 kV Transmission Project
San Diego County, California
Directed visual resource study with realistic simulations for 230-kV electric transmission line project that crosses the cities of San Diego, Santee, Chula Vista, National City, and unincorporated areas in San Diego County. Prepared aesthetic mitigation measures including landscape design concepts for visually sensitive portions of the transmission line corridor and new substation facility.

North San Jose Transmission Capacity Increase Project
Santa Clara County, California.
Directed visual resource assessment with realistic simulations for the project proponent's Environmental Assessment of a new 230kV 15-mile transmission line and substation. In consultation with public agencies, developed streetscape design treatment and other aesthetic mitigation.

Professional Affiliations

- Member, American Society of Landscape Architects (ASLA)
- Member, Urban Land Institute (ULI)

ENVIRONMENTAL
VISION
2550 NINTH STREET
SUITE 205
BERKELEY CA 94710
510.540.4882
FAX 510.540.1154

Additional Experience

Project Visual Studies

- Rocky Mountain Energy Center – Weld, CO
- Tracy to Silver Lake Transmission Line Project – Sparks, NV
- Carlsbad Energy Center Project - San Diego County, CA
- Santa Clara- Getty Transmission Line Project – Santa Barbara County
- Tehachapi Renewable Transmission Project – Kern, San Bernardino Co.
- Elk Hills Power Plant - Kern County, CA
- Inland Energy Center - Riverside County, CA
- Valley-Auld Transmission Line Project - Riverside County, CA
- Cabazon Wind Development - Riverside County, CA
- Malaga Power Plant - Fresno County, CA
- Clovis Substation Project – Fresno County, CA
- SMUD Solano Wind Project EIR - Solano County, CA
- Vasona Substation Project - Los Gatos, CA
- Indio Transmission Improvement Project - Riverside County, CA
- Otay Mesa 230 kV Transmission Line Project – San Diego County, CA
- Robles Substation Project PEA – Contra Costa, CA
- Fairfield Energy Center -Solano County, CA
- China Shipping Terminal Project EIS – Port of Los Angeles, CA
- Bayside Water Treatment EIR – Alameda County, CA
- Salton Sea Water Transfer Project EIR/EIS – Riverside County, CA
- San Clemente Dam Seismic Improvements– Monterey County, CA
- Altamont Wind Repowering Project EIR- Alameda County, CA
- Potrero- Hunters Point Transmission Project PEA – San Francisco, CA
- Mare Island Dredge Disposal Site EIR/EIS – Vallejo, CA

HARRIS ENVIRONMENTAL GROUP, INC.

58 E. 5th Street, Tucson, AZ 85705 520-628-7648 Fax 520-628-1458

Robin L. Llewellyn, M.S.

EDUCATION

2003 M.S. Biological Sciences/Herpetology
Idaho State University, Pocatello, ID

1989 B.S. Wildlife Management
Humboldt State University, Arcata, CA

PROFESSIONAL EXPERIENCE

2007 to present – Senior Biologist/Project Manager, Harris Environmental Group, Tucson, AZ

Ms. Llewellyn manages a multi-disciplinary team which successfully guides biological, archaeological, and (pre) jurisdictional wetland projects from conception to final document submittal. She has the proven experience to direct and coordinate all components of large projects, including researching background information, coordinating fieldwork, managing budgets, supervising both field and office staff, assuring quality control of deliverables, and developing a strong relationship with clients to ensure project satisfaction.

Recent pipeline and transmission lines projects completed by Ms. Llewellyn include biological monitoring for desert tortoise (Mojave and Sonoran populations), flat-tailed horned lizard, bighorn sheep, and migratory birds. Included in these projects were the development and presentation of environmental educational programs for construction personnel. She has conducted population status and habitat use studies for special status species, including desert tortoise, Mexican garter snake, Chiricahua leopard frog, bullfrog, native plants, and several raptor species.

With extensive experience in environmental laws and regulations, Ms. Llewellyn guides clients through the regulatory compliance process. She has experience applying the Endangered Species Act, Clean Water Act, National Environmental Protection Act, National Historic Preservation Act, Arizona Native Plant Law, and numerous municipal native plant ordinances to conduct and prepare biological evaluations and assessments, Section 401 and 404 permits, and native plant reports for a variety of clients including federal, state, local and tribal, as well as utility companies and private landowners. Ms. Llewellyn's broad background as a multi-disiplinary project and resource manager, will ensure that projects are completed on-time and on budget.

2000-2007 – Wildlife Biologist/Project Manager, SWCA Environmental Consultants, Tucson AZ

As a project manager and field supervisor, Ms. Llewellyn was responsible for the threatened and endangered species program. She conducted special status species surveys, native plant and noxious weed surveys, and pre-jurisdictional waters delineations and prepared biological evaluations and assessments, NEPA documents, and native plant reports. Conducted and

supervised species surveys for desert tortoise, burrowing owl, cactus ferruginous pygmy-owl, Pima pineapple cactus, Chiricahua leopard frog, yellow-billed cuckoo, in accordance with USFWS protocol. Managed up to 70 projects/year, maintained deadlines, scheduled staff, wrote proposals, scopes, and developed budgets. Designed and implemented environmental and educational training programs for pipeline and transmission projects.

1997, 1999 (seasonal) - Research Field Biologist, University of Arizona, Dept. of Renewable Natural Resources, Tucson, AZ

Monitored and surveyed for special status herpetofauna at San Bernardino and Buenos Aires Natioanl Wildlife refuges, Arizona. Sampling techniques included pitfall traps, aquatic drift fence with funnel trap arrays, night road driving, and aural/visual encounter surveys to document species. Conducted mark/recapture of Mexican and checkered garter snakes and implanted pit-tags into over 100 garter snakes and collected cloacal scale samples. Evaluated impact of bullfrogs on native fauna in riparian habitats.

1994–1998 Graduate Researcher, Idaho State University, Dept. Biological Sciences, Pocatello, ID

Designed and conducted surveys for two field seasons, to determine the abundance, distribution and habitat associations of herpetofauna on 60,000 acres in Northern Idaho. Utilized many sampling techniques including pond and stream surveys, drift fences with pitfall and funnel traps, road driving, calling surveys, and visual encounter surveys. M.S. thesis: Tested GAP Analysis to determine accuracy in predicting amphibian and reptile distributions.

1993 (seasonal) Northern Spotted Owl Biologist, A.G. Crook Consultants, Beaverton, OR

Conducted protocol Northern spotted owl surveys to satisfy Section 7 of the ESA on privately-owned forests. Planned and scheduled all field work, analyzed data, wrote reports . Worked alone in remote forests the day and night.

1992 (seasonal) Research Field Assistant, Marc Hayes Biological Consultant, Portland, OR

Conducted herpetological night surveys along old-growth creek systems in national forests to determine drainage conditions by the density of tailed frogs and Pacific giant salamanders. Data collected included vegetation measurements, bank characteristics, and presence of potential habitat. Job required physical agility, endurance, and knowledge of amphibian life histories.

1992 (seasonal) Research Field Assistant, Oregon Wildlife Research Coop Unit, Oregon State University, Corvallis, OR

Conducted protocol northern goshawk surveys in ponderosa pine forests in eastern Oregon. Located nesting pairs in old-growth forests and gathered data on population, distribution, habitat characteristics, and relationships with other raptor and prey species. Mist-netted, banded three adult and young Goshawks.

1991-1992 Wildlife Biologist, Shasta Land Management Consultants, Redding, CA,

Developed and completed protocol Northern spotted owl surveys for private timber companies. Supervised biological technicians during field surveys and prepared vegetation and habitat suitability maps. Conducted nighttime bat surveys, using a night-vision spotting scope, visual identification and ultrasensitive microphone to determine bat species along the Sacramento River to determine the impact of a chemical spill.

1990-1991 Wildlife Biologist, Rogue River National Forest, Ashland R.D., Ashland, OR

Developed and implemented the northern Spotted Owl inventory program. Responsible for completing reports and evaluating status of program. Supervised and trained six biological technicians in protocol field techniques and owl biology. Responsible for all scheduling and project deadlines. Conducted sensitive plant and vegetation surveys. Monitored active raptor nests, constructed fish structures and surveyed perennial creeks.

1989-1990 Wildlife Biologist, Siskiyou National Forest, Gold Beach R.D., Gold Beach, OR

Surveyed southwest Oregon for potential Peregrine Falcon nesting habitat and counted breeding pairs. Conducted Spotted Owl surveys and special status plant surveys. Inventoried pristine creeks for spawning salmon using protocol methodology. Assisted in constructing fish structures for stream restoration.

1988 Ocean Salmon Sampler, Oregon Dept. Fish & Game, Newport, OR

Sampled commercially caught coded-wire tagged salmon from fishing boats along the Oregon Coast. Analyzed, tabulated and developed a senior research paper on the geographical and age distribution of salmon.

1987 Wildlife Assistant, Klamath National Forest, Goosenest Ranger District, Macdoel, CA

Surveyed high desert, juniper, and ponderosa pine forest of northeast California for new and existing nests of Swainson's hawks, northern goshawks, red-tailed hawks and bald eagles. Monitored nest behavior to determined breeding and reproductive status. Mist-netted over 15 raptors and assisted with leg-banding and attaching radio-telemetry equipment. Studied diet and habitat use by these raptor species.

SPECIALIZED TRAINING

- Flat-tailed Horned Lizard Training, BLM , El Centro CA, May 2009
- SWPPP Monitoring, Arizona Contractors Assn, Feb 2009
- Wetland Training Institute, Nationwide Permits 2-day training, November 2008
- Project Management Training, SWCA, January 2007
- Desert Tortoise Surveying, Monitoring, and Handling Techniques Workshop, Ridgecrest, CA 2005
- Chiricahua Leopard Frog training, AGFD, Santa Cruz County, Arizona, 2004
- Cactus Ferruginous Pygmy-Owl protocol survey training, AZ Game & Fish, November 2000
- Certified to delineate pre-jurisdictional wetlands, U.S. Corps of Engineers, 1992
- Certified Northern Spotted Owl protocol survey training, U.S. Forest Service, 1990
- Supervisory training, U.S. Forest Service, 1990
- Wildland firefighting training, U.S. Forest Service, 1987. Participated in three seasons of firefighting in California and Oregon.

PUBLICATIONS

Llewellyn, R.L., H. Messing, N. Olsker, D. Hall, K.B. Bezy, K. Bolles, R.L. Bezy, and P.C. Rosen. 2008. Geographic Distribution. *Terrapene ornata luteola* (Desert box turtle). Herpetological Review 29:1

Llewellyn, R.L., S. Zetlan. 2007. *A Baseline Herpetological Inventory within the Audubon Esperanza Ranch Santa Cruz River Restoration Site*. Final Technical Report, Tucson Audubon Society, AZ

Llewellyn, R.L. 2003. *Distribution of Amphibians and Reptiles on Craig Mountain: A Test of the Gap Analysis Models*. Idaho State University, Pocatello, Idaho. M.S. Thesis

Llewellyn, R. L. and C.R. Peterson. 1998. *Distribution, Abundance and Habitat Associations of Amphibians and Reptiles on Craig Mountain, Idaho*. BLM Technical Report 98-15

Llewellyn, R. L. 1998. Geographic Distribution. *Hypsiglena torquata*, Herpetological Review 29:1

D.H. Olson, W.P. Leonard, and R.B. Bury. 1997. Sampling Amphibians in Lentic Habitat, *In* C.R. Peterson and R.L. Llewellyn Chapter 7 Checklist for Amphibian Survey Report, Society for Northwestern Vertebrate Biology Olympia Washington.

Llewellyn, R. L. 1997. Geographic Distribution. *Spea intermontana*, Herpetological Review 28:2

AWARDS/GRANTS

- 2005. Tucson Herpetological Society, Awarded the Charles H. Lowe Jr. Research Grant, "Effects of Restoration on Herpetofauna at Audubon's Santa Cruz River Study Area," Santa Cruz County, AZ.
- 1991 - Certificate of Merit, Rogue River National Forest, In recognition of successfully completing protocol Northern Spotted Owl surveys on 13 timber sales.

RESEARCH PROJECTS

- Developed and conducted a three year baseline inventory project on reptile and amphibian species within the Tucson Audubon Society's habitat restoration site along the Santa Cruz River near Tubac, Arizona.
- Attended planning meetings for Tarahumara frog introduction according to the USFWS recovery plan. Participated with USFWS in reintroducing this endangered species into historic habitat.

PRESENTATIONS

- National Wildlife Society Meeting, Tucson, Arizona, poster presentation, *A Baseline Herpetological Inventory within the Audubon Esperanza Ranch Santa Cruz River Restoration Site*.
- Current Research of Herpetofauna in the Sonoran Desert Symposium, Tucson, Arizona, poster presentation, *A Baseline Herpetological Inventory within the Audubon Esperanza Ranch Santa Cruz River Restoration Site*.
- Tucson Herpetological Society, *A Baseline Herpetological Inventory within the Audubon Esperanza Ranch Santa Cruz River Restoration Site*.
- Estrella Mountain Community College, *My Life as a Wildlife Biologist*, Wildlife Speaker Series funded by an Arizona Game & Fish Heritage Grant.
- Ironwood Festival, yearly educational presentation of natural and life histories of Sonoran herpetofauna at environmental festival, Tucson Audubon Society, 2001-2008.
- Tohono O'Chul Park, *Sonoran Herpetofauna*, Docent Training, 2002.
- Bookman's Bookstores, "*Sonoran Herpetofauna*" 2001, 2003.

PROFESSIONAL MEMBERSHIPS

- Tucson Herpetological Society, since 1997, Currently a Board of Director
- Arizona Native Plant Society, Southeast Arizona Chapter, since 2008
- Audubon Society, Southeast Arizona Chapter, since 2005
- Desert Tortoise Council, California, since 2005

E-mail
shapirowill@pacificlegacy.com

William August Shapiro

Senior Project Supervisor

Summary of Qualifications

Mr. Shapiro is a professional archaeologist with 30 years experience in archeological research including 28 years in cultural resource management. During this period, he has worked with private consulting firms on numerous projects including those for the California Department of Transportation (CALTRANS), Department of Defense (DOD), U.S. Army Corps of Engineers (COE), and the U.S. Forest Service throughout California and the Hawaiian Islands. He has also worked on other federal, state, and local agency projects and is familiar with historic preservation laws and regulations at the federal and state level, including Section 106. Mr. Shapiro has extensive experience in California, Nevada, southern Oregon, central Florida, the Hawaiian Islands, American Samoa, Wake Island, and Saipan in the Northern Marianas. He is certified to work at sites with hazardous waste/materials (40-hr HAZWOPER).

Mr. Shapiro's areas of expertise include:

- Project management and supervision of cultural resource investigations
- Conducting cultural resource surveys, inventories, and evaluations for National Register eligibility
- Prehistoric and historic archaeological site testing and data recovery excavations
- Compliance with cultural resource regulations under National Historic Preservation Act (Section 106) and California Environmental Quality Act
- Archival and background research for prehistoric and historic resources
- Native American and Indigenous peoples consultation, coordination and oral interviews
- Technical report writing and production

Education

M.A., Anthropology, California State University, Chico, California, 1990
B.A., Anthropology, California State University, Chico, California, 1982

Recent Key Projects

2009-current Project Manager and Supervisor for an inventory survey and site evaluation for a proposed geothermal power plant expansion in Mammoth Lakes, California. Work included archaeological survey of alternative plant site locations and monitoring of geologic trench exploration prior to plant expansion designs. Testing of discovered archaeological resources for site evaluation is planned once alternative plant selection site is determined.

2008-current Project Manager and Supervisor for an archaeological inventory survey and extended Phase I evaluation for the Olancha-Cartago Four-Lane All-West Alternative in Inyo County, California for the California Department of Transportation. Conducted Inventory Survey for a proposed re-route of Highway 395 above Owens Lake. Included site recording of over 100 prehistoric and historical resources with limited subsurface excavation at several of the sites for preliminary evaluation.

2008-current Project Supervisor for the Ruby Pipeline Survey Project, Nevada. Assisted with a large inventory survey for a proposed natural gas pipeline across the state of Nevada. Supervised crews conducting the inventory of the pipeline route in portions of Humboldt and Washo Counties during the summer of 2008 and the spring of 2009. Recorded numerous prehistoric and historical cultural resources for project management purposes.

E-mail
shapirowill@pacificlegacy.com

William August Shapiro

Senior Project Supervisor

2007-current Project Supervisor and Manager for the on-call contract with Western Area Power Administration. Manager of several task orders under our contract with Western which to date has included the monitoring of vegetation management activities near know archaeological resources along their transmission lines. Currently preparing a large scale archaeological site evaluation and management plan for over 400 resources within their jurisdiction throughout northern California.

2006-current Project Manager and Supervisor for an archaeological inventory survey for a proposed power plant with new transmission lines, water and gas pipelines in Fresno, Kings and Tulare Counties. Work included an archaeological survey and site recording of discovered resources and the attending of public workshops and California Energy Commission meetings to assist with the cultural resource needs and concerns with regard to the proposed project.

2005-current Project Manager and Supervisor for an archaeological inventory survey, extended Phase I and Phase II evaluation and Phase III data recovery excavations for the YOL-16 Safety Widening Project along State Route 16 for the California Department of Transportation. Conducted Inventory Survey within the APE of a 14 mile long area on either side of State Route 16. This was followed by Extended Phase I work at two prehistoric sites and Phase II evaluation at CA-YOL-125, a prehistoric midden deposit with human remains. Recently completed data recovery excavations at CA-YOL-125/H and currently working on the laboratory analysis and reporting.

2000-current University of California, Davis – On Call Archaeological Services – Project Manager. Assisting the University of California at Davis, Office of Resource Management and Planning with their cultural resource management needs with regards to various planning and construction projects. Involves working with various campus project managers (from the Office of Architects & Engineering, Operations and Maintenance Facility, the Arboretum and Grounds, etc.) to access the potential impacts of proposed projects to cultural resources. Work includes surface survey, subsurface survey testing for buried cultural resources, monitoring of project construction activity near environmentally sensitive zones, sensitivity training for construction contractors with regard to cultural resources, excavations for site evaluation and data recovery mitigation, and project planning and feasibility studies for the protection of cultural resources within the UCD campus.

2005-2008 Western Area Power Administration – North Area EA Inventory - Field Director and Project Manager for a contract administered by CH2M Hill, Burleson Consulting, Inc., and Aspen Environmental Group. Includes intensive inventory survey of Western's right-of-way easements and legal access roads from the Sacramento / San Joaquin Delta to the Oregon border along high voltage transmission lines on both sides of the Sacramento Valley. Project area includes portions of San Joaquin, Contra Costa, Sacramento, Solano, Sutter, Colusa, Glenn, Tehama, Butte, Shasta, Trinity, Siskiyou and Modoc Counties. Historic and prehistoric resource identification, recording, site record updating and mapping. Requires extensive GPS data acquisition and training to coordinate with a Geographic Information System (GIS) database for cultural and biological resources that could be integrated with other planning and management information used by the Department of Energy.

E-mail
shapirowill@pacificlegacy.com

William August Shapiro

Senior Project Supervisor

2005-2008 Project Supervisor for archaeological Phase III data recovery excavations for the "Black Rock" Investigations at Archaeological Sites CA-INY-5267, CA-INY-5273/H, CA-INY-5275/H, CA-INY-5276, CA-INY-5873/H and CA-INY-5877 for the SR-395 Highway Widening Project, Inyo County, California for the California Department of Transportation. Conducted data recovery excavations at three of the sites and currently coordinating the laboratory analysis and reporting.

2004-2005 Project supervisor for data recovery excavations at the site of Fatumafuti Village (AS-25-062) on the island of Tutuila in American Samoa to mitigate adverse effects to a subsurface cultural layer identified during a prior highway improvement project. Identified seven features including three human burials, hearths and fire episodes. Conducted for Fulton Hogan, Ltd.

2001-2003 Project supervisor and senior author for Phase II excavation and evaluation of three prehistoric sites along U.S. Highway 395 in Mono County, California for the Mammoth Fence Replacement Project. Work conducted for the California Department of Transportation, Eastern Sierra Environmental Branch, Bishop.

2001-2003 Project supervisor for a Phase I inventory of the proposed Hopland Bypass project in Mendocino County, California. Work conducted for Caltrans and included coordinating access to various parcels with property owners and surveying various project alternatives and recording both prehistoric and historic resources. Conducted for the California Department of Transportation, North Region Office of Environmental Management, Sacramento.

2002 Monitored the removal of the 1930s Old Spencer Beach Road through the Pu'ukohola Heiau National Historic Site, in Kawaihae, Hawaii in order to bring the area back to its original pre-contact setting. Recorded buried rock wall and pavement features, and ensured the road removal and landscape restoration work avoided impacting cultural deposits and surface features including the massive Pu'ukohola and Mailekini Heiau. Co-author of draft report which was prepared for the U.S. National Park Service, Honolulu.

2000-2002 Project supervisor and co-author for Phase II excavation and evaluation of seven prehistoric sites along State Route 89 in Shasta County, California. Supervised field excavations and worked with Native American monitors at the Pit River Tribe's curation facility in Burney. Among the sites was an extensive midden deposit with a wide variety of materials including prehistoric ceramics, baked clay objects and shell and bone ornaments. Prepared for the California Department of Transportation, North Region, District 2, Redding.

1995-2002 Project supervisor and co-author of a surface survey, testing, data recovery, and monitoring project for the Ta'u Road improvements on Ta'u Island in the Manu'a Islands, American Samoa. Supervised field survey and excavation crews during documentation and testing of 21 feature complexes within the ancient village of Faga, located on the north side of Ta'u Island. Also conducted construction monitoring and data recovery excavations. Prepared for American Samoa Department of Public Works/ and the COE for the U.S. Federal Highways Administration...

2000-2001 Project supervisor for archaeological survey and monitoring of the Sunrise Cogeneration and Power Project in Kern County, California. Included extensive environmental awareness training sessions for various construction

E-mail
shapirowill@pacificlegacy.com

William August Shapiro

Senior Project Supervisor

personnel as requested by the California Energy Commission. Coordinated needs with various construction personnel and project managers. Work conducted for the Sunrise Cogeneration and Power Company, Bakersfield.

1999-2001 Project supervisor for several survey and inventory projects related to seismic 3-D natural gas and oil exploration studies in the Sacramento River Delta and in Kern County. Involved recording resources and relocated drill or vibrating points to avoid impacts to cultural resources. Work conducted for Robert Booher Consulting, Fairfield.

1998-2001 Project supervisor and co-author for archaeological survey and monitoring of subsurface soil tests within the Tanapag Fuel Farm, Saipan, as part of the U.S. Army Corps of Engineers' Defense Environmental Restoration Program – Formerly Used Defense Sites (DERP-FUDS). Recorded 45 WWII era fuel tank features and pre-WWII Japanese historic features.

2001 Project supervisor and co-author for Phase III excavations and monitoring at the Tanapag Beach Park and the historic Tanapag Cemetery 1, Saipan as part of the U.S. Army Corps of Engineers PCB remedial clean-up activities. Included excavation of a WWII Japanese mass grave feature and monitoring of PCB contaminated soil testing within an historic cemetery with unmarked graves. Job required Hazmat training with use of personal protective equipment and establishment of a decontamination zone as work areas contained contaminated PCB soils.

1998-2000 Project supervisor and senior report writer for a Phase II excavation and evaluation at prehistoric site CA-LAK-1883 for proposed road improvements. Prepared for the California Department of Transportation, District 3.

1998-1999 Project supervisor and co-author of archaeological monitoring and archival research for the Edoni Site, Saipan in conjunction with a COE soil and groundwater contamination study at the site, a former U.S. borrow pit/landfill associated with World War II activities. Recorded over 600 prehistoric and historic artifacts during the investigation. Required Hazmat certification.

1998 Archeological supervisor for monitoring, and sampling, project (DERP/FUDS) at Chalan Kanoa, Saipan. Documented early deposits associated with initial human occupation of Saipan. Also recorded numerous trash pits associated with Japanese occupation of the island. Required Hazmat certification. Prepared for U.S. Army Corps of Engineers, Honolulu District.

1997-1998 Project supervisor and senior report writer for a cultural resources inventory and evaluation for the U.S. Army Corps of Engineers, Sacramento District, PL 84-99 Levee Rehabilitation on the Feather, Bear, Sacramento, and San Joaquin River Systems. Managed 58 separate task orders under this emergency contract between approximately April 1997 and April 1998 and participated in all aspects of fieldwork and reporting.

1996-1998 Project Supervisor for Twelve Bridges Project, conducted survey and inventory of 4,800 acre property, test excavations at 23 prehistoric and historic archeological sites, and data recovery excavations at 4 prehistoric and historic archeological sites. Prepared for Placer Holdings, Inc.

1994-1995 Project supervisor and co-author of a heritage resources inventory and evaluation for a proposed land exchange between Western States Minerals

E-mail
shapirowill@pacificlegacy.com

William August Shapiro

Senior Project Supervisor

Corporation and the Humboldt-Toiyabe National Forest in Nye County, Nevada. Twenty-eight sites including prehistoric lithic scatters, overhang shelters, and rock ring features as well as historic mining sites were subjected to detailed recording and exploratory excavation to determine NRHP eligibility. Prepared for Western States Minerals Corporation (Reno, NV) and Environmental Management Services Corp. (Ft. Collins, CO).

1994-1995 Field supervisor and co-author of inventory surveys at the Hanalei and Huleia National Wildlife Refuges on Kauai Island, Hawaii. Work included survey and inventory of historic and prehistoric sites, test excavation and preliminary National Register of Historic Places significance assessments. Reports submitted to the U.S. Department of the Interior, Fish and Wildlife Service, Pacific Region.

1992-1994 Field supervisor and co-author of two inventory and evaluation surveys at the Pahakuloa Training Area (PTA) on Hawaii Island. Work included Explosive Ordnance Demolition (EOD) safety training, coordination with range control and training activities, and escort by EOD specialists. Reports submitted to the U.S. Army Corps of Engineers, Honolulu District.

Professional Experience

1985-1987 Field Supervisor/Director. Florida State University, Tallahassee. Directed all aspects of fieldwork for archaeological excavations at the Windover Site, an Early Archaic bog cemetery in central Florida.

1988 Field Supervisor. Paul H. Rosendahl, Ph.D., Inc. Directed survey, excavation and construction monitoring projects on O`ahu, Maui, Hawaii and Kahoolawe Islands, Hawaii.

1989-1990 Field Supervisor. Jensen and Associates. Directed archaeological survey and excavation projects in northern California, Oregon and Hawaii.

1990-1992 Field Director and Project Manager. PAR Environmental Services. Directed archaeological projects under contract to the USDA Forest Service, Lassen, Plumas, Stanislaus and Klamath national forests. Conducted extensive historical archival research for various projects and co-authored survey and test excavation reports.

1992-1995 Field Director and Project Manager. BioSystems Analysis, Inc. Directed all aspects of archaeological fieldwork for projects in California, Nevada, Hawaii and American Samoa. Co-authored numerous survey and excavation reports.

Selected Publications & Accomplishments

2009 *Archaeological Monitoring Services for the Trinity Public Utilities District Direct Interconnect Project, Trinity County, California* (lead author). Prepared for Aspen Environmental Group, Sacramento, CA

2009 *Archaeological Mitigation Report for the AG-TPUD-8 Site, Trinity Public Utilities District Direct Interconnection Project, Weaverville, Trinity County, California* (with E. Reese, W. Anderson and H. Ballard). Prepared for Western Area Power Administration, Folsom; Aspen Environmental Group, Sacramento; and CH2M Hill, Sacramento.

2008 *Supplemental Archaeological Survey Report for the Kings River Conservation District Commiunity Power Plant, Fresno Kings and Tulare Counties, California* (lead author). Prepared for Navigant Consulting, Inc., Rancho Cordova, California.

E-mail
shapirowill@pacificlegacy.com

William August Shapiro

Senior Project Supervisor

2007 *Archaeological Survey Report for the Kings River Conservation District Community Power Plant, Fresno, Kings and Tulare Counties, California* (lead author). Prepared for Navigant Consulting, Inc., Rancho Cordova, California.

2005 *Archaeological Excavations at CA-YOL-199/H, CA-YOL-125/H & the CA-YOL-207 Sites for the YOL-16 Safety Improvement Project, Capay Valley, Yolo County, California* (lead author). Prepared for the California Department of Transportation, MS-15, District 3, Sacramento.

2002 *Archaeological Investigations at Three Prehistoric Sites on U.S. Highway 395 in Mono County, California for the Mammoth Fence Replacement Project* (with R. Jackson). Draft report submitted to the California Department of Transportation, Eastern Sierra Environmental Branch, Bishop.

2002 *Archaeological Monitoring of the Obliterate the Old Spencer Road Project, Pu'ukohola Heiau National Historic Site, Kawaihae, South Kohala, Hawaii* (with L. Shapiro and P. Cleghorn) Draft report submitted to the U.S. National Park Service, Honolulu. 2002 Region, District 2.

2002 *Archaeological Investigations at Seven Prehistoric Sites on State Route 89 Between Lake Britton and Pondosa Road, Shasta County, California* (with L. Shapiro, B. Bloomer and R. Jackson). Prepared for the California Department of Transportation, North Region, District 2, Redding.

2002 *Archaeological Monitoring Report for the Construction of the Ta'u Road, Faga and Fitiuta, Ta'u Island, Manu'a, American Samoa* (with P. Cleghorn). Draft final report submitted to the U.S. Army Corps of Engineers, Honolulu District.

2001 *Draft Report: Archaeological Investigations for the Defense Environmental Restoration Program at Formerly Used Defense Sites (DERP/FUDS) PCB Clean-up, Phase III at Tanapag Village, Island of Saipan, Commonwealth of the Northern Mariana Islands* (with P. Cleghorn and J. McIntosh). Prepared for Wil Chee Planning, Inc., Honolulu and submitted to the U.S. Army Corps of Engineers, Hawaii.

2001 *Final Report: Archaeological and Ethnographic Investigations at the Tanapag Fuel Farm, Tanapag Village, Saipan, Commonwealth of the Northern Mariana Islands* (with P. Cleghorn, J. McIntosh, and U. Prasad). Prepared for Wil Chee Planning, Inc., Honolulu, prepared by Ogden Environmental and Energy Services Co., Inc., and submitted to the U.S. Army Corps of Engineers, Pacific Ocean Division, Hawaii.

2000 *Archaeological Data Recovery Report for the Proposed Ta'u Road Construction at Faga and Fitiuta, Ta'u Island, Manu'a, American Samoa* (with P. Cleghorn, J. Robbins and D. Latinis). Prepared by Scientific Consultant Services / Cultural Resources Management Services, Inc., Honolulu, and prepared for the U.S. Army Corps of Engineers, Pacific Ocean Division, Hawaii.

2000 *Final Report, Phase II Archaeological Investigations at CA-LAK-1883 Near Clearlake Oaks, Lake County, California* (with R. Jackson, L. Shapiro and H. Price). Prepared for California Department of Transportation, District 3.

1999 *Report of Archaeological Investigations at the Edoni Site, Edoni, I Agag, Saipan, Commonwealth of the Northern Mariana Islands* (with P. Cleghorn and J. McIntosh). Draft report prepared for Wil Chee Planning, Inc., Honolulu and submitted to the U.S. Army Corps of Engineers, Pacific Ocean Division, Hawaii.

E-mail
shapirowill@pacificlegacy.com

William August Shapiro

Senior Project Supervisor

1997 *Final Report of an Archaeological Surface Survey for the Ta'u Road Between Lepule and Avatele Cove, Ta'u, Manu'a Islands, American Samoa* (with P. Cleghorn and L. Shapiro). Prepared for the American Samoa Power Authority, Pago Pago, American Samoa.

1995 *Redleg Trail Archaeological Investigations for the Legacy Resource Management Program at Pohakuloa Training Area, Hawaii Island, Hawaii* (with P. Cleghorn and L. Shapiro). Submitted to the U.S. Army Corps of Engineers, Pacific Division.

1995 "Of Passing Interest": Heritage Resources of the Northumberland Mine Land Exchange, Nye County, Nevada (with R. Jackson and L. Shapiro). Submitted to Western States Minerals Corporation and Environmental Management Services Company.

1995 *Archaeological Investigations of the Hanalei national Wildlife Refuge, Hanalei, Island of Kauai, Hawaii* (with L. Shapiro). Submitted to the U.S. Department of the Interior, Fish and Wildlife Service.

1995 Final Report for the Archaeological Investigation of the Wiegand Property, Dixon, California (with K. Tremaine). Submitted to Lewis Homes of California.

1987 "Age, Abstract Thinking, and the American Concept of Person." (co-author). *American Anthropologist,* Vol. 89(3), September 1987.

Additional Publications

Author, co-author and contributor to numerous (100+) cultural resource management reports for local, state, and federal compliance.

Professional Affiliations & Memberships

Register of Professional Archaeologists
Society for American Archaeology
Society for California Archaeology
Society for Hawaiian Archaeology

Professional Achievements

Received a certificate in cultural resource management from CSU, Chico and periodically attends Section 106 and CEQA training sessions to keep current with latest revisions and updates.

Other Interests

History, Museums, Art and Traveling

Professional References

Ms. Cherie Johnston-Walder
Archaeologist/Native American Liaison, Western Area Power Administration, Sierra Nevada Region, 114 Parkshore Dr., Folsom, CA 95630-4710. Phone Number: (916) 353-4035.

Ms. Erin Dwyer
Archaeologist, California Department of Transportation, District 3, P.O. Box 911, Marysville CA 95901. Phone Number: (530) 741-4538.

Ms. Patti Johnson
Archaeologist, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, CA 95814-2922. Phone Number: (916) 557-6611.

Exhibit E

David T. Larsen

David T. Larsen
Director

Navigant Consulting, Inc.
3100 Zinfandel Drive, Suite 600
Tel: 916-631-3247
Fax 916-852-1073

dlarsen@navigantconsulting.com

Professional History

Navigant Consulting, Inc. (1986 - Present) Director

Arizona Electric Power Cooperative, Inc. (1975 - 1986) Supervisor of System Planning

Education

B.S., Electrical Engineering, South Dakota State University, Brookings, 1970

Professional Associations

Institute of Electrical and Electronics Engineers

National Honorary Electrical Engineering Society

Mr. Larsen is a Director with Navigant Consulting, Inc. (NCI) and has over 35 years of experience in transmission and resource planning and the development and negotiation of power contracts. At NCI, he oversees the evaluation and planning of transmission projects and provides technical support in the evaluation and negotiation of power contracts and the performance of power marketing analyses. Mr. Larsen has performed or supervised interconnection and system impact assessments for proposed renewable (wind and solar) and thermal generating projects in the Desert Southwest and other portions of the western United States. He has also participated in the planning of several major electric transmission projects. He has also represented one of NCI's major transmission owner clients on the Western Electricity Coordinating Council's Planning Coordination Committee.

Prior to joining NCI, Mr. Larsen was employed by the Arizona Electric Power Cooperative and was actively involved in resource and transmission planning in the Desert Southwest. Mr. Larsen was one of the original members of the Southwest Area Transmission Planning Committee, which was responsible for the performance of coordinated power flow and transient stability evaluations of the interconnected system (500-kV, 345-kV, and 230-kV) in the Desert Southwest and served as chairman of the Committee.

Professional Experience

» **Solana Generating Station Solar Project (Arizona).** Abengoa Solar (Abengoa) is developing the 270 MW Solana Generating Station Solar Project near Gila Bend, Arizona and has entered into a contract under which Abengoa would build, own, and operate the Project and Arizona Public Service (APS) would purchase the Project's electrical output. Since early 2008 NCI has provided transmission interconnection related services to Abengoa relative to the Solana Project. These services have included: (i) performing a preliminary system impact study which was filed as part of the CEC application with the ACC; (ii) assisting in the development of the Project interconnection application with APS and participating in the scoping meeting with APS : (iii) reviewing and providing comments on the Interconnection Feasibility Study, the System Impact Study, and the Facilities Study reports prepared by APS; and (iv) participating in meetings with APS at which the results of the above studies were discussed.

» **Lathrop Wells Solar Project (Southern Nevada).** Abengoa Solar (Abengoa) is proposing the development of a the Lathrop Wells Solar Project which would include a 270 MW (gross) CSP unit and up to 10 MW of PV generation which would be interconnected with the Valley Electric Association (VEA) system in the Project area. To date NCI has assisted Abengoa with the development of the interconnection applications for both the 280 MW CSP unit and the 10 MW PV unit and has participated in the scoping meeting with VEA for both applications. Future activities will include reviewing and providing comments on the Interconnection Feasibility Study, the System Impact Study, and the Facilities Study reports prepared by VEA and participating in meetings with VEA at which the results of the above studies were discussed.

» **Proposed Solar Project (Southern California).** An NCI client is considering the development of a 20 MW PV solar facility that would be interconnected with the 66-kV system of Southern California Edison (SCE) in the proximity of Lancaster, California. To date NCI has undertaken an assessment (including power flow analyses) of the 66-kV system to accommodate the proposed project and other proposed solar generation in the area. Should the client elect to proceed with the development of the project NCI will provide them with technical support during the California ISO generation interconnection study process.

» **Third Party System Impact Studies (California).** As a result of the CAISO's Generator Interconnection Process Reform (GIPR) activities, several proposed generating projects had been placed in the "transition cluster" and, as a result, work had ceased on the impacts studies being performed for these projects. In order for a project to proceed through the California Energy Commission's (CEC) Application for Certification (AFC) process a system impact study for the project must be completed. The CEC had stated that it would accept a "third party" impact study and, as a result, NCI was asked to perform system impact studies (SIS) for three projects. These studies identified the transmission system impacts caused solely by the addition of the proposed project, identified the system reinforcements necessary to mitigate the adverse impacts of the proposed project under various system conditions, and provided preliminary cost estimates for the above system reinforcements.

» **Impact of Unit Retirements on Import Capability and RMR Requirements (California).** Performed a preliminary assessment of the potential impacts which the retirement of certain power plants identified by the CEC as being at high and medium risk of retirement would have on the Southern California Import Transmission (SCIT) nomogram and on local area transmission reliability. The SCIT nomogram analysis focused on impacts if the high probability units in Southern California were retired while the local area reliability analysis investigated the impacts of retirement of both the high and medium probability units on the transmission systems serving local area load pockets. Both sets of studies assessed such impacts for 2005, 2006, 2007, and 2008 summer peak conditions.

» **Assessment of Interconnection Options, Southern California Public Power Authority (Southern California).** Assisted the Cities of Burbank, Glendale, and Pasadena in identifying and assessing potential new transmission interconnections between themselves to increase system reliability and new interconnections with the SCE system to facilitate wholesale transactions through the California Independent System Operator (ISO) controlled grid. As part of this effort, NCI performed powerflow and transient stability studies of the system in the Los Angeles Basin (including detailed models of the Cities systems) to evaluate eight different options for providing the new interconnections. The options considered included the development of new 69-kV or 230-kV facilities between the Pasadena and Glendale systems and enhanced interconnections between the Burbank and Glendale systems. NCI also developed preliminary cost estimates for selected new interconnection options.

» **Assessment of Interconnection Options, City of Palo Alto (Northern California).** Managed a project in which NCI assisted the City of Palo Alto Electric Utilities Department in the assessment of potential alternatives for providing a second interconnection point between the electric systems of the City and Pacific Gas & Electric (PG&E). Activities included the development of both pre- and post-project power flow data sets, performing power flow studies to assess the construction period impacts associated with one of the alternatives and of the post-project impacts of both alternatives, and developing preliminary cost estimates for both alternatives.

» **Magnolia Power Project, Southern California Public Power Authority (Southern California).** Managed and was actively involved in the power flow, transient stability, post-transient, and short circuit studies performed by NCI on behalf of the Project participants to assess impacts on the City of Burbank 69-kV system, to which the project will be connected, and on the 500-kV and 230-kV grid in the Los Angeles Basin. Also coordinated Project-related technical studies with the Los Angeles Department of Water and Power (LADWP) and with Southern California Edison (SCE). Developed documents for use in the Application for Certification (AFC) submitted to the California Energy Commission and provided technical support to the Project manager in various discussions with LADWP and SCE regarding the replacement of circuit breakers on the LADWP and SCE systems. In addition, performed studies assessing incremental losses on the Burbank system for various load levels and dispatch levels for the MPP and the existing Burbank generation and assessing system impacts if the normally open ties between Burbank and the City of Glendale were closed.

» **Malburg Power Project, City of Vernon (Southern California).** Managed and was actively involved in the power flow and short circuit studies performed by NCI on behalf of the City of Vernon to assess impacts on the City's 66-kV system, to which the project will be connected, and on the 500-kV and 230-kV grid in the Los Angeles Basin. Also coordinated Project-related technical studies with the Los Angeles Department of Water and Power (LADWP) and with Southern California Edison (SCE). Developed documents for use in the AFC submitted to the California Energy Commission and provided technical support to the Project manager in various discussions with LADWP and SCE regarding the replacement of circuit breakers on the LADWP and SCE systems.

BEFORE THE ARIZONA CORPORATION COMMISSION

COMMISSIONERS

KRISTIN K. MAYES, Chairman
GARY PIERCE
PAUL NEWMAN
SANDRA D. KENNEDY
BOB STUMP

IN THE MATTER OF THE APPLICATION OF SULPHUR SPRINGS VALLEY ELECTRIC COOPERATIVE, INC. FOR A HEARING TO DETERMINE THE FAIR VALUE OF ITS PROPERTY FOR RATEMAKING PURPOSES, TO FIX A JUST AND REASONABLE RETURN THEREON, TO APPROVE RATES DESIGNED TO DEVELOP SUCH RETURN AND FOR RELATED APPROVALS.	DOCKET NO. E-01575A-08-0328
IN THE MATTER OF THE APPLICATION OF SULPHUR SPRINGS VALLEY ELECTRIC COOPERATIVE, INC. FOR AN ORDER INSTITUTING A MORATORIUM ON NEW CONNECTIONS TO THE V-7 FEEDER LINE SERVING THE WHETSTONE, RAIN VALLEY, ELGIN, CANELO, SONOITA, AND PATAGONIA, ARIZONA AREAS.	DOCKET NO. E-01575A-09-0453

PRE-FILED DIRECT TESTIMONY OF RONALD C. OROZCO, P.E., CEM ON BEHALF OF SULPHUR SPRINGS VALLEY ELECTRIC COOPERATIVE, INC.
(A.R.S. §40-252 Proceeding)

FEBRUARY 23, 2010

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Ronald C. Orozco, and my business address is 1348 Giuilio Cesare Avenue, Sierra Vista, Arizona 85635.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am employed by Sulphur Springs Valley Electric Cooperative, Inc. ("SSVEC" or the "Cooperative") as its Engineering Manager. In this position, I have overall responsibility for planning, design, rights-of-way acquisition, mapping, regulatory compliance, construction unit standards, line siting and staking, and engineering support during construction for all facilities owned and operated by SSVEC. The Engineering team consists of 32 positions with trained professionals, including: six registered Professional Engineers; three Engineers-in-Training; and three Right of Way Agents, one a Senior Member of the International Right of Way Association with certifications in Negotiation/Acquisition. Last year, we engineered approximately 100 miles of overhead and underground distribution line, one substation, eleven miles of 69kV sub-transmission line, and negotiated more than 250 land and easement acquisitions. We also engage professional consultants as necessary.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND AND WORK EXPERIENCE.

A. A copy of my official resume is been attached as Exhibit A. However, suffice it to say, I am a registered Professional Engineer in the State of Arizona (#21623) with 29 years of professional experience in rural electrification, demand-side management, renewable energy technologies, and direct electric utility engineering. Other certifications include: Professional Engineer in New Mexico

(#12607); Certified Energy Manager (#5266); recently Certified Green Building Engineer (#618) through Association of Energy Engineers. Certifications that I have held but are not current to avoid any conflict of interest with current employment, include: Journeyman Electrician (EE-98J in NM #35084), Licensed Electrical Contractor (EE98 in NM #91998), NABCEP Certified Solar PV Installer™. I have completed the National Rural Electric Cooperative's Management Internship Program and am currently enrolled in a Microsoft Certified Technology Specialist (MCTS) prep class in MS Project (project management software) leading to a Project Management Professional certification through the Project Management Institute (PMI). I hold a Bachelor's Degree in Engineering from the University of Arizona and have completed numerous electric utility design courses, as well a presented numerous workshops and presentations on the US model of rural electrification throughout the world.

My experience spans most aspects of rural electrification including: program development and management; design of transmission, distribution, and substation systems; construction management; project management; and, most recently, engineering management. I have worked as a private consultant; an electrical contractor; a journeyman electrician; owner/operator of a solar and wind energy company; employee of a consulting firm specializing in electric cooperative engineering; and, most recently, Engineering Manager at SSVEC where I began my career in 1981. My rural electric utility experience includes work for National Electric Cooperative Association, as well as investor-owned, municipal, and government-owned utilities in Alaska, Canada, US, Mexico, Central and South America, and Africa. I have served as an energy consultant to the National Rural Electric Cooperative Association, the US Agency for International Development, the World Bank, Sandia National Laboratories, the National Renewable Energy

Laboratory, the American Wind Energy Association, and others.

I was Lead Engineer in design and construction of the first 3-phase grid-connected photovoltaic system (20kW) installed in New Mexico in 1999. I have designed and built dozens of solar and wind electric systems from Alaska to Bolivia. I served as Field Engineer for a 75MW wind energy project in Appalachia and was responsible for site evaluation, permitting, and project design, including array layout, substation design, and underground sub-distribution system design.

More recently at SSVEC, my team is engaged in: substation design; construction and automation; distribution and sub-transmission line design, automation and operation; line staking and standards development; utility planning; engineering support in rate cases and public comment functions; management of joint use of poles by other utilities; and management of an entire electric distribution facility on a military installation. I recently lead a team in development of a successful $15M Smart Grid grant from the US Department of Energy under the American Recovery and Reinvestment Act ("ARRA").

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE ARIZONA CORPORATION COMMISSION ("COMMISSION")?

A. No. I have, however, attended various Commission hearings, procedural conferences, and Open Meetings.

Q. BASED UPON YOUR EDUCATIONAL BACKGROUND AND EXPERIENCE, ARE YOU AN EXPERT IN YOUR FIELD?

A. Yes, I am.

. . .

. . .

Q. ON WHOSE BEHALF ARE YOU TESTIFYING IN THIS MATTER?

A. I am testifying on behalf of SSVEC.

Q. ARE YOU AUTHORIZED TO TESTIFY ON BEHALF OF SSVEC?

A. Yes, I am.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of my testimony is to provide technical information and background regarding the Sonoita Reliability Project ("Project"). This includes an overview of the technical analysis that SSVEC undertook leading up to the conclusion that the proposed 69 kV line and substation are expeditiously needed. My testimony, as corroborated by the Independent Feasibility Study ("Independent Study"), done by Navigant Consulting, Inc. ("Navigant") demonstrates that following SSVEC's intensive analysis of all the viable options to resolve the capacity problems in the Sonoita/Elgin/Patagonia areas ("Affected Areas"), construction of the proposed 69 kV line is the option which: (i) provides the most optimal long-term proven and viable solution to improve feeder performance and increase firm capacity to Cooperative members in the Affected Areas; (ii) is the least possible cost-viable solution; (iii) will impact the fewest number of members; and (iv) is the most compatible with prudent technical and financial practices. My testimony will also address the issues raised in our A.R.S. §40-252 Petition and for Related Authorization ("Petition") with respect to the Cooperative's potential loss of ARRA and Clean Renewable Energy Bond ("CREB") money for the Affected Areas if the Commission does not expeditiously grant the relief requested in the Petition.

Q. PLEASE DESCRIBE THE PROJECT.

A. The Project need was first identified in a Longe Range Study done in 1971. In a 1980 two-year Construction Work Plan Analysis, potential future reliability issues in the Affected Areas of SSVEC's system became evident. At that time, SSVEC's planning staff recommended that initial action be taken to acquire an easement to provide a more reliable power supply to the Affected Areas. The practice of acquiring easements years in advance of construction has proven cost effective for SSVEC. In 1982 a 19.85- mile easement was acquired on private property of the Babacomari Ranch ("Ranch") for a 69 kV sub-transmission line, along with a new property for a substation site ("Buchanan") in a Sonoita residential subdivision.

By 1991, load in the Affected Areas had grown to a point that the substation transformer was exceeding its limit of 3.75 megawatts ("MW"), and a 7MVA substation transformer was installed. By 2005, load growth indicated that this replacement transformer would soon reach capacity. In 2007, SSVEC conducted an in-depth analysis of the existing V7 feeder line, which serves the Affected Areas, and found significant deterioration in capacity, power quality, and reliability of service. SSVEC analyzed many options to meet increasing load demand in the Affected Areas and concluded that the <u>only remaining proven, viable, cost-effective solution</u> was to construct a substation in the Sonoita area, which would also require a 69 kV line along the previously-acquired Ranch easement in order to energize the substation.

As more fully discussed in Deborah White's Pre-filed Direct Testimony, SSVEC conducted many public meetings for its members regarding the Project and took action on several suggestions, including acquisition of another substation site in a commercial area in Sonoita, which would replace the Buchanan site. SSVEC evaluated and presented extensive details on several route options to get through

the Sonoita residential area and to the new substation location. The chosen option cost the least, affected the fewest members, and utilized existing.

To summarize, electric facilities currently serving the Affected Areas have reached capacity and have significant power quality and reliability problems. SSVEC has taken all prudent measure to postpone construction of the 69 kV line and substation. In 2005, my staff proposed to SSVEC's member-elected Board of Directors, and received approval, to proceed with construction of the line and substation.

Q. DESCRIBE YOUR ROLE IN THE PROJECT?

A. My primary role at SSVEC is to provide engineering support to our Cooperative's mission which, as summarized in our By-Laws, states:

> *The aims of SSVEC are to provide an adequate, reliable supply of electric energy ... to its members, keeping the cost of electric energy as low as possible...and to help in the economic development of the area...*

It should be noted that my role in this Project goes back to 1981 when I began work as a young engineer at SSVEC in the planning group. I assisted in some of the early analysis on the Project. Currently, as Engineering Manager, all of the planning and system analysis studies, as well as the line and substation design work related to the Project, has been under my direct management and supervision.

. . .

. . .

. . .

Q. WHAT OPTIONS DID SSVEC CONSIDER AS ALTERNATIVES TO CONSTRUCTION OF THE 69 KV LINE ALONG THE PROPOSED ROUTE?

A. At the hearing held in April 2009, SSVEC introduced significant evidence regarding the Project, the various options that it considered as alternative routes for the 69 kV line, the costs of such options, and member communications and meetings through the date of the hearing. Attached to my testimony as Exhibit B is an informational communication sent to all SSVEC members describing the various options and associated cost of each option that SSVEC considered.[1] All of the underlying information that served as the basis of this document was provided to Navigant, whose conclusions and recommendations corroborated SSVEC's findings regarding these other options. The Independent Study states in three references (Executive Summary, page 5; Preferred Alternative(s), page 64; and Summary, page 93) that:

> *The preferred alternative based on feeder performance and firm capacity requirements is the construction of the new 69kV line along the Ranch where SSVEC has easement rights.*

Q. WHAT OTHER NOTEWORTHY CONCLUSIONS THAT SSVEC HAD PREVIOUSLY REACHED DID THE INDEPENDENT STUDY CONFIRM?

A. Regarding visual impacts, the Independent Study concluded on page 72 that:

> *...the T-1-A route has the least visual constraints due to its relatively lower exposure to residential and roadway views. In addition, most of this route variation follows existing distribution lines which would tend to decrease the degree of noticeable visual change.*[2]

---

[1] A copy of this April 2009 member communication is included as part of the pre-filed Direct Testimony of Deborah White and was previously admitted into evidence at the April 2009 hearing as part of SSVEC Exhibit A-3.

[2] The referenced T-1-A route is the route that SSVEC has chosen for the proposed 69 kV line.

Pages 3, 64, and 92 of the Independent Study refer to the need for immediate action to increase capacity, that is, build the line, or restrict additional load growth in the Affected Areas. Specifically quoting from the Executive Summary on page 3:

> *The results of NCI's investigation indicates SSVEC should take immediate action to address current performance issues and capacity limits, including carefully assessing the impact of customer requests for new or expanded service on V-7 feeder performance capacity.*

Q. DOES THIS MEAN THAT IF THE COMMISSION DOES NOT GRANT THE PETITION, SSVEC WILL CONTINUE TO PURSUE ITS APPLICATION FOR A MORATORIUM ON NEW HOOK-UPS TO THE EXISTING V-7 FEEDER LINE?

A. It is my recommendation, as corroborated by the Independent Study, that additional loading of the V-7 feeder will likely result in further degradation of service quality and reliability in the Affected Areas, and if the Petition is not immediately granted, the moratorium must be pursued.

Q. DID SSVEC ALSO CONSIDER RENEWABLE ENERGY OPTIONS, INCLUDING DISTRIBUTED GENERATION, AS AN ALTERNATIVE TO CONSTRUCTION OF THE 69 KV LINE?

A. Yes. SSVEC had considered distributed generation options, including renewable energy generation, but determined that these alternatives would not resolve the capacity and reliability problems for the Affected Areas. Additionally, subsequent to the hearing in April 2009, members of the public opposed to the construction of the 69 kV line filed information in the docket reiterating their opposition to the line and proposing that the capacity problem in the Affected Areas could be alleviated

through renewable/distributed generation applications allegedly at less than the approximate $13 million cost of the Project. Such information was also provided to SSVEC. My staff and I carefully analyzed this information to ensure that we had not missed anything in this regard. SSVEC's professional staff has the technical expertise and requisite experience to conduct such an analysis.

Despite the unfounded assertions made at the August 17, 2009, Open Meeting ("Open Meeting") by some members who opposed construction of the 69 kV line to the contrary, SSVEC did conduct a careful and thorough evaluation of the renewable generation and other proposals submitted by the opposition group and prepared an extensive report that it provided to Commission Staff prior to the Open Meeting and was referenced at the Open Meeting. A copy of that report is attached to my testimony as Exhibit C.[3] Additionally, Deborah White, an SSVEC Project Team member, and I personally met with Staff the week before the Open Meeting for more than ten hours to go over every aspect of the Project, including SSVEC's analysis of the renewable energy and alternative proposals which had been submitted by the opposition group subsequent to the hearing. At the Open Meeting, and consistent with SSVEC's analysis, Commission Staff reiterated that the problem in the Affected Areas can not be solved by renewable energy alone. Staff did not disagree with any of the Cooperative's conclusions or recommendations, and the Independent Study corroborates these findings.

. . .

. . .

. . .

. . .

[3] Attachment C was also attached to SSVEC's September 28, 2009, *Application for Reconsideration and Rehearing* as Attachment E.

At the Open Meeting, the Cooperative advised the Commission that it had in fact looked at all of the proposals submitted and that a renewable/distributed generation alternative would not resolve the capacity, power quality, and reliability problems for the Affected Areas. The Cooperative also reiterated that if the Project did not go forward, the Affected Areas would still be plagued by outages and voltage instabilities and that for years, it has been assuring its members in the Affected Areas that relief was on the way through the construction of a new substation and 69 kV line.

Q. DID THE INDEPENDENT STUDY CONFIRM THE CONCLUSIONS REACHED BY YOU AND YOUR STAFF REGARDING RENEWABLE/DISTRIBUTED GENERATION APPLICATIONS AS A VIABLE ALTERNATIVE TO CONSTRUCTION OF THE 69 KV LINE?

A. Absolutely. Suffice it to say, the Independent Study concluded on page 5 that:

> *Most renewable energy options, including wind and solar photovoltaic, did not provide sufficient coincident peak load reduction to be feasible – the feeder peak occurs during cold winter mornings when the sun is low on the horizon.*

Q. THE COOPERATIVE'S PETITION STATES ON PAGE 11 THAT "THE COMMISSION'S AUTHORIZATION FOR SSVEC TO IMMEDIATELY COMMENCE CONSTRUCTION OF THE 69 KV LINE WILL ALLOW SSVEC TO TAKE ADVANTAGE OF A $6 MILLION CLEAN RENEWABLE ENERGY BOND ("CREB") OFFERING TO CONSTRUCT A LARGE SOLAR PROJECT CO-LOCATED WITH THE NEW SUBSTATION." PLEASE ELABORATE ON THIS TOPIC.

. . .

. . .

A. SSVEC was recently awarded a CREB offering of $6M, made available to cooperatives via the Emergency Economic Stabilization Act of 2008, for design and construction of a 750 kW grid-connected solar electric system. SSVEC's intention is to install this system as part of the new Sonoita Substation in the Affected Areas. Power from this solar system would be injected onto the substation "bus" and be distributed throughout the Affected Areas.

This project would reduce the amount of coal-fired energy (kWh) that SSVEC would be required to purchase, but this would not alleviate the need for the 69 kV line to provide power (kW) to meet the peak power needs of all members in the Affected Areas.

Q. IS THERE A TIME LIMIT ON THE USE OF THESE FUNDS AND IS THERE A CHANCE THESE FUNDS MIGHT BE LOST IF THE PROJECT IS FURTHER DELAYED?

A. Yes. The Internal Revenue Service regulations pertaining to CREBs require that the project be completed within three years starting October 23, 2009. In order for the solar project to be fully commissioned, the 69 kV line and substation must be fully operational. Given the long lead time for solar equipment in today's marketplace, SSVEC must immediately begin design preparations to avoid the risk of losing the CREBs funding for the Affected Areas. Given the statements that have been made to the Commission regarding the community's alleged desire for the Cooperative to incorporate more renewable generation into the generation plans for the Affected Areas, it would be a shame to jeopardize installation of this solar facility in the Affected Areas by further delaying the Project.

. . .

. . .

Q. THE COOPERATIVE'S PETITION MENTIONS ARRA MONEY FOR SMART GRID AND DEMAND SIDE MANAGEMENT INFRASTRUCTURE FOR THE AFFECTED AFEAS. PLEASE EXPLAIN HOW THIS GRANT IS RELATED TO THE PROJECT.

A. SSVEC submitted a proposal and is in final negotiation for a total of $15 million ARRA grant, commonly referred to as a "Stimulus Grant" to expand and accelerate on-going Smart Grid and Demand-Side Management ("DSM") activities at SSVEC. The grant will provide 50/50 cost share for installation of about 140 miles of fiber optic cable to be installed mostly on SSVEC's 69 kV sub-transmission system and automation of line equipment and substations along that path. Automation and "smartening up" of the proposed 69 kV line to Sonoita and the new Sonoita Substation were included in our proposal.

The Project, if implemented in a timely fashion, would receive approximately $1.1 million of that grant money to support the following project components: (1) automation of the 69 kV switch at the new Sonoita Tap (thus allowing remote operation of the switch for increased system reliability); (2) installation of fiber optic cable on the 69 kV line from the new Sonoita Tap to the new Sonoita Substation (to provide a robust communication path from the Affected Areas to SSVEC operations centers); (3) installation of digital relay and control devices within the new substation (thus increasing system reliability and operational performance); (4) installation of a complete System Control and Data Acquisition (SCADA) system at the substation to allow SSVEC to monitor and control substation devices; (5) installation of a power line carrier, two-way communication system (commonly referred to as Automated Metering Infrastructure or "AMI") to allow real time communication between SSVEC's control center and individual meters in the Affected Areas; (6) installation of

approximately 2,500 new two-way meters at residences and commercial services in the Affected Areas; and (7) an aggressive DSM program. This entire AMI system will allow SSVEC to implement a state-of-the-art DSM, energy efficiency, and load control program throughout the Affected Areas and significantly improve system reliability, outage response, and system operation.

Q. YOU JUST STATED THAT THE "PROJECT, IF IMPLEMENTED IN A TIMELY FASHION, WOULD RECEIVE APPROXIMATELY $1.1 MILLION OF THAT GRANT MONEY...". IS THERE A TIME LIMIT ON THESE FUNDS, AND IS THERE A CHANCE THESE FUNDS MIGHT BE LOST IF THE PROJECT IS FURTHER DELAYED?

A. Yes. The term of this grant is 36 months from the date of the award. SSVEC anticipates contract award within the next 30-60 days. All work must be completed within this time frame. The 69 kV line and substation will take approximately 12 to 18 months once we are allowed to re-commence design, materials procurement, and construction. However, please understand that the Smart Grid meters can not be deployed until the substation is fully commissioned and operational, which would add 6 to 8 months to the schedule. Further, the DSM interventions such as Home Energy Displays that will allow real-time pricing signals to be sent to member homes via this AMI system, can not fully commence until the Smart Meters are installed and participation from the community is actuated, for which scheduling is yet unknown.

It should be noted that the backbone of this Smart Grid project is the installation of fiber optic cable. If SSVEC is not permitted to build the 69 kV line, the fiber will not be installed and the *entire* $1.1 million in Smart Grid intervention proposed for the Affected Areas will be lost. Given the conclusions and

recommendations of the Independent Feasibility Study that the 69 kV line should be built, there is no reason for further delays that will put this money in jeopardy for the Affected Areas.

Q. DOES THIS CONCLUDE YOUR TESIMONY?

A. Yes, it does.

11200216.2

Exhibit A

Ron Orozco, P.E., CEM, CDSM

Engineering Manager, SSVEC

Phone: (520) 609-5026

e-mail: rorozco@ssvec.com

Ron possesses a unique background of education and work experience on both the electric utility side and the industry side of various renewable energy technologies. This experience spans thirty years beginning in 1979 with early solar and wind energy system research at the University of Arizona to current position as Engineering Manager at Sulphur Springs Valley Electric Cooperative. Included in this period is: increasingly more challenging and professional development in conventional rural electric utility engineering; energy efficiency, and demand-side management; renewable energy system design, installation and maintenance; renewable energy program design, implementation and evaluation worldwide; solar and wind energy training worldwide; wind resource assessment.

Ron holds the following credentials: B.Sc. Engineering – University of Arizona; registered Professional Engineer in Arizona (AZ#21623) and New Mexico (NM#12607); Certified Energy Manager (#5266) and Certified Demand Side Manager (#83) through Association of Energy Engineers; Journeyman Electrician (EE-98J in NM #35084) and Licensed Electrical Contractor (EE98 in NM #91998) in New Mexico (neither current to avoid any conflict of interest with current position at SSVEC); NABCEP Certified Solar PV Installer™ (not current to avoid conflict of interest); Member of the NRECA Cooperative Research Council's Renewable and Distributed Energy Management Advisory Group; graduate of the NRECA/University of Nebraska Management Internship Program.

Electric Utility Experience

- **Conventional Electric Utility Engineering**
  - Engineering Manager with direct management responsibility for a team of 28, including five Professional Engineers, for all design, field staking, right-of-way acquisition, power quality, construction standards, and planning for a $25M+ construction work plan
  - Transmission line (up to 115 kV), distribution line (7.2/12.47 kV and 14.4/24.9 kV), and substation design and construction
  - Load flow analysis and system losses evaluation
  - Development, training, and use of distribution line staking manuals
  - Power requirements studies
  - Rate studies and presentation to state utility commission

- **Energy Management**
  - Certified Energy Manager and Certified Demand Side Manager through Association of Energy Engineers
  - Completed energy audits of dozens of irrigated farms in Arizona establishing metric for energy conservation program goals leading to implementation of a demand-side load management program to shed 20+ MW of irrigation load for peak shaving
  - Taught irrigation load management programs for Western Area Power Authority
  - Conducted dozens of residential energy audits as part of marketing and application assessment for grid and off-grid renewable energy applications

- Provided technical assistance in energy conservation programs to various Central American electric utilities during nationwide power shortages
- Arranged for representatives of the National Association of Energy Service Companies to visit Central American utilities and present ESCO and ESPC concepts
- Developed and implemented energy conservation training programs and materials for use in newly electrified rural villages of Central America
- Successfully identified funding for, and completed field installation of, 100+ residential electric meters in previously unmetered solar/wind/diesel hybrid village in Mexico

Renewable Energy Experience

➢ **Renewable Energy System Design, Installation and Maintenance**

- Charter NABCEP Certified Solar PV Installer™ through the North American Board of Certified Energy Practitioners dedicated to recognizing the most qualified and experienced solar energy professionals (not current)
- Responsible for design review and field inspection of forty-one 21kW, 3-phase grid connected photovoltaic systems installed at schools in Cochise County
- Responsible for design review and field inspection of dozens of residential grid-connected solar and wind energy systems through SSVEC's SunWatts program.
- Owned and managed Energía Total – an electrical contracting firm specializing in solar and wind energy system design, installation and maintenance in New Mexico (1996-2001)
- Designed and installed over 50kW of solar and wind electric systems for domestic, Arctic, Antarctic and Latin American markets
- Designed, built and marketed the "FireFly" line of pre-assembled, skid-mounted solar and solar/wind/gasoline genset systems
- Designed and built DC power control system for remote telecomm application in the Amazon of Brazil
- Designed and built two solar/wind/gasoline hybrid systems for Arctic application
- Designed and installed more than six wind energy systems using turbines ranging from 10kW to 500 watts
- Designed and installed approximately 20kW of grid-connected solar electric systems including a one commercial 10kW and one 6kW – 3 phase system and several residential systems
- Field engineer for 75MW+ wind energy project in Appalachia responsible for site evaluation, permitting, and project design including array layout, substation design and underground sub-distribution system design

➢ **Renewable Energy Program Design, Implementation and Evaluation**

- Renewable Energy Consultant to World Bank, US Agency for International Development, Sandia National Laboratories, Southwest Technology Development Institute, American Wind Energy Association, Solar Energy Industries Association, Solar Energy Research and Development Fund and others in design and evaluation of renewable energy programs in US, Mexico, Central and South America and Africa.
- World Bank assessment of renewable energy opportunities in rebuilding of energy infrastructure for Mozambique

- **Solar and Wind Energy Training**
  - Developed training materials and presented dozens of training sessions ranging from community meetings to week-long technical training courses in US, Mexico, Central and South America, and Africa for audiences ranging from national Ministers of Energy to small farmers

- **Village Power**
  - Established and implemented a private ownership model for a 6MW diesel generation station and associated transmission and distribution system on the island of Roatan, Honduras including interim management and implementation of a demand- and supply-side energy management programs
  - Directly engaged in design, installation, review and/or maintenance of numerous diesel only, wind/diesel, and wind/solar/diesel village power systems in Mexico, Central America, Brazil and Peru
  - Conducted field evaluation of 10+ village diesel systems in Amazon for potential conversion to hybrid renewable systems
  - Institutional and Energy Management Specialist for large diesel/solar village power system in the Peruvian Amazon with International Lead Zinc Research Institute, the Solar Energy Industry Association and the Solar Energy Research and Education Fund

- **Domestic Wind Energy Experience**
  - **Western Maryland**
    - Installation of 50-meter meteorological tower and supervision of two other towers
    - Implement project scheduling, land acquisition, permitting, micro-siting, and town meetings
    - Engineering representative to transmission utility on substation and interconnect issues
    - Oversee various site environmental studies, surveying, and sub-contractor activities
  - **New Mexico**
    - Owner/Operator of company that installed seven 40-meter anemometer towers for State of NM Energy, Minerals and Natural Resources
    - Personally installed two 40-meter resource assessment towers
    - Isleta Pueblo Wind energy proposal for DOE/Kirtland Air Force Base/Sandia Labs
  - **South Dakota**
    - Site assessment, partnering agreements, PPA discussions with local utilities, interconnect review, avian issue paper, oversight of environmental assessment, detailed financial analysis, for single-turbine grid-connected 750kW-1MW project with Rosebud Sioux tribe and DOE.
    - Integrated Resource Plan for Rosebud Sioux tribe including wind energy

Ron Orozco, P.E.
rorozco@ssvec.com

- **International Wind Energy Experience**
  - **Mexico**
    - Baja California – Directed wind resource assessment program for DOE/Sandia. Arranged institutional partnering, general and micro siting for anemometer towers, local fabrication and installation of 15-meter towers in seven sites along Pacific coast of Baja California. Facilitated data collection and delivery of data.
    - Yucatan Assessment – Pilot and project director for aerial and ground survey of potential wind energy sites along Southern Yucatan coastline.
    - Oaxaca Assessment - Pilot and project director for aerial and ground survey of potential wind energy sites along the coastline and Isthmus of Tehuantepec (La Ventosa).
  - **Brazil**
    - Co-author of Training Needs Assessment for USAID/Brazil including support large wind energy technologies
    - Taught technical and commercial portions training course on commercial development of large wind energy projects in Brazil
  - **Guatemala**
    - Assisted in identification and project development for Huité Wind Energy Project and facilitated tour of US manufacturers
    - Consultant to Ministry of Energy of Guatemala for development of energy policy friendly to renewables
  - **Honduras**
    - Facilitate wind project near Tegucigalpa
    - INCAE/REETI Wind Energy Training
  - **Peru**
    - Host Ministry of Energy representative to Tehachapi and beyond
  - **Canada**
    - Prepare Wind/Gas project proposal for First Nations of Canada
    - Prepare Wind/Gas project proposal to Canadian Department of Energy

Exhibit B

Sulphur Springs Valley Electric Co-op

Every member of the Sulphur Springs Valley Electric Co-op conducts an analysis of its entire electrical system for performance, reliability, and improvements requirements as part of our construction work plan study.

What every member of Sulphur Springs Valley Electric Co-op should know about the Sonoita Reliability Project

In coming weeks, you may be hearing more about our plan to build a new 69,000 volt (69kV) sub-transmission line in the Sonoita area. Let me reassure you about several key points:

- We have thoroughly studied all reasonable alternatives.
- We have made extensive efforts to inform the public at every major step.
- We have listened to public comments and have modified our plans wherever possible, including moving a proposed substation to a better site suggested by area residents.
- The route we have chosen is the most cost-effective way to solve the growing reliability problems in Sonoita/Elgin/Patagonia area.
- The route we have chosen is the fairest to all of SSVEC's ratepayers.
- The chosen route affects the fewest landowners.
- The chosen route visually affects the fewest members.
- The construction of this line is absolutely necessary and must begin without further delay.

We are sending this letter to provide full details and to respond to several information requests we have received over the past few months from a variety of sources and as part of our promise to the Arizona Corporation Commission (ACC) to investigate alternatives and keep our members informed. The ACC is the part of state government that regulates electric utilities.

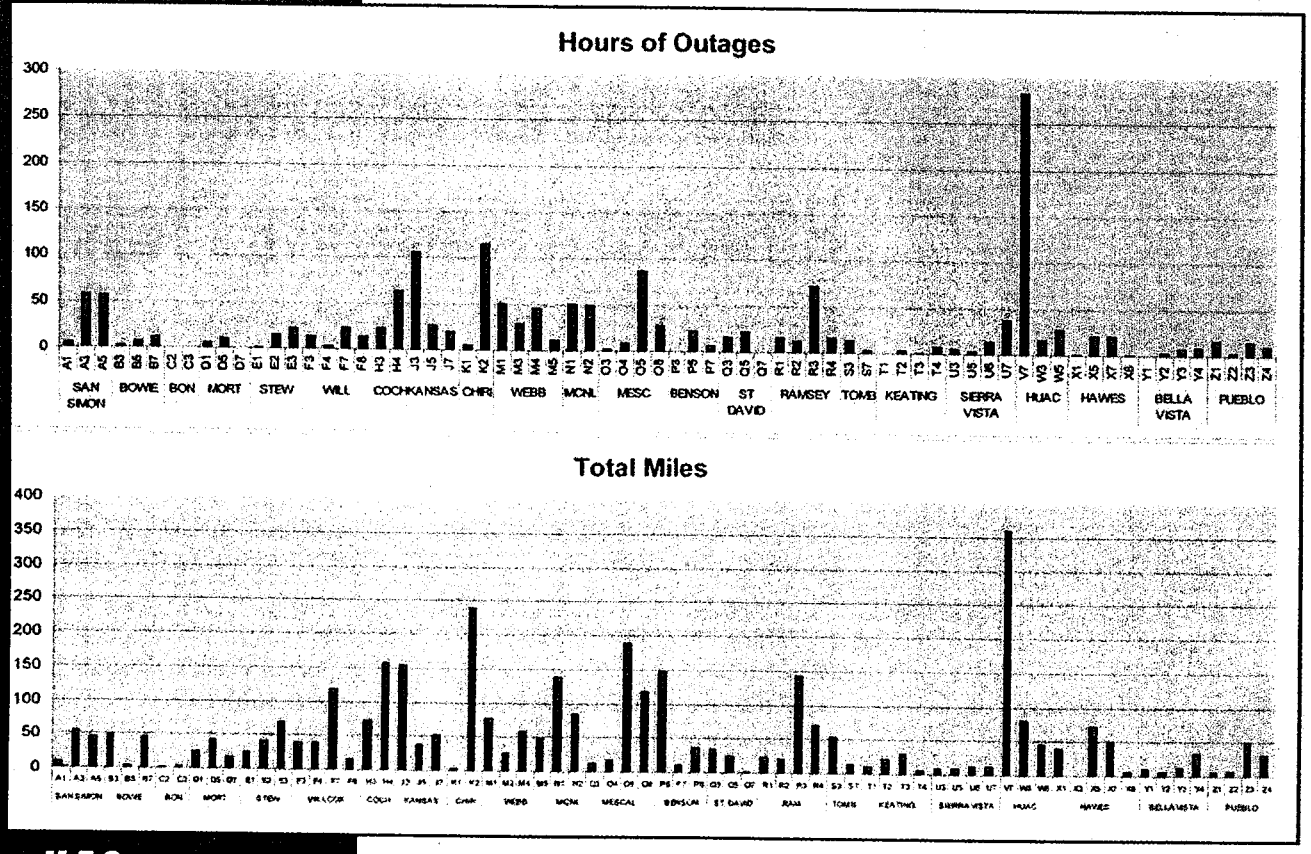
WHY A NEW LINE IS NEEDED

The Huachuca Substation, which is located near the junction of Highway 90 and Highway 82 in Whetstone, provides all of the power to Rain Valley, Elgin, Sonoita, Canelo, and Patagonia. It provides services to more than 2,400 meters and has more than 360 miles of line. This line is known as the "V-7 Feeder."

The V-7 is served by what we call a "radial" line, meaning that there is only one connection point to the power supply at the substation. The industry standard is to have two or more lines providing

service out of a substation, which provides back-up capability from one line to another. Such connections are called "loops." Currently, all of the power on the V-7 feeder comes directly from the one substation. If that substation or the line fails, all of the customers on this line lose power.

the potential for future electric reliability issues in the Sonoita/ Elgin/Patagonia area. It is the policy of SSVEC to purchase and record easements far in advance of the actual construction of the line so that members who purchase land and build on the property can be aware that eventually a line could



V-7 Outages per Year and Length in Miles as compared to all SSEVC feeders

Much of this single line travels though diverse landscapes of open plains, rolling hills, dense oak forests, rugged mountains, and remote areas to serve small communities or just one customer. Outage times are often long because of the time required to get into the terrain and patrol the line looking for the cause of the outage. This is also the longest feeder line in our system and it has twice as many outages as the next worst feeder line.

SSVEC identified as early as 1980

be built on these easements.

SSVEC does not build lines until they are actually needed. In the meantime all other options are explored, to be conservative with our members' money. In 1982, SSVEC purchased the 69 kV sub-transmission easements as well as substation property in the area and these were recorded with the appropriate governmental agencies.

Every two to three years, SSVEC conducts an analysis of its entire electrical system for performance,

reliability, and required improvements as part of our construction vork plan study.

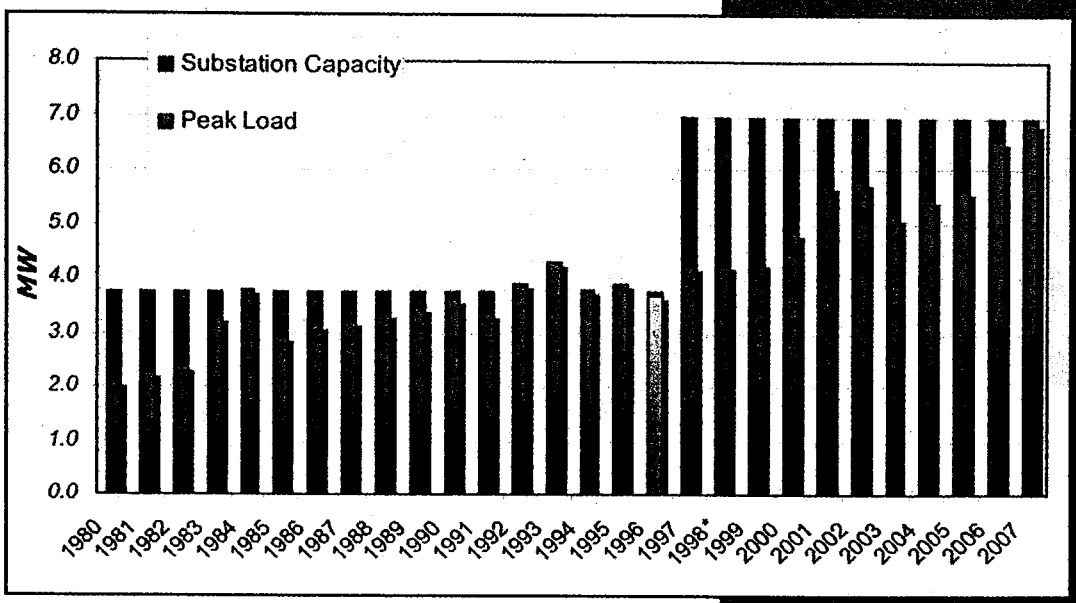
In 1991, as a result of our analysis, it was determined that the Sonoita/Elgin/Patagonia area growth was quickly approaching the maximum capacity of the existing current electric equipment. SSVEC began to explore the options available to ensure reliable power in the future for this area, including the possible construction of a new substation and 69 kV sub-transmission line.

In 1996, SSVEC evaluated the situation and installed improved voltage regulation equipment on the V-7 feeder and upgraded the Huachuca Substation from a 3.75 megawatt (MW) transformer to a 7.0 MW transformer, deferring the significant cost of the substation and 69 kV sub-transmission line.

In other words, we took advantage of as many technological updates as possible to avoid building this line until absolutely necessary.

In 2005, due to increased growth in the area and the resulting increase in electricity use, the SSVEC system planning study identified the need to upgrade its infrastructure. This growth represents the ddition of new members and the fact that each member typically now has more appliances that use more electricity, compared to the past – more air conditioners, heat pumps, electric ranges, furnaces, water heaters, plasma televisions, computers, etc.

In 2007, SSVEC again conducted an in-depth analysis of all of the options to ensure electric reliability and concluded that the only remaining viable, cost-effective solution was to construct the 69kV line and a substation in the Sonoita area. In 2007, the management of SSVEC presented that recommendation to the Board of Directors, who subsequently approved the funding for the Sonoita Reliability Project.



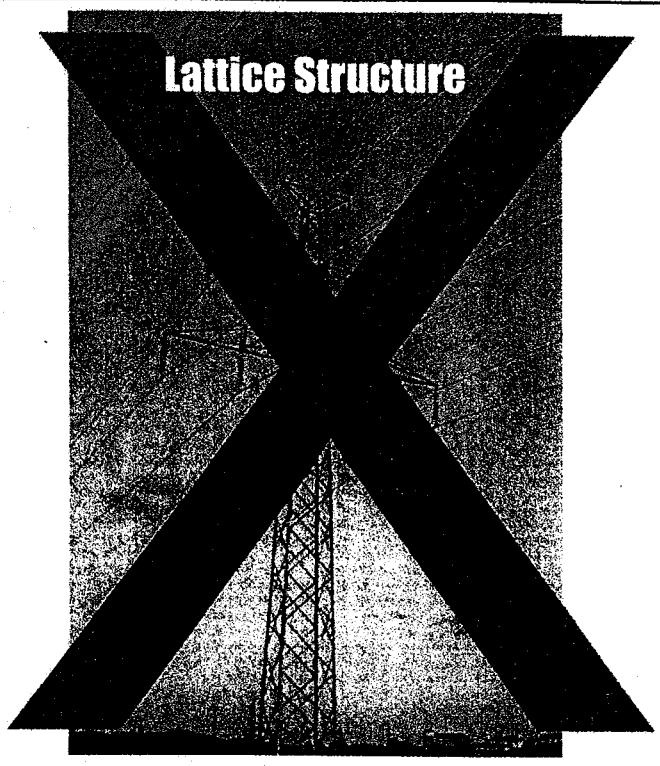
Increasing Load vs. Capacity
Huachuca Substation Reaching Capacity

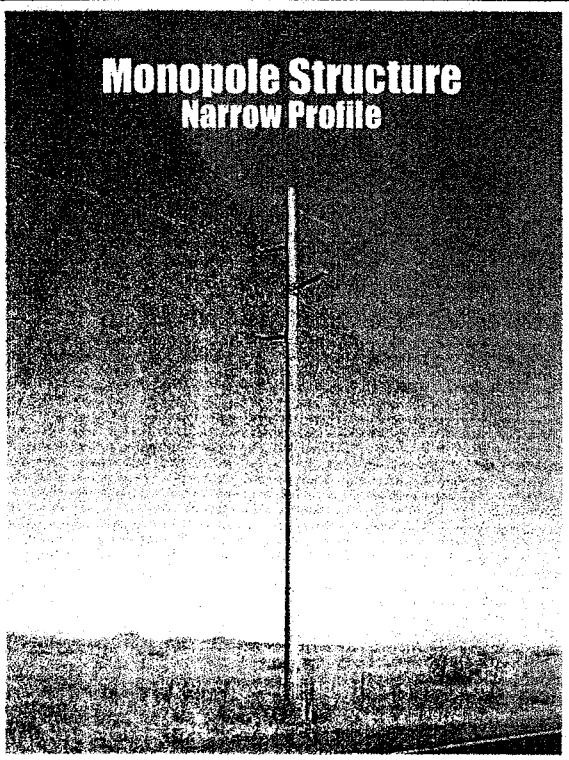
The purpose of the Sonoita Reliability Project is to provide a solution to the current reliability issues affecting the V-7 feeder. The solution is to install a substation in the Sonoita area and eliminate the long radial length of the V-7 feeder by establishing four separate, shorter feeders. Each of the four feeders would then be:

- Individually operated at the substation, with separate voltage regulators to adequately control the

distribution line voltages for the type of community load on each feeder.

• Sectionalized individually, meaning that if an outage occurs on one feeder, it will not interrupt any of the consumers on the other feeders. This will reduce the number of members who suffer power outages, and will shorten those outages.





Overhead Structures

• "Tied" together where possible to reduce outages. This means that portions of an interrupted feeder may be transferred to another feeder so power availability is continued to our members while repairs are being made at the outage location.

These features will have an immediate and lasting positive impact on the quality of service to all SSVEC members in the Sonoita/Elgin/ Patagonia area.

KEEPING YOU INFORMED

Once SSVEC determined that the only solution was to build the 69kV line and the substation, we prepared an initial engineering study and solicited input from our members who are affected by this line.

Two Board of Directors Meetings were held in Patagonia, one in 2008 and most recently in March 2009. During these and other board meetings over the past two years, members from the area spoke to our board, both in favor of and in opposition to this project. SSVEC took all of these comments under advisement.

SSVEC also has held several public meetings in the community regarding this project: March 28, 2008 (meeting with community to discuss the project), July 22, 2008 (community presentation in Elgin), August 13, 2008 (neighborhood meeting with Sonoita residents), September 12, 2008 (meeting with the "community committee"), and

January 17, 2009 (meeting of the landowners who are impacted by he easement).

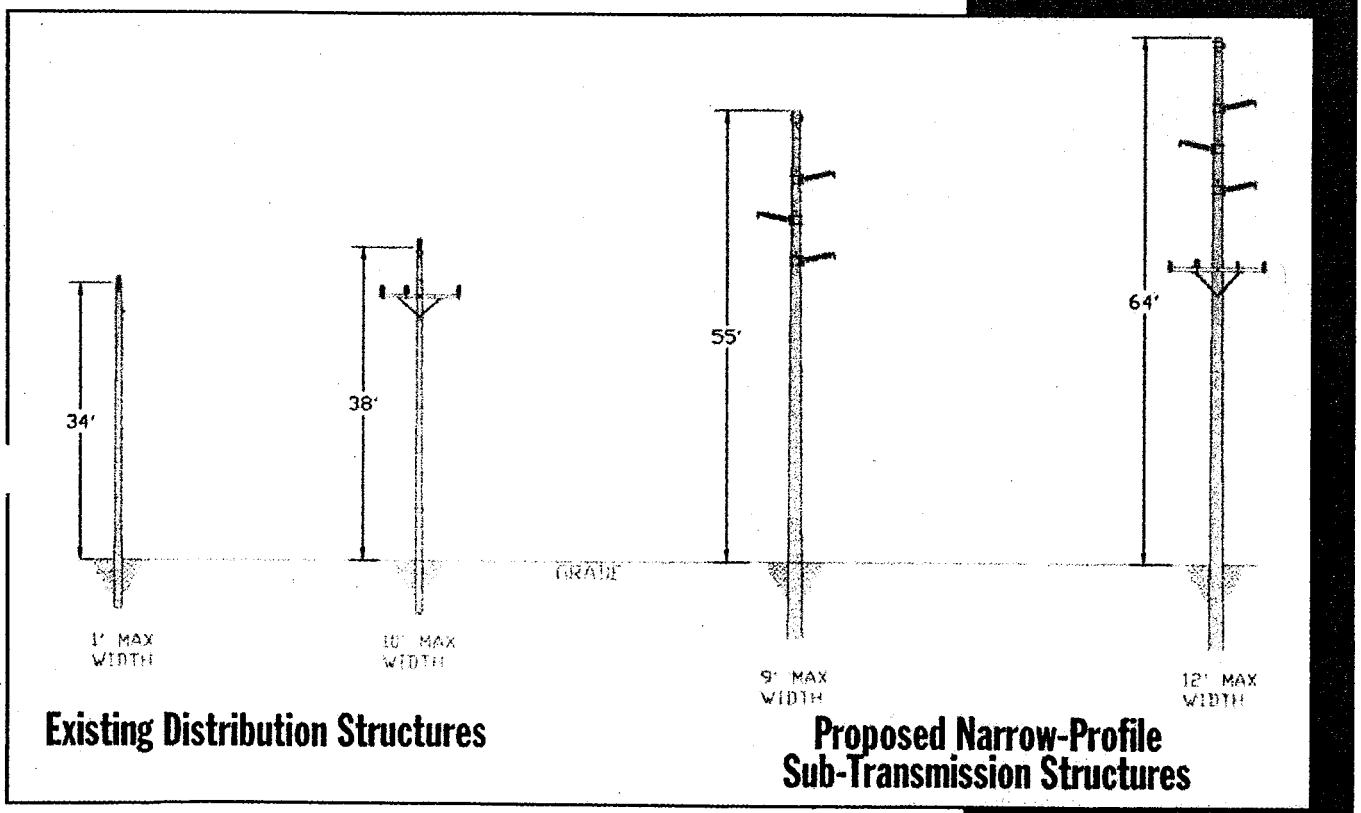
SSVEC employees have had scores of discussions, either one-on-one or in small groups. We have also reviewed many letters, e-mails, telephone calls, and other contacts. We have sent out six mailings about this subject to our members. These mailings were on March 4, 2008; July 7, 2008; August 6, 2008; August 8, 2008; September 22, 2008 and December 1, 2008. All of this correspondence, including the PowerPoint presentation from July 22, 2008 was placed on our Web site for all SSVEC members to view.

Based on member input, SSVEC has made several changes in the 9kV line as well as the substation. Some of the major changes include:

• Moving the original substation location from a residential area to an industrial/commercial location. This new location will allow the substation to be concealed from residential neighborhoods.

• Using narrow-profile mono sub-poles with smaller arms. We will use pole colors that more easily blend in with the terrain. We will also use reduced glare conductors and longer spans for reduced visual impact. In short, we have reduced the visual impact as much as possible.

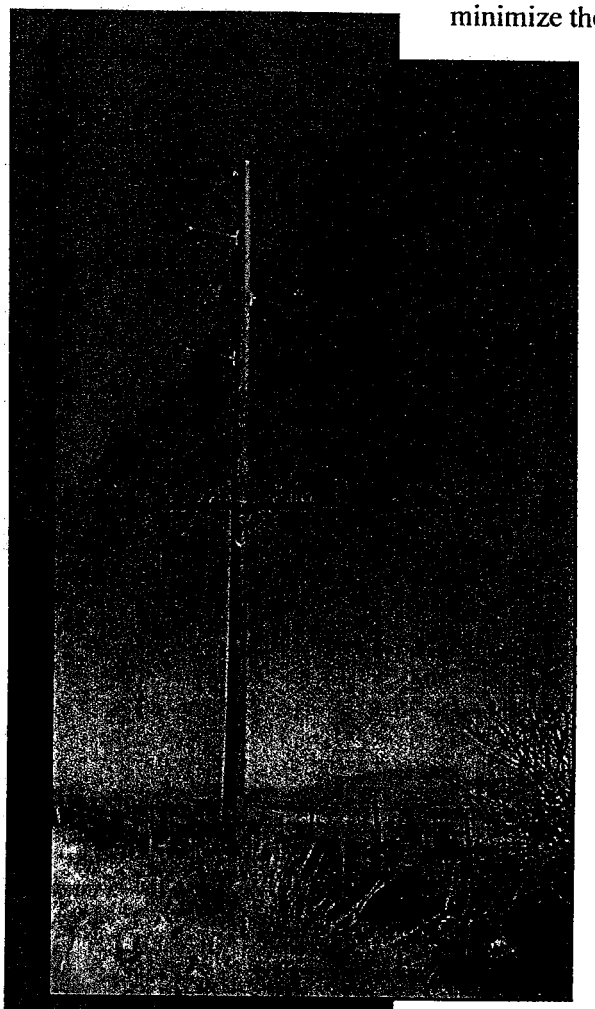
• On a portion of the route, the existing overhead distribution lines will be converted to underground to allow 69kV poles at least 10 feet shorter than originally planned. This will allow SSVEC to remove 46 existing distribution poles in the residential area of Sonoita Hills and replace them with 12 of the newly designed low profile 69kV poles. In net terms, this portion of the



Pole Height Comparisons

route will have 34 fewer poles than currently exist.

• Our engineers will work with residents affected by the line and make reasonable pole location adjustments whenever possible to minimize the visual impact.



Low-profile Sub-Transmission Pole with High Flat Distribution Crossarm

OPTIONS AND COSTS

By now I hope we have made it clear that SSVEC considered many options before making the final decision on where to build, and what kind of system to build, to ensure quality and reliable service to all of our members in the Sonoita/Elgin/ Patagonia area.

The route that SSVEC has chosen (Option One – described above) is the most cost efficient route, affects the fewest members, and uses existing easements. The cost to build this route and substation is $13.5 million. Other alternatives would be 1.8 to 4.1 times more expensive.

Option	Cost
One	$13,500,000
Two – Energized	$24,600,000
Two A – De-energized	$19,600,000
Three – Bury Line	$55,000,000
Four – Original Substation	$13,300,000
Five – TEP Interconnect	Not Viable/ High Cost

The other routes and options considered included:

• *Option Two: Upgrading the existing feeder line along Highway 82 and Elgin Road. This could be done either energized or by building it de-energized (build an adjacent line to the existing one).*

Rebuilding the line while energized would be slow, expensive, and dangerous to our linemen as the line would have to be rebuilt with the lines energized. It would require the acquisition of right-of-ways from more than 80 landowners as the existing right-of-way does not include sub-transmission land rights. In addition, the majority of this route has been designated a part of the 2000 Las Cienegas Conservation Area, so special permitting from the Bureau of Land Management would be required. The cost of this option would be about $24.6 million.

• *Option Two A:*

Rebuilding this line by building an adjacent line to the current one while safer for our linemen, will still require the right-of-ways mentioned above. The cost of this option is $19.6 million.

• *Option Three: Build along the current option, but instead bury the 69 kV sub-transmission line underground.*

This option seems to be a simple solution, especially since many residential members have opted to install underground distribution lines. However, installing an underground sub-transmission line is a very complex issue and significant issues are involved:

1. The insulated cables used in underground sub-transmission lines require one or two large trenches, which lead to greater environmental disturbances. Also, concrete vaults or large manhole covers are required

every 900 to 2,000 feet depending on terrain.

2. Underground electric conductors produce heat and for efficient operation this heat must me carried away from the conductors. (Air performs this function for overhead lines.) This requires special concrete caps around the soils and special thermal backfill material to move the heat away for the line. Once again, greater environmental damage would result.

3. The right-of-way must be kept clear of any vegetation due to the possible interference by root systems.

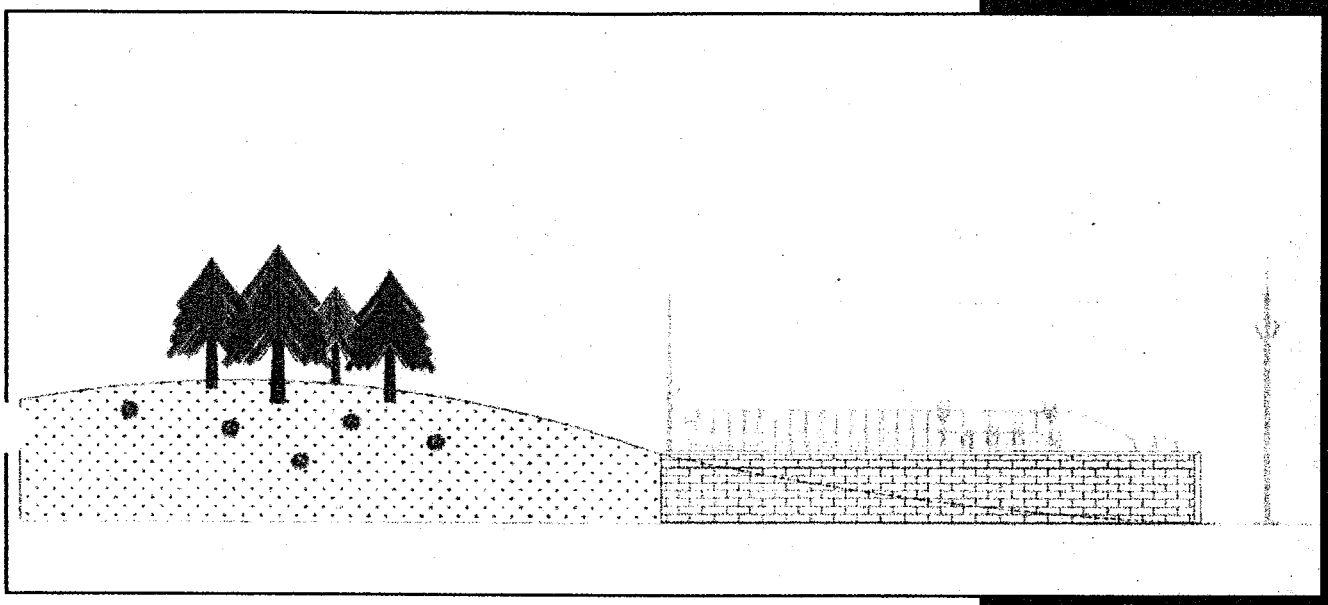
4. Studies have indicated the life span of underground conductors is half of that of overhead lines thus increasing costs over time.

5. Any failures in underground transmission lines are extremely costly, disruptive, and time expensive to repair. Underground outages can last for weeks and even months.

The cost of underground 69kV sub-transmission line is estimated to be $55 million plus the shorter life span and increased cost to repair over time.

• *Option Four: Build the substation at the original Buchanan Substation location.*

After input from the community, it was determined that moving this substation to an industrial/commercial location would impact fewer people. If SSVEC were to use this site, it would require the building of not only a substation, but also one triple-circuit and one single-circuit large conductor feeders through the Sonoita Hills Subdivision. It will also not change the route of the 69kV line through the ranch area. This option would cost $13.3 million, but was not chosen because for $200,000 more we could move the substation and the lines to an industrial/commercial location.



Substation Screening

• *Option Five: Interconnect with the Tucson Electric Power (TEP) 46kV sub-transmission line.* This line was built in the 1940's. Several issues were identified with this alternative:

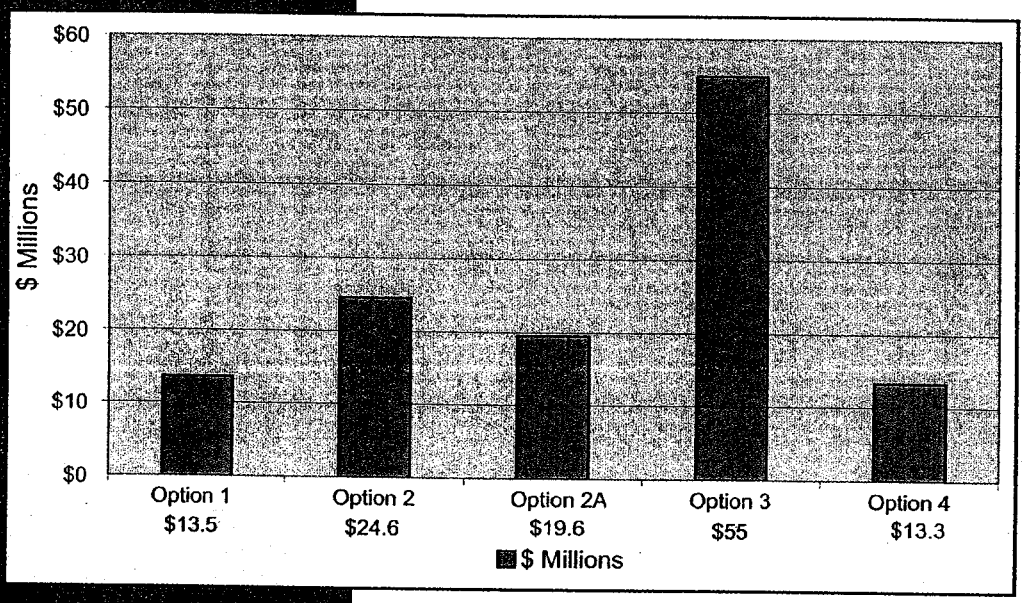
1. This power line serves Fort Huachuca and does not have enough capacity available for a substation to carry the additional load of the Sonoita/Elgin/ Patagonia area.

2. TEP is bound through their Certificate of Convenience and Necessity by a special bonding arrangement which strictly limits their ability to serve outside two counties. TEP's management in 1993 and in 2007 indicated a joint project may violate their bonding agreement.

3. Additional rights-of-way adjacent to the TEP line would be required which will be expensive.

4. SSVEC's short cost analysis also indicates that this option will be much more expensive than the route chosen.

**Option Five was not a viable option and was not estimated.*



Cost of Options

IN SUMMARY

SSVEC listened to the community input and wherever possible made changes.

The V-7 feeder has reached its maximum capacity, and, in fact, has exceeded it several times recently, which resulted in reduced voltage (brownouts), blinks, and some outages. The new substation and 69kV line must be built now. Without this critical new infrastructure, SSVEC will have no choice but to invoke a moratorium on new services in this area – and keep in mind that this action would still not resolve the current reliability problems.

SSVEC considered many options before making its final decision on what the best solution was for the all of the members served by the V-7 feeder. SSVEC strongly believes that it made the best, most cost-effective decision and the one that visually affects the fewest members. This solution will greatly improve power quality and reliability to all members in the Sonoita/Elgin/Patagonia area as well as being just and equitable to all SSVEC members.

Sincerely,

Creden Huber

Chief Executive Officer
Sulphur Springs Valley Electric Cooperative

Exhibit C

SONOITA RELIABILITY PROJECT

Sulphur Springs Valley Electric Cooperative, Inc.

A Touchstone Energy® Cooperative

SSVEC

INDEX

Sulphur Springs Valley Electric Cooperative, Inc.

A Touchstone Energy® Cooperative

INDEX

Article I. REQUEST for PROPOSAL

Section 1.01 *3SEG Draft RFP*

Section 1.02 *SSVEC RFP Rebuttal*

Article II. V7 FEEDER ANALYSIS

Section 2.01 *3SEG Analysis and Recommendations*

Section 2.02 *SSVEC Analysis Rebuttal*

Article III. CONSTRUCTIVE POINT PAPER

Section 3.01 *3SEG CPP Reliability Alternatives*

Section 3.02 *SSVEC CPP Rebuttal*

Article IV. LETTERS

Section 4.01 *Evolution of 3SEG Complaints*

Article V. TRANSFORMER CAPACITY

Section 5.01 *Huachuca Substation Transformer*

Section 5.02 *V7 Load Curves*

Section 5.03 *V7 Load & Solar Radiation 2/06/2008*

Section 5.04 *Industry Practice on Transformer Loading*

Article VI. V7 MILSOFT ANALYSIS

Section 6.01 *July 2009 477 Express Feeder Model*

Article VII. COST ESTIMATE

Section 7.01 *2009 Estimates for Line Construction Alternatives*

Section 7.02 *1993 Historical Cost Estimates for Construction Options*

Article VIII. TUCSON ELECTRIC POWER (TEP)

Section 8.01 *Back-Up Service Alternative Rebuttal*

Section 8.02 *2003 TEP Letter for Proposed 46kV Tap*

Article IX. UNISOURCE ENERGY (UNS)

Section 9.01 *Load Serving and Back-Up Service Alternative Rebuttal*

Article X. RELIABILITY

Section 10.01 *V7: 3SEG Outage Analysis for 2008 (partial)*
Section 10.02 *SSVEC 3SEG Outage Analysis Rebuttal and Graphs*
Section 10.03 *NRECA Reliability Survey: Definitions*
Section 10.04 *2009 Outage Study for Construction Work Plan Analysis*
Section 10.05 *Reliability Solutions Implemented for High Outage Feeders*
Section 10.06 *V7 Graphic representing April 2009 Fire Outage Impact*
Section 10.07 *1992-1996 Outage Analysis from Historical Archive*

Article XI. GROWTH FORECASTS

Section 11.01 *3SEG Growth Forecast*
Section 11.02 *SSVEC Rebuttal of 3SEG Growth Forecast*
Section 11.03 *Sonoita/Elgin/Patagonia Demographics Information*

Article XII. VISUAL IMPACT

Section 12.01 *Traffic Comparison between Highway 82 and Highway 83*
Section 12.02 *SSVEC Line Design Photos from Community Presentation*

Article XIII. SUNWATTS PROGRAM

Section 13.01 *SunWatts Program Rebate Tracking for V7*
Section 13.02 *SunWatts Interconnection Requirements*

Article XIV. SSVEC SOLAR PROPOSAL

Section 14.01 *July 2009 RFQ to Develop a Solar Energy Generation Facility*
Section 14.02 *August 2009 Clean Renewable Energy Bond (CREB) Proposal*

Article XV. SSVEC DISTRIBUTED GENERATION

Section 15.01 *October 2008 Distributive Generation Study for V7*
Section 15.02 *September 2006 Interactive Distributed Generation Proposal*

Article XVI. RENEWABLE ENERGY RESOURCES

Section 16.01 *Northern Arizona University: Arizona Wind Energy Assessment*
Section 16.02 *USDOE Arizona-Biomass Resource Map*

SSVEC

Request for Proposal

DRAFT

Request for Proposal
For Sulphur Springs Valley Electric Cooperative
Review, Critique, Accept

May 20, 2009

{a working document}

Project Summary

The Sonoita/ Elgin Communities have significant concerns regarding a proposed 69kV transmission line proposed by Sulphur Springs Valley Electric Cooperative, Inc. (SSVEC). The concerns can be summaries in four key areas:

1. Visual pollution (aesthetics) of the beautiful northeast portion of Santa Cruz county;
2. The ecological and research impacts of the installation and maintenance of the proposed line;
3. The lack of renewable energy utilization – furthering dependence on non-renewable energy generation; and
4. Rising Energy Costs; Would employing Renewable Energy now save Cooperator Dollars in the future?

The purpose of a feasibility study would be to examine renewable energy alternatives to the installation of the proposed line, and to preliminarily quantify the cost of such an alternative.

Completion of such a study would satisfy SSVEC Cooperator concerns about the proposed line and quantify possible renewable distributed energy alternatives, by a qualified company. Improving the relationship and understanding of the Cooperative and its members, as unresolved questions are answered. The outcome would promote a mutually beneficial working relationship between cooperators and company.

Feasibility Study Overview

The feasibility study will determine a recommended best course of action for the proposed project. Specifically, the study would address two needs for customers on the SSVEC V-7 feeder line:

1. Providing increased capacity; and
2. Improving continuity (reducing power outages, or the risk thereof).

While special attention will be given to finding reasonable renewable energy solutions, the proposed 69kV transmission line will be evaluated, and compared and contrasted to other considered options. Cooperation with SSVEC engineers and staff will be critical to the information sharing and evaluation of all alternatives.

The study will include (but not be limited to); site details, resource requirements and availability (water), area guidelines/regulations (fed/state/county), technical options appraisal, technical suitability, demonstration value, capital cost range, energy output, CO2 savings, water usage (if any) or savings, practical considerations, system sizing requirements and a project commissioning timeline.

Particular attention will be paid to identification of potential funding options/sources, financing options/sources, and federal/state incentives. Consideration will be given to utility, SCCF, Patagonia, and third party system ownership.

Due to the sensitive nature of this project there should be an emphasis and/or focus on environmental, social and planning issues that may be associated with each option. Methods and assumptions should be detailed throughout the document. Verifying the availability of a renewable energy source at a specific site (e.g., wind studies, seasonal flow rates of a watercourse, landfill gas production rates and expected life, etc.) will be included.

Deliverables

The following Reports with accompanying Presentations are to be delivered in contractor format, including, as a minimum, information from the below deliverables with conceptual studies, feasibility and sensitivity analyses, power flow analysis, public relations and contact information, cost information with a financial and business plan, and Action Items and Status.

The deliverables will be integrated, updated at least every Friday by noon, and available, under controlled conditions, to designated study participants on a mutual website. Development of a comprehensive presentation series, as a minimum in PowerPoint with notes, shall parallel each report. At end of each third week, each report will be completed; however, the "reports" in between are to be considered as "working papers" and may be outlines and include TBD's as placeholders. The Third Week Reports will provide completed work but may have appendices showing report plans for the next 3-week cycle.

No. 1 – The Project Plan (including trade and technical studies)
No. 2 – Media, Contact and Promotion Plan
No. 3 – Funding, Financial and Business Plan, Proposed Agreements and REPs
No. 4 – Feasibility Study Results Report and Program Schedules, Action Items and Status

I. FEASIBIBLITY IDENTIFICATION AND ANALYSIS PLAN

Scope: Upon execution of this Agreement and any extension thereof consultants engaged by the company (SSVEC), under the direction and supervision of Company's Chief Executive Officer ("CEO") or specified designee, shall devote sufficient time and effort in conducting the following:

In coordination with engineers, manufacturers, contractors and sub-contractors from design, installation, operation and warranty disciplines

1. Identify the most efficient and cost-effective types of renewable energy systems that can be successfully installed throughout the northeastern area of Santa Cruz County served by Feeder V-7.

2. Include as potential candidates for feasibility analysis photovoltaic (PV), solar thermal, concentrated solar, wind, and biomass generation systems with, as appropriate, additional "peaker" opportunities in Report No. 1.

3. Establish contact and work closely with Sulphur Springs Valley Electric Cooperative (SSVEC) staff to review level of interest in renewable energy project so participation and electricity purchase are facilitated to meet the connectivity and capacity needs in Report No. 1. Negotiate preliminary terms as indicated and appropriate in Report No. 3.

4. Establish contact and work with Tucson Electric Power Company (TEP) to ascertain level of interest in renewable energy project participation, electricity purchase, and potential interconnectivity in Report No. 1. Negotiate preliminary terms including cross-boundary agreements, as indicated and appropriate in Report No. 3.

5. Establish contact and work with UNS Electric (UNSE) to ascertain level of interest in renewable energy project participation, electricity purchase, and potential interconnectivity in Report No. 1. Negotiate preliminary terms including cross-boundary agreements, as indicated and appropriate in Report No. 3.

6. Establish contact and work including project promotion and solicit support from the Santa Cruz County Board of Supervisors, County Community Planning Department, the Sonoita Community Crossroads Forum, the Town of Patagonia and Planning Department to present a preliminary renewable plan(s) for best sites to locate small (1-3 MW) renewable energy generation sources in Report Nos. 1, 2, 3, and 4.

7. Establish contact and work including project promotion and solicit support from the Arizona Department of Commerce Energy Office, the Arizona Governor's Office, Arizona Corporation Commission Utility Division, and State Congressional Delegates. Attention must be given to identify, submit, and negotiate state or federal grants, other funding, and/or loan incentives that could impact renewable energy funding for the project in Report Nos. 2, 3, and 4.

8. Establish contact and work including project promotion and solicit support from the federal Congressional delegations, Department of Energy, Department of Agriculture and Forest Service for near-term federal stimulus package assistance in Report Nos. 2, 3, and 4.

9. Establish contact and work including project promotion and solicit support from Department of Interior including the Bureau of Land Management for inclusion in Federal stimulus package assistance and

assistance with a preliminary overview and determination of possible site locations environmental and natural resource impacts in Report Nos. 1, 2, 3 and 4,

10. Establish contact and work including project promotion and solicit support from Arizona State Land Department, Parks and Recreation Department, Fish and Game Department for assistance with possible site locations in Report Nos. 2, 3 and 4.

11. Develop a comprehensive media and promotion, preliminary and final, plans to provide extensive media coverage and positive media for SSVEC, the Project, and all entities that dedicated resources to the Project in Report Nos. 2,3, and 4.

12. Provide advocacy, promotion, and negotiation of renewable energy incentives from public utility companies, and negotiate wholesale power purchase agreements for sale of power generated from the Project in Report Nos. No. 3 and 4.

13. Make specific recommendations, based on analysis and research, as to Project sizing, location, engineering, schedule, design and cost with proposed return on investment (ROI) determination, appropriately, in Reports No. 1, 3 and 4. Recommendations will include equipment and inverter specifications, grid-tie engineering, "Sonoita reliability loops," and interconnection specifications between SSVEC and/or TEP/UNSE, and construction scheduling in Reports No. 1 and 4.

14. Incorporate recommended system and schedule in the format of an RFP ready for bidding, including objective source selection criteria in the RFP in Report No. 4.

15. Identify experienced and qualified Arizona contractors and sub-contractors as potential bidders for the recommended system for presentation of Statement of Qualifications (SOQs) in Report No. 3.

16. Prepare a comprehensive project (and phasing, if appropriate) timeline and schedule from inception through system commissioning with Feeder V-7 capacity changes over time, viewed as annual and daily demand curves.

17. Coordinate and conduct with the Town of Patagonia and SCCF community meeting(s) to secure feedback from the SSVEC cooperative's members in the service area, and other parties for comment prior to development of final project plan in Report No. 2.

18. Develop an ongoing Operations and Maintenance (O&M) plan for the recommended system in Report No. 1.

19. Assist Town of Patagonia and Sonoita Crossroads Community Forum to prepare and submit of applications for local, state, and national grants, low cost loan programs or other assistance determined feasible in Report No. 3.

20. Present funding options for construction and/or permanent financing – depending on recommenced system and subsequent financing recommendation in Report NO. 3.

21. Secure letter(s) of intent from funding providers in Report No. 3.

22. Negotiation of terms for presentation with Staff to the SSVEC Board from utility(ies) and/or power purchasers in Report No. 3.

23. Identification of necessary permits required for project in Report Nos. 1 and 4.

24. Projected Completion date: August 30, 2009.

II. POSSIBLE COMPENSATION AND PAYMENT SCHEDULE

Estimated $ 250,000		$75,000
At Award - startup	$25,000	
On 30 Aug 2009, after Final Reports delivered	$35,000	
Upon SSVEC Review Final Reports	$15,000	

The above are on a Not-To-Exceed-Basis. However, if Patagonia, SCCF and SSVEC request additional deliverables or changes to above deliverables and is agreed to by the company awarded the Project, they will provide a written estimate of costs – to be agreed to by all parties in writing.

All out-of-pocket expenses incurred by awarded company are in the price of this contract and will be fully the responsibility of successful bidder, including any expenses incurred for engineering, professional consultants, and travel.

SSVEC

Request for Proposal Rebuttal

Sulphur Springs Valley Electric Cooperative, Inc.
A Touchstone Energy® Cooperative

REBUTTAL OF 3SEG'S
Request for Proposal for a Feasibility Study

The Request for Proposal (RFP) for a Feasibility Study as submitted by 3SEG is to *"...determine a recommended best course of action...to address two needs... 1) Provide increased capacity; and 2) improving continuity (reducing power outages, or the risk thereof)."*

SSVEC <u>feels strongly</u> that this RFP for a Feasibility Study is <u>not necessary</u> for the following reasons:

1. **<u>SSVEC's staff is fully capable of such a study.</u> SSVEC staff includes:**
   a. **Five registered Professional Engineers,**
   b. **Two Engineers-in-Training,**
   c. **A Right of Way staff, including a Senior Member, International Right of Way Association (SR/WA) with certification in Right of Way Negotiation and Acquisition,**
   d. **An Engineering Planning division with state-of-the-art computer modeling software, MilSoft Windmil and PowerWorld Simulator, to perform complex load flow analysis,**
   e. **A Substation and Transmission Line Design Engineer with a Masters degree in Electrical Engineering and 20+ years experience,**
   f. **An Engineering Manager with extensive experience in renewable energy technologies, policies and assessments dating from 1979 to date and ranging from solar and wind system installations in Alaska to renewable energy assessments throughout Latin America and Africa,**
   g. **Among other qualified personnel.**

2. **<u>Most of the topics proposed for evaluation in the Feasibility Study have already been addressed by SSVEC staff.</u>**
   The following pages present a detailed comment on work already performed by SSVEC and outside consultants in each of the major study points proposed by 3SEG.

3. **<u>The RFP is too broad, too vague, and is non-conventional in the utility industry.</u>**
   Distributed generation (DG) projects such as those discussed by the 3SEG group are typically handled by utilities in the following manner:

Not less than $250,000

a. A System Impact Study is done for a specific project (size, technology, voltage) at a specific site. This study evaluates the impact of the proposed DG system on the interconnecting distribution or transmission line. Often these studies identify line re-conductoring for voltage requirement and other necessary upgrades.
b. A Feasibility Study follows to define the exact system improvements needed to interconnect the DG system. A detailed design for the system interconnection results from this Feasibility Study.

The Feasibility Study proposed by 3SEG attempts to combine these two independent studies into one study and also expands the scope to tasks typically reserved for post completion of the detailed studies, such as marketing and promotion, funding/grants, and in this case, negotiation of certificated boundary agreements.

4. Since 1982 SSVEC has had a plan to "*...1) Provide increased capacity; and 2) improve continuity (reducing power outages, or the risk thereof).*"
   a. SSVEC has already done everything possible to extend the capacity of the V-7 feeder including:
      1. SSVEC has an obligation to provide safe and reliable power for current and new customers – The peak load of 7 MW already exceeds the substation and line capacities. In addition, SSVEC has facilities to the lot line and has committed service for 219 residential lots representing an additional 1.5MW of load. Unless system capacity is increased immediately, SSVEC will be forced to consider a moratorium on new facilities in the area – thus violating our obligation to serve all requests for power in our certificated service territory.
      2. Utilizing five line regulators - the Rural Utility Service (RUS) recommends not more than one line regulator on a feeder. Multiple line regulators result in both high and low voltages on the feeder as experienced by numerous residents in the area.
      3. Allowing loads to exceed substation transformer capacity – The existing transformer is rated for 5 MVA in open air and 7 MVA with fans. Recent peak load of 7.123 MW at 98% Power Factor equals 7.50 MVA – a 7% overload on the transformer. Current loads have exceeded this higher rating and a remedy must be implemented immediately.
      4. Re-conductoring of the main line is not a viable option - SSVEC studies show this option is costly ($12M including

ROW, substation, retirement of old facilities, and additional labor for energized work), must be done energized to keep area residents in service during the construction, requires significant rights-of-way acquisition, provides only minimal increased capacity due mainly to voltage drop, and does nothing for the reliability issue resulting from a 37-mile mainline from Huachuca West substation to Patagonia.

b. **SSVEC studies have clearly shown <u>that improving continuity of service (reducing power outages) in the area is best addressed with a new, uninterrupted 69kV line</u> along a completely separate corridor, mostly on private property, and a new substation in Sonoita.**

5. **SSVEC has thoroughly briefed ACC staff, including recent review of an additional 3" of support documents from SSVEC files, on analyses already completed by SSVEC and/or outside consultants on this project.**

The following is a detailed commentary of each of the points made in the 3SEG Request for Proposals for a Feasibility Study. <u>Again, SSVEC feels this study is not needed!</u>

Save the Scenic Sonoita/Elgin Grasslands Group (3SEG)
REQUEST FOR PROPOSAL – Rebuttal by SSVEC

The format used below presents points made in the 3SEG RFP for Feasibility Study and, using this font, rebuts statements made. Text presented in *"italic quotes"* is taken directly from the 3SEG presentation.

FOUR KEY CONCERNS:

* *VISUAL POLLUTION: Visual pollution (aesthetics) of the beautiful northeast portion of Santa Cruz County*
    - **Pole color study done**
        - **Gray poles are less noticeable**
        - **This matter addressed in detail at community presentations in Sonoita and Patagonia**
    - **Fewer poles with 69 kV line (202 poles @ 55'-65' vs. 382 poles @ 45'-55')**
    - **Fewer vehicles pass the 69 kV line (3000 vehicles/day on HWY 82 vs. 510 vehicles/day along HWY 83)**
        - **Remote sighting (4.4 mi. along paved road with 69kV vs. 23.3 mi. with V7 route)**

* *ECOLOGICAL & RESEARCH IMPACTS: The ecological and research impacts of the installation and maintenance of the proposed line*
    - **Corridor has already been violated with buried telecommunications cable trench and maintenance road**
    - **Full Storm Water Pollution Prevention Plan (SWPPP) compliance**
    - **Re-seeding with native species using local range consultant will be done**

* *RENEWABLE ENERGY UTILIZATION: The lack of renewable energy utilization – furthering dependence on non-renewable energy generation*
    - **7/7/09 - Issued RFP to 14 companies for up to 750 kW of renewable energy near Sonoita**
    - **7/21/09 – Evaluated 10 bids for Renewable Energy Power Purchase Agreements (PPA) and Design/Build options**
    - **8/3/09 – Submitted a $6M proposal for Clean Renewable Energy Bond (CREB) funding to RUS**

* *RISING ENERGY COSTS: Would employing Renewable Energy now save Cooperator dollars in the future?*
    - **SSVEC recognizes the need for a reduced carbon footprint**
    - **SSVEC is investing in renewable energy generation today!**
        - **Nearly 1 MW installed to date under SunWatts and Solar Schools programs**
            - **40kW with SunWatts (SSVEC pays $4/watt)**
            - **900 kW at Solar Schools (SSVEC owns via CREBS loan)**

STUDY ADDRESSES TWO NEEDS:

* *IMPROVING CAPACITY*
* *IMPROVING CONTINUITY*
    - *Study to Include (but not limited to):*
        - *Special attention to finding reasonable renewable energy solutions*
            - **SSVEC contracted POWER ENGINEERS to evaluate a 2 MW DG option for the area. Determined that the best site is Sonoita.**
                - **Study looked at:**
                - **Fault current analysis**
                - **Distance relaying required**
                - **Volts per Hertz protection**
                - **Under-voltage protection**
                - **Reverse power protection**
                - **Loss of field protection**
                - **Status unbalanced current protection**
                - **Voltage time overcurrent relay**
                - **Overvoltage protection**
                - **Stator ground fault protection**
                - **Frequency relay**
                - **Differential protection**
                - **Grounding**
                - **Need for communications processor**
                - **Assuming the system will require a diesel generator for power generation when renewables are not available, a 2MW diesel genset:**
                - **Fuel consumption (135 gal/hr)**
                - **Operation & Maintenance (O&M) cost = $700/hr**
                - **Noise Pollution (80 db) – not recommended for residential area**
                - **Arizona Department of Environmental Quality (ADEQ) permitting required**
                - **Requires 20,000 diesel storage tank on-site**

- **SSVEC received bid for 2MW genset from PowerSecure. $1M plus inter-tie.**
- *Evaluation of 69kV transmission line; <u>to be compared/contrasted to other considered options</u>*
- *Study Scope*
    - **Typically a System Impact Study is done first to determine if the distribution system can handle the power injection**
    - **6/2008 - SSVEC developed a Scope of Work for POWER Engineers to study DG options in the Sonoita area**
    - ***"Sonoita Distributive Generation Study"* submitted to SSVEC 10/2008 (See above for results)**
    - **Engineers Estimate of Probable Cost equals $1M plus $700/hr O&M**
    - *Site details*
        - **Detailed siting completed in POWER Study using MilSoft system modeling software**
    - *Resource requirements and availability (water)*
        - **Radiator cooling recommended by POWER**
    - *Area guidelines/regulations (fed/state/county)*
        - **ADEQ air pollution permit required under Environmental Protection Agency (EPA) Tier 2 criteria. Subject to Santa Cruz County (SCC) zoning and permitting.**
    - *Technical options appraisal*
    - *Technical suitability*
    - *Demonstration value*
    - *Capital cost range*
        - **POWER estimates $1M plus $700/hr O&M cost.**
        - **ASSUMING THE ARIZONA CORPORATION COMISSION (ACC), SCC, AND THE COMMUNITY WILL ALLOW A 2 MW DIESEL GENSET**
    - *Energy output*
        - **Derated for 5,000 foot elevation**
    - *CO2 savings*
    - *Water usage or savings*
        - **Negligible**
    - *Practical considerations*
    - *System sizing requirement*
        - ***A* 2MW system is needed. When using renewable energy, a back-up system is needed for periods when the sun does not shine or wind is not present. A 2MW**

diesel genset "peaker" would be required to back-up the renewables.

- *Project commissioning timeline*
  - **PowerSecure proposal quotes 42 weeks to final commissioning**

- *Particular attention to:*
  - *Potential funding options/sources*
    - **8/3/09 – SSVEC submitted a $6.0M proposal to CREBS for at least 750 kW of solar with low-interest loan funds to be re-paid by Renewable Energy Standard and Tariff (REST) funding**
  - *Financing options/sources*
    - **7/09 - RFP for renewables in Sonoita solicited Power Purchase Agreements (PPA) and Design/Build options**
  - *Federal/state incentives*
  - *Ownership (utility, SCCF, Patagonia, third party)*
    - **Results of 7/09 RFP suggests SSVEC ownership has lower life-cycle cost**
- *Emphasis and/or Focus on:*
  - *Environmental, social and planning issues*
- *Verifying the availability of a renewable energy source at a specific site*
  - *Wind studies*
    - **Northern Arizona University (NAU) wind map for Sonoita area shows Class 1 wind resource (Poor) 0.0-12.3 mph. 12.3 mph = 5.4 m/sec. SAVOIA "Raduga-1" 1MW wind turbine requires minimum of 5 m/s to operate.**
  - Seasonal flow of a watercourse,
    - **No rivers in the area**
  - *Landfill gas production rates*
    - **Arid western United States has limited landfill gas potential**
      - **Low moisture content in landfills inhibits anaerobic digestion and production of methane gas**
      - **Gasification technologies are applicable but typically sited at much larger waste processing facilities**
      - **Plasma gasification was considered in Cochise County but did not get approval**

  - *And expected life, etc.*

- *Identification and Analysis Plan*
  - *Most efficient and cost-effective types of renewable energy systems that can be installed*
    - *Photovoltaic*
      - **7/09 RFP respondents to SSVEC all quoted a Photovoltaic (PV)-based solution**
    - *Solar thermal*
      - **Reserved for larger grid-connected facilities (10MW+) or co-generation at industrial waste site (Dairy, steam plant, etc.)**
    - *Concentrated solar*
      - **Reserved for larger facilities**
    - *Wind*
      - **NAU study shows Class 1 resource (Poor) in Sonoita area**
    - *Biomass generation*
      - **Limited biomass in the area.**
      - **Do not want cut the Scenic Grasslands for biomass generation**
      - **Agricultural waste from the Tubac/Rio Rico area seem to be the closest bio-resource**
    - *"Peaker" opportunities*
      - **Completed *"Sonoita Distributive Generation Study"* submitted to SSVEC 10/2008 for DG peaker in Sonoita (See above for results)**
  - *"Level of interest in renewable energy from SSVEC"*

    SSVEC has high level of interest in renewables:
    - **Aggressive REST plan approved by ACC. Collecting:**
      - **$1.30/residential/month**
      - **$42.00/Small Commercial**
      - **$150.00/Large Commercial (over 3MW)**
    - **SSVEC's SunWatts program offers $4/Watt rebate for individual renewable energy systems in the service territory. This compares with:**

UTILITY	REBATE (Watt)
SSVEC	$ 4.00
TRICO Electric	4.00
Arizona Public Service (APS)	3.00
Tucson Electric Power (TEP)	3.00
UniSource Energy	3.00
Salt River Project (SRP)	2.70

    - **SSVEC's SunWatts program has installed 40 kW to date (Source: SSVEC SunWatts Report as of 8/2009)**

- **SSVEC installed and owns 41 solar school shades for a total of 900 kW**
- **SSVEC has bids for at least 750 kW of grid-connected solar for the Sonoita Substation**
- **SSVEC will offer net metering in new rates**

- *Level of interest in renewable energy participation, purchase, and interconnectivity from TEP*

  In 2003, SSVEC submitted a formal Request for Possible Transmission Service in the Sonoita area. TEP response:
  - **46kV line dedicated to Fort Huachuca back-up**
  - **When 138 kV line is out, load must shift to Fort Huachuca. No firm power.**
  - **To serve Fort Huachuca <u>and</u> Sonoita would require a conductor upgrade to the South Loop Substation**
  - **Two-county rule must be adjusted by Bond Council**
  - **Line suffered three outages in 2002. Total outage time of 42 hours.**
- *Negotiate preliminary terms of cross-boundary agreements*

  Terms of this Agreement must address issues of:
  - **Energy metering**
  - **Energy cost**
  - **System protection and coordination**
  - **Safety**
  - **Operations agreements (who controls switches)**
  - **Remote control of switching facilities**
  - **Payment (who pays for the inter-tie facilities)**
  - **Requires ACC approval**
  - **Estimated cost for SSVEC portion of inter-tie is: $420,000. NOTE: this does not include UNS costs to convert 2-phase to 3-phase and other inter-tie facilities.**
- *Level of interest in renewable energy participation, purchase, and interconnectivity from UNSE*
  - *Negotiate preliminary terms of cross-boundary agreements*
    - **Intertie to UNS is not applicable for load serving as proposed by 3SEG**
- *Promotion and support from Santa Cruz County Board of Supervisors; Community Planning/Development, SCCF, Town of Patagonia for site location of RE Generation 1-3MW sources*
  - **Large grid-connected renewable projects (1 MW-10 MW) are either co-located with an existing substation or require a new substation. SSVEC has an additional 2-3 acres at our Sonoita substation that, with SSC BOA approval, will be used for up to 750kW of grid-connected solar. An additional 12 acres are for sale adjacent to the**

substation that could accommodate approximately 1 MW-2 MW expansion.

- *Promotion and support from AZ DOC Energy Office, AZ Governors Office, ACC Utility Division, State Congressional Delegates for federal/state grants, other funding or incentives*
  - **Not typically solicited until you have a technical proposal in hand**
- *Promotion and support from Federal Congressional Delegates, DOE, DOA and USFS for federal stimulus assistance*
  - **Not typically solicited until you have a technical proposal in hand**
- *Promotion and support from DOI/BLM for federal stimulus package and environmental/natural resource impact.*
  - **CREBS funding for renewables is a better value and more readily accessible to SSVEC**
- *Promotion and support from ASLD, Park and Recreation, Fish & Game Department for site location*
  - **Not typically solicited until you have a technical proposal in hand**
- *Comprehensive media plans to provide extensive positive coverage for SSVEC/the Project/all Entities*
  - **Not performed until all details of the project have been defined and more development progress has been accomplished. It would be pre-mature to develop media plans at this early stage of project development.**
- *Provide advocacy, promotion, negotiation of RE Incentives from PU Companies*
  - **SSVEC's RFP solicited both Design/Build and Power Purchase pricing for at least 750 kW of renewables at the Sonoita Substation. Design/Build appears to be a better value for SSVEC.**
- *Negotiate wholesale power purchase agreements for sale of power generated from project*
  - **Typically this is not done until well after the system impact and feasibility studies are completed and funding mechanisms are identified**
- *Make specific recommendations based upon analysis and research on:*
  - *Project sizing*
    - **2 MW has already been determined as optimal by SSVEC and confirmed by POWER Engineers**
  - *Location*
    - **Sonoita Substation is the ideal location as the renewable energy can be injected directly onto the 25kV bus for distribution/utilization by all feeders in the area and export to Sierra Vista and beyond via the 69kV line**
  - *Engineering*

- **Completed by POWER Engineers in 10/2008 (See above for details)**
- *Schedule*
- *Design*
- *Cost with proposed Return on Investment determination*
- *Equipment specifications*
  - **2MW generator specification is in-hand as presented by PowerSecure. 750kW solar specifications are in-hand provided by bidders to SSVEC's renewables RFP dated 7/09.**
- *Inverter specifications*
  - **Completed as part of SSVEC's renewable RFP issued 7/09**
- *Grid-tie engineering*
  - **Minimal study if injection point is Sonoita Substation as proposed**
- *Sonoita reliability 'loops'*
  - **There are no "distribution loops" existing or proposed by SSVEC. There will be a limited transfer "feeder tie" between the existing Huachuca West substation and the new Sonoita Substation once the new sub is built.**
- *Interconnection specifications between SSVEC and/or TEP/UNSE...*
  - **SSVEC/UNS:**
    - **UNS is 2-Phase System / SSVEC 3-Phase**
    - **UNS is 13.8 kV System / SSVEC is 25kV System**

New 3-Phase line to be constructed from SSVEC to UNS at Flux Canyon – 1 mile	**$ 100,000**
Step-down transformers (specialized phase shift corrections) required	**70,000**
Set of 3-Voltage regulators	**60,000**
3- Automatic Circuit Reclosures, SCADA controlled	**150,000**
1 mile ROW for 3-Phase line on private property – Transformer Site	**40,000**
SSVEC Cost (does NOT include costs for UNS facility upgrades)	**$ 420,000**
DOES NOT INCLUDE ANY LEGAL EXPENSES OR ANY COSTS ASSOCIATED WITH CCN BORDER AGREEMENTS, ACC APPROVAL PROCEDURES, ETC	

- **SSVEC/TEP:**
  - **TEP is 46 kV System / SSVEC is 25kV System**
  - **TEP 46kV Line is a Radial line to Ft Huachuca**
  - **3SEG is suggesting 2 OR 3 interconnection sites at $3.27M each (minimum)**

Interconnect location substation site	**$ 170,000**
46:25kV transformers	**230,000**
Set of 3-Voltage regulators	**120,000**
2- Distribution Automatic Circuit Reclosures, SCADA controlled	**100,000**
Substation structure	**350,000**
Control house	**300,000**
Construction	**500,000**
Switching Station 3 Breaker Ring Bus	**1,500,000**
SSVEC Cost (does NOT include costs for TEP line upgrades)	**$ 3,270,000**
DOES NOT INCLUDE ANY LEGAL EXPENSES OR ANY COSTS ASSOCIATED WITH CCN BORDER AGREEMENTS, ACC APPROVAL PROCEDURES, WHEELING COSTS, ETC	

- *Construction scheduling*
  - **Premature at this time**
- *Provide RFP, ready for bidding, of recommended system and schedule, include objective source selection…*
  - **Already completed by SSVEC.**
- *Identify experienced and qualified Arizona contractors/subcontractors for potential bidders*
  - **SSVEC's RFP for renewable energy in Sonoita was sent to 14 pre-qualified bidders**
- *Prepare comprehensive project (and phasing) timeline schedule from inception through commissioning with Feeder V7 capacity changes over time in format of annual/daily demand curves*
- *Coordinate/conduct meetings with Town of Patagonia/SCCF for feedback and comment prior to development of final project plan*
  - **Premature at this time**
- *Develop an Operations & Maintenance Plan for recommended system*
  - **Included in bid proposals from various respondents to the SSVEC RFP for solar in Sonoita.**
- *Assist Town of Patagonia/SCCF with application grants for funding*
  - **Already performed by SSVEC in submittal of $6M proposal for CREBS funding for 750 kW of solar energy at Sonoita**

- *Present funding options for construction/permanent financing of recommended system*
  - **CREBS funding is the best financing option considering interest rate and payment terms**
- *Secure letter of intent from funding providers*
  - **Awaiting response on SSVEC's CREBS proposal**
- *Negotiation of terms from utilities and/or power purchasers*
  - **Contained in SSVEC RFP responses from bidders**
- *Identify necessary permits for recommended project*
  - **ADEQ air quality if a generator is used. SSC for siting/building permit.**

* *Four Reports addressing multiple levels of concern: (20, or so, pages):*
  - SSVEC has volumes of studies, cost estimates, designs, analysis, presentations and support materials already developed, evaluated and synthesized on this project.
* *a) technical;*
  - Technical study of viable options has already been completed
* *b) cost and schedule;*
  - SSVEC has already completed and presented cost estimates for numerous route options, technology options, cost options, and substation location options.
  - SSVEC is on schedule for completion of the 69kV line and substation for service in Fall 2010.
* *c) public relations;*
  - Public relations is never included in a Feasibility Study
* *d) recommended action*
  - SSVEC already has a recommended action based on detailed analysis of all alternatives.

* *RFP COMPLETION DATE: August 30, 2009 (3-months)*
  - **SSVEC feels strongly that this Feasibility Study is not needed as analysis of alternatives has already been done utilizing both SSVEC staff and outside consultants familiar with SSVEC's system. To commission another complete study would be time consuming, costly and redundant.**
  - **As previously stated,**

* *RFP COMPENSATION: $75,000*
  - **SSVEC has already spent $1,367,543.60 on the Sonoita project.**
  - **In addition, Purchase Orders are issued for poles and a substation transformer totaling an additional $1.1M.**

SSVEC

V-7 Feeder Analysis and Recommendations

COMPARISON of JULY 13 PRESENTATION and JULY 22 ACC SUBMITTAL

V-7 FEEDER ANALYSIS AND RECOMMENDATIONS

Notes for
Information Exchange Discussions with the

Sulphur Springs Valley Electric Cooperative's Engineering Staff

And the Sonoita/Patagonia/Elgin Team
Represented by the

Sonoita Cross-Roads Forum's Renewable Energy Committee

Bob Barnhill (President)
Gail and Steve Getzwiller, Linda Kennedy, Jeanne Horsman
Renewable Energy Committee, Sonoita Cross-Roads Forum,
a Section 501(c)3 IRS tax exempt organization

with

Marshall Magruder, Santa Cruz County Energy Commission, 2001-2008, consultant

Ron Belvel, Tucson Electric Power (TEP) and UNS Electric, Inc.

Robbie Richards, Copernicus Energy

Carolyn Shafer and CD Butsch, former Power Line Contractors, current E Santa Cruz Local Sustainability facilitator

Held at the SSVEC Office, Sierra Vista, AZ

13 July 2009

These Notes provide an overview of the present status, analysis, and recommendations to the SSVEC Engineering Staff.

Team Members include

Marshall Magruder

- BS Naval Academy; MS in Physical Oceanography, Naval PG School; MSSM, USC
- Retired Naval Officer (25 years) and Hughes Aircraft/Raytheon (17 years),
- Consultant recently with ISIS, Sierra Vista (Virtual Proving Ground, USAF IW Aggressor Squadron SBIR&D), Border Patrol SBI (Virtual Fence), USN/RN Aircraft Carriers, etc.

Bob Barnhill

- President of the Sonoita Crossroads Community Forum

Sonoita Crossroads Community Forum Renewable Energy Committee:

- Gail and Steve Getzwiller
- Linda Kennedy PhD, Director, Audubon Research Ranch with Rachel Burand (intern)
- Jeanne and Rob Horsman (unable to attend)

Tucson Electric Power (TEP) and UNS Electric, Inc.:

- Ron Belvel, Transmission and Distribution Systems Manager
- Bill Damitzel, Transmission and Distribution Systems Supervisor

Copernicus Energy, LLC:

- Robby Richards, owner

E Santa Cruz Local Sustainability

- Carolyn Shafer, Facilitator

CD Butsch, former power line contractor, Journeyman Lineman, Master Electrician
Sue Downing, Concerned Citizen Elgin, Arizona

OUTLINE OF THE DISCUSSIONS

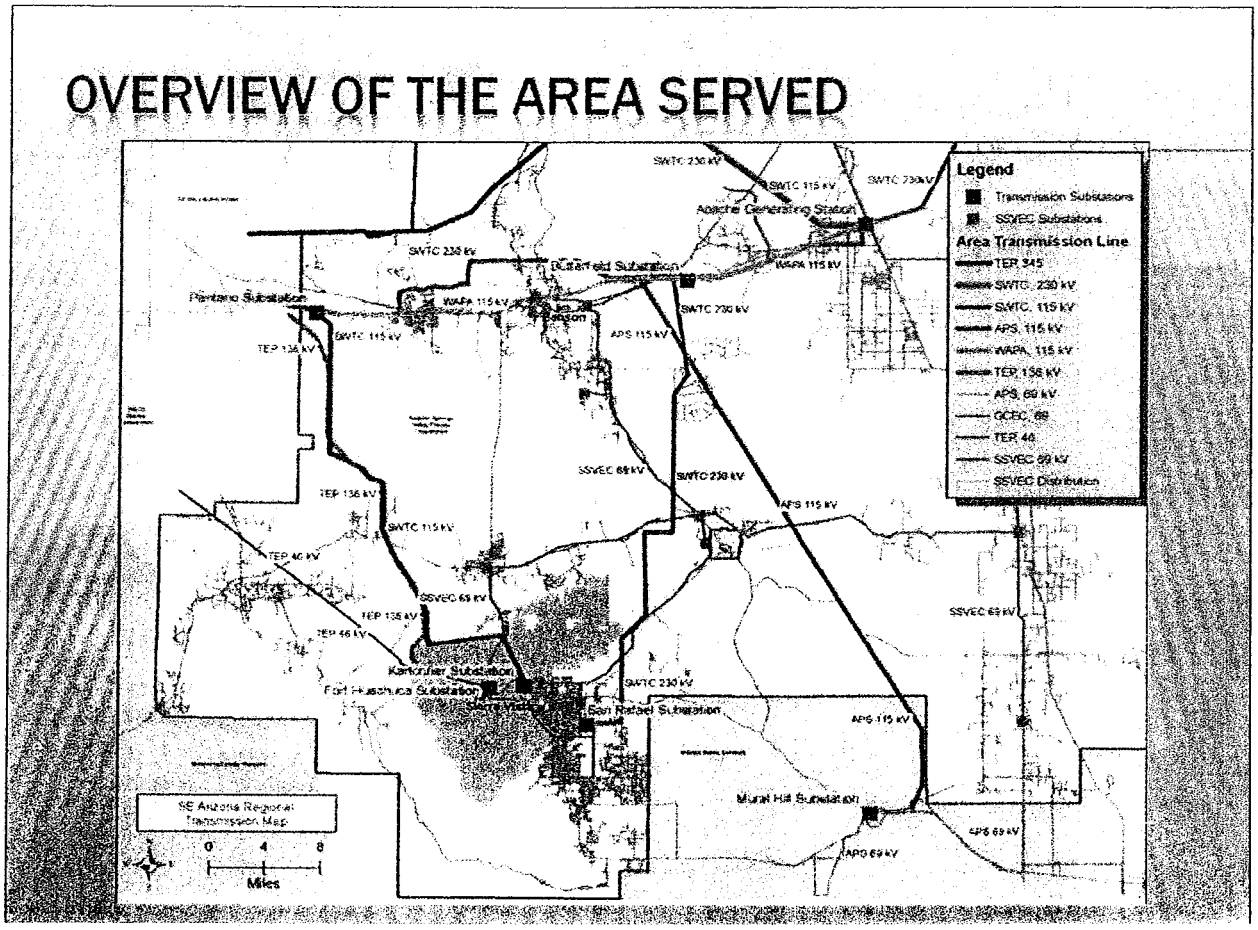
- Opening
- Overview of the V-7 Feeder Area
- Reliability Definition (NERC/WECC)
- CONNECTIVITY Status
- CAPACITY Status
- Benefits of a Substation
- How to meet N-1 Reliability Criteria
  - For CONNECTIVITY
  - For CAPACITY
- Cost of Option, what is BEST?
- Use a FEASIBILITY STUDY to Determine
- Recommendations

We will overview the V-7 Feeder and its existing status, define reliability criteria, determine existing status for connectivity and capacity, discuss the benefits of a substation, and look at options to ~~best MEET RELIABILITY CRITERIA~~ most reasonably MEET CONTINUITY OF SERIVICE and RESTORATION for CONNECTIVITY and CAPACITY.

Since several options exist and some details are not presently known, we are recommending that a FEASIBILITY STUDY conducted by a reputable, independent organization be used to determine details and provide a complete trade-study necessary for decision makers. The USDA has announced a stimulus package just for this purpose we would like to work with the company in obtaining and implementing.

We will provide recommendation to benefit all concerned to lead to the BEST solution for our communities.

We will agree with the results of such a FEASIBILITY STUDY.



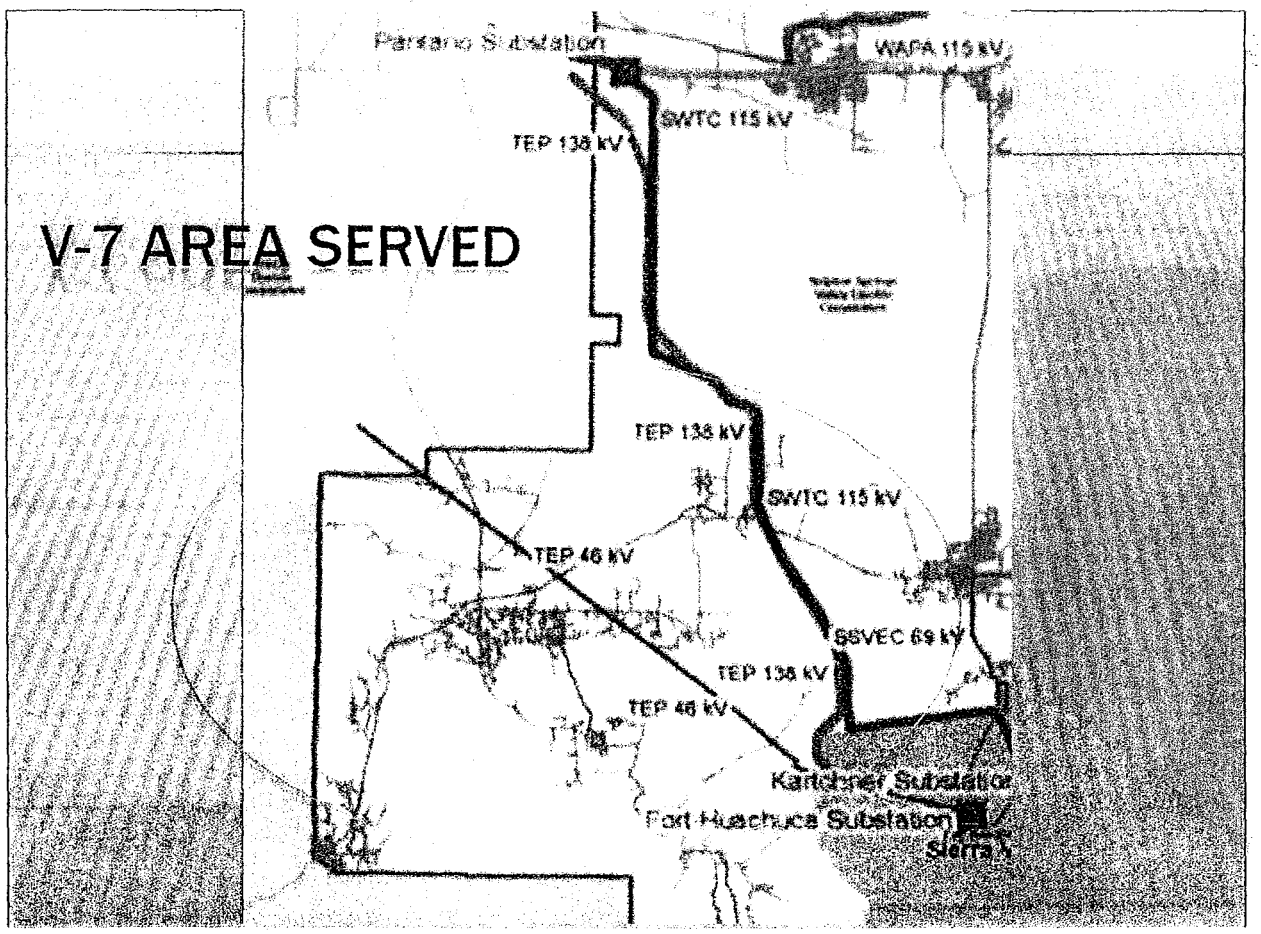
This picture is well known. Some features will be important as we continue.

First, there are several different electric utility company's services areas, with SSVEC in white. TEP has a service area in the NW corner in yellow, and UNS Electric in the SW corner in pink. Both TEP and UNS Electric, Inc. are subsidiaries of the same holding company, UniSource Energy, Inc., and, in general, use the same engineering staff personnel.

The area of interest involves the rural communities of Sonoita, Patagonia, and Elgin, that are at the "end of the line" compared to the rest of SSVEC's operational areas.

Also, the UNS Electric area in pink covers the San Rafael Valley and is just south of the Town of Patagonia. It also is at the "end of the line" with similar outages as with its neighbors in Patagonia. No ties exists between these two areas.

The next slide shows more localized details.



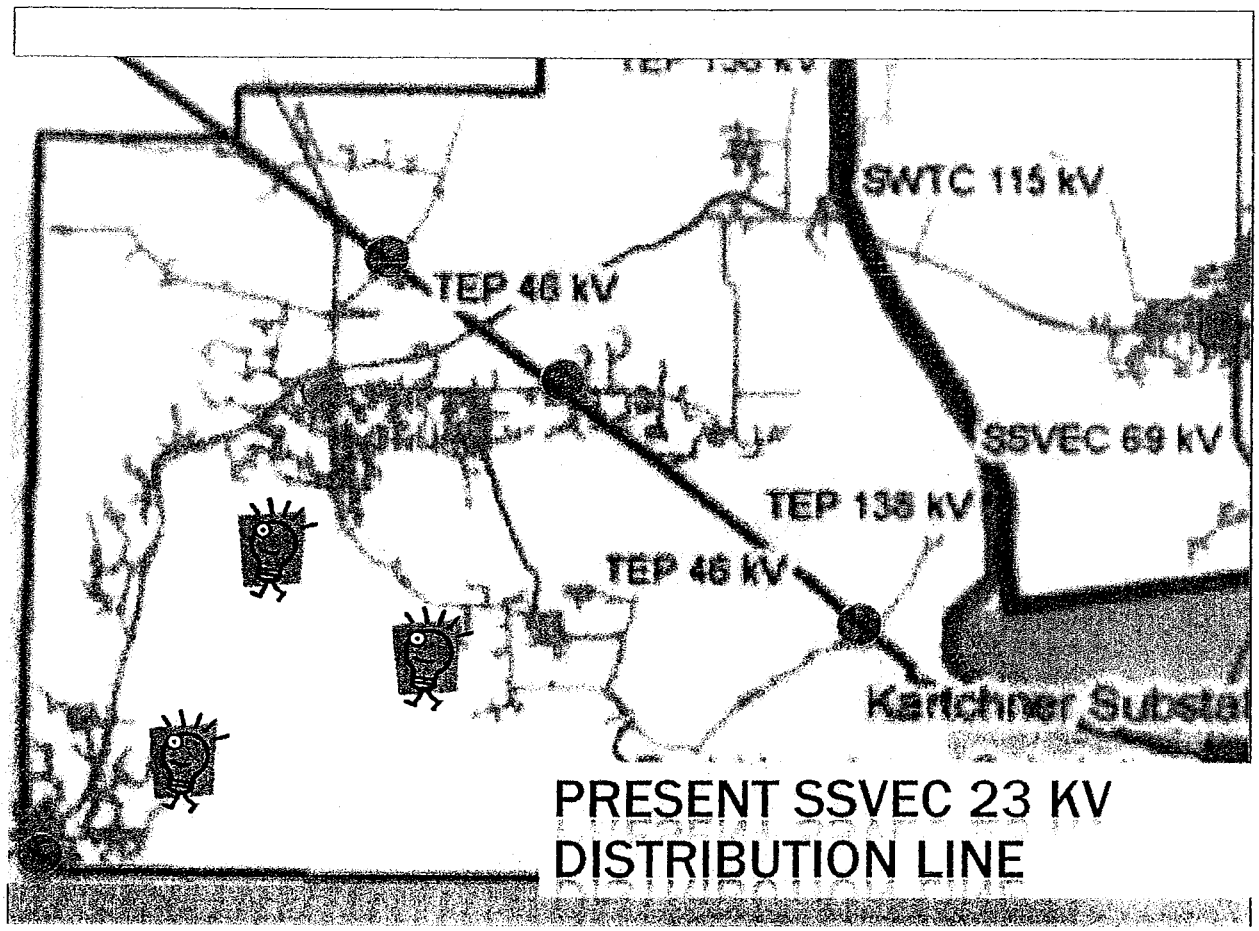
The V-7 Feeder is the single, radial 23 kV distribution line that extends west from the SSVEC substation at Mustang Corner, shown in light blue, within the oval and also includes Patagonia at the SW corner.

In general, this line goes west along SR-82 until Elgin Road, then south, then west along SR-83 through Sonoita continuing along SR-82 to Patagonia. Many additional distribution lines to Elgin and other communities form branches.

Please note that three higher voltage transmission and subtransmission lines cross the V-7 feeder, The Southwest Transmission Cooperative's 115 kV, TEP's 138 kV to Ft. Huachuca, and a TEP 46 backup line to Ft. Huachuca.

It is noted that TEP has IRS furnishing bond restrictions that permit it to only serve customers in two counties, namely Pima and Cochise Counties, thus TEP can not directly serve SSVEC customers in Santa Cruz County. UNS Electric can now can directly interconnect with SSVEC. TEP can provide service only in an emergency, such as an outage. This has implemented between the TEP Canoa substation in Pima County via a 46 kV line with 22 MW to the UNS Electric Amado Substation. This provides emergency backup service whenever primary service is interrupted.

The existing V-7 feeder has a capacity of 7 MW that will be discussed later.



This view is of the V-7 feeder service area. The Mustang Corner's 69kv to ~~23~~25 kV substation that serves this area is in the NE corner. The three crossing SWTC and TEP transmission lines are also shown.

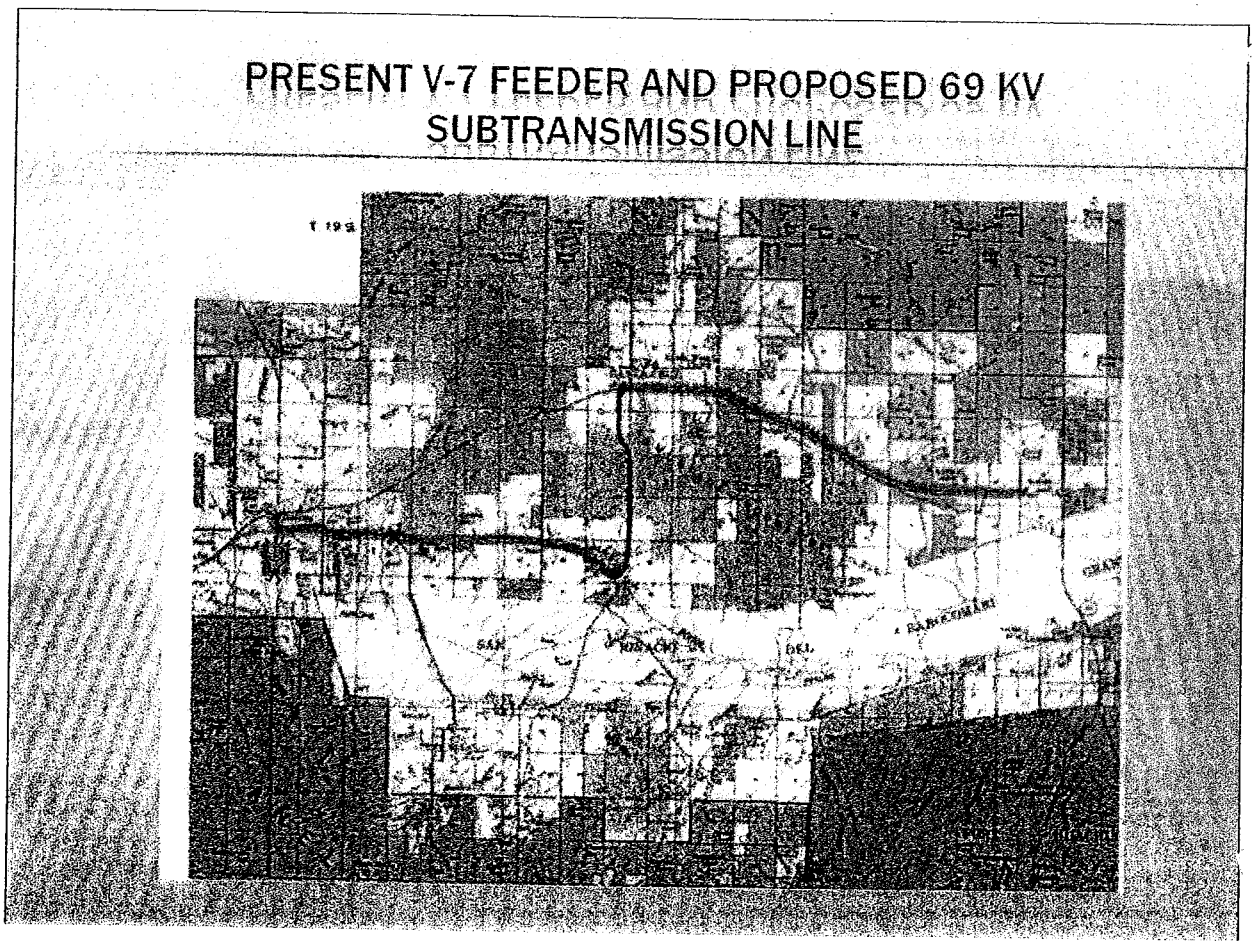
There are at least three points where the TEP 46 kV backup line to Fort Huachuca crosses the V-7 feeder. These are shown as small red circles. Only the middle red circle is a 3-phase connection, necessary for a tie with SSVEC's 25 kV. If a 46:23 kV transformer was installed, at two locations, then the V-7 feeder would always have backup power. TEP could build and maintain these transformers as SSVEC does not use 46 kV.

Further, SSVEC has proposed a substation in "downtown" Sonoita, shown in the yellow circle. This is planned to be the hub for four reliability loops (N, E, W, and S).

In the SW corner is shown a green circle shows where a possible tie to the UNS Electric might be considered. Less than 1 mile of line will be required plus a transformer plus remote disconnect switches to make islands then interconnect either Patagonia or San Rafael Valley with the other. Obviously both utilities will have to established an operational protocols and procedures, have a cross-boundary agreement and PPAs.

This is to show the physical relationships between these points.

Also, shown are prospective locations for 2 or so, small Renewable Energy "plants" with backup generation, plus another site at the Nogales International Airport (with county leased land). Robbie will discuss these and other renewable options later.



The existing 23 kV line from Mustang Corners to Sonoita is shown in Green, while the proposed 69 kV sub-transmission line is in yellow. Each will be discussed more later.

Again, the picture prospective for reference.

One distributed generation 1 to 3 MW RE plant near downtown would provide power boost to the local area. Adjacent to or in the SSVEC substation could be ideal.

RELIABILITY DEFINITION FOR TRANSMISSION LINES

(FROM WECC'S MINIMUM OPERATING RELIABILITY CRITERIA)

RELIABILITY. The combination of Security and Adequacy, as defined herein.

SECURITY. The ability of the ~~bulk~~ electric system to withstand sudden disturbances such as electric short circuits, anticipated loss of system components or switching operations.

ADEQUACY. The ability of a ~~bulk~~ electric system to supply the aggregate electrical demand and energy requirements of the customers at all times, taking into account schedule and reasonably expected unscheduled outages of system components.

In common terms, this means that **CONNECTIVITY** must be always maintained and that there must always be adequate **CAPACITY** to meet the demand.

Shown is the electricity industry's definition for RELIABILITY used by the National Electricity Reliability Corporation (NERC) and implemented for the Western Connection by the WECC, in its *Reliability Criteria* and the Arizona Corporation Commission's criteria used in its Biennial Transmission Assessments.

We are not discussing the national "bulk electric" system but a local distribution area: however, the Energy Policy Act of 2005 implemented a nationwide Electric Reliability Organization, which is also NERC. These reliability standards impact operations of all electric utilities, and will form the general basis for this presentation. The proposed 69 kV line is known as a sub-transmission line and is excluded from these helpful criteria.

It is possible for utilities to receive millions in fines when not meeting NERC criteria.

This is NOT an exhaustive nor detailed review of these standards but will use the terms CONNECTIVITY and CAPACITY as the two driving requirements for the V-7 Feeder Assessment process to determine needed and potential reliability improvements.

A FEASIBILITY STUDY should look at this in much greater detail, including flow diagrams under various contingencies. These can determine the constraints that determine the size of renewable energy systems.

ENTIRE PAGE ADDED

RELIABILITY DEFINITION FOR DISTRIBUTION LINES

(FROM THE ARIZONA ADMINISTRATIVE REGULATIONS R14-2-208C AND D)

C. CONTINUITY OF SERVICE.

Each utility shall make reasonable efforts to supply a satisfactory and continuous level of service. However, no utility shall be responsible for any damage or claim of damage attributable to any interruption or discontinuation of service resulting from:

1. Any cause against which the utility could not have reasonably foreseen or made provision for.
2. Intentional service interruptions to make repairs or perform routine maintenance.

D. SERVICE INTERRUPTIONS

1. Each utility shall make reasonable efforts to reestablish service within the shortest possible time when service interruptions occur.
2. Each utility shall make reasonable provisions to meet emergencies resulting from failure of service, and each utility shall issue instructions to its employees covering procedures to be followed in the event of emergency in order to prevent or mitigate interruption or impairment of service.
3. In the event of a national emergency or local disaster resulting in disruption of normal service, the utility may, in the public interest, interrupt service to other customers to provide necessary service to civil defense or other emergency service agencies on a temporary basis until normal service can be restored.

Summary. A utility shall make reasonable efforts to supply satisfactory and continuous service and reestablish service in the shortest possible time when interruptions occur. CONNECTIVITY and CAPACITY are designed to meet demand.

Extract from the Arizona Administrative Code (A.A.R.) section R2-12-208.

C. Continuity of service.

Each utility shall make reasonable efforts to supply a satisfactory and continuous level of service. However, no utility shall be responsible for any damage or claim of damage attributable to any interruption or discontinuation of service resulting from:

1. Any cause against which the utility could not have reasonably foreseen or made provision for, that is, force majeure.
2. Intentional service interruptions to make repairs or perform routine maintenance.
3. Curtailment.

D. Service interruptions

1. Each utility shall make reasonable efforts to reestablish service within the shortest possible time when service interruptions occur.
2. Each utility shall make reasonable provisions to meet emergencies resulting from failure of service, and each utility shall issue instructions to its employees covering procedures to be followed in the event of emergency in order to prevent or mitigate interruption or impairment of service.
3. In the event of a national emergency or local disaster resulting in disruption of normal service, the utility may, in the public interest, interrupt service to other customers to provide necessary service to civil defense or other emergency service agencies on a temporary basis until normal service to these agencies can be restored.
4. When a utility plans to interrupt service for more than 4 hours to perform necessary repairs or maintenance, the utility shall attempt to inform affected customers at least 24 hours in advance of the scheduled date and estimated duration of the service interruption. Such repairs shall be completed in the shortest possible time to minimize the inconvenience to the customers of the utility.
5. The Commission, Consumer Services Section, shall be notified of interruption in service affecting the entire system or any significant portion thereof. The interruption of service and cause shall be reported by telephone to the Commission within 2 hours after the responsible representative of the utility becomes aware of said interruption and followed by a written report of the Commission.

V-7 FEEDER - PRESENT CONNECTIVITY STATUS

The ENTIRE V-7 feeder will fail ~~with the loss of ONE element~~ whenever:

- A remote generator fails to meet demand, there is no local generation or backup, or
- There is a transmission line fails prior to the eastern ~~Mustang Corners~~ Substation, or
- There is a transformer fails (69:25 kV) at the eastern ~~Mustang Corners~~ Substation

ENTIRE V-7 FEEDER FAILS

PROPOSED 69 kV LINE MAKES NO IMPROVEMENTS

Whenever there is a single pole failure on the V-7 between a customer there will always be an outage failure for that customer and ALL other customers further down the line, and up the line to a breaker that should have opened when a failure is observed.

REST OF V-7 FEEDER FAILS

PROPOSED 69 kV LINE MAKES A LITTLE IMPROVEMENT

~~PRESENT V-7 FEEDER CAN NOT MEET N-1~~

There are no specific rules for distribution line failures other than in prior slide. There are several IEEE distribution indices used for distribution lines however, SSVEC does not have them available.

Note: If a remote generator, transmission line, or transformer fails before Mustang Corners or the Huachuca City Substation, the entire existing V-7 Feeder fails for any radial line to the Sonoita substation.

NERC/WECC have four contingency categories:

A – No Contingencies – **All Facilities in service**, called N minus Zero or N-Ø
B – Event resulting is the loss of a **single element** (generator, line, circuit, transformer), called N minus One or N-1
C – Event(s) resulting in loss of 2 or more elements (N-2)
D – Extreme Event including cascading (N-3)

NERC Category A is also called N-Ø, Category B is N-1, Category C is N-2.

The ACC requires companies to meet N-1 conditions, and when performing work on an element, to also meet N-1, which is called N-1-1.

Meeting N-2 is a goal and that simulations be conducted for N-2 and N-3 to assess areas necessary to prevent these contingencies

2008 V-7 AND OTHER FEEDERS (CONNECTIVITY) OUTAGE DATA

Feeder Line	Hours Off	Number of Customers	Customer Hours OFF	Hours OFF/customer
V-7 Sonoita/Patagonia	179.98	3057	3839.91	0.06
R-3 Ramsey	64.16	1006	2988.66	0.06
K-2 Chri	239.75	1828	4299.75	0.13
O-5 Mescal	392.22	2639	4657.97	0.15
J-3 Kansas Settlement	197.05	1202	3409.05	0.16

1. Three feeder lines have higher outages than V-7, with twice the outage hours per customer.
2. Only 1 V-7 outage was due to "overload" impacting 1 customer.

Analysis prepared by Jeanne Horsmann and Gail Getzwiller, Sonoita.
Ref: SSVEC 2008 Feeder Outage Data (without November)

In 2008, there were 80 outages for total of 180 hours on the V-7 feeder. Note November data was not provided; however, 12 months of data are shown as January 2008 and 2009 were provided.

- 50 Outages (63%) impacted 1 meter (Causes: 18 unknown, 11 birds, 11 lightning, 3 animals, 3 wind, 3 other, 1 overload)
- 7 Outages (9%) impacted 2 meters (Causes: 3 lightning, 2 birds, 2 unknown, 1 Other)
- 5 Outages(6%) impacted 3 meters (Causes: 2 lighting, 1 birds, 1 tree, 1 unknown)

ONLY 3 Outages (4%) impacted a significant number of people on the main line with causes as indicated:

- 1 impacted 1,700 meters– cause "Other"
- 1 impacted 580 meters – cause wind
- 1 impacted 450 meters – cause wind

Others, 1 impacted 60 meters (cause "accident"), 1 impacted 45 meters (wind), 1 impacted 40 meters (lightning), 1 impacted 20 meters (birds), 1 impacted 12 meters (underground fault)

The causes for V-7 outages in 2008 were as follows:

Cause	No. of Outages	Hours
Overload	1	2.0
Tree	1	2.0
Underground Fault	2	10.0
Accidents	3	10.5
Animals	3	25.0
Other	5	6.5
Wind	7	21.0
Birds	15	22.3
Lightning	21	39.9
Unknown	25	42.8

WHAT IS THE V-7 GROWTH FORECASTS

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Patagonia CCD	**3,323**	**3,394**	**3,464**	**3,533**	**3,602**	**3,671**	**3,738**	**3,806**	**3,872**	**3,937**	**4,000**	**4,063**	**4,124**
Elgin CDP	441	458	475	492	509	525	542	558	574	590	605	621	636
Patagonia town	946	954	962	971	979	987	995	1,003	1,011	1,019	1,026	1,034	1,041
Sonoita CDP	1,084	1,117	1,151	1,184	1,217	1,249	1,281	1,314	1,345	1,376	1,406	1,436	1,465
Remainder of Patagonia CCD	853	864	876	887	898	909	920	931	942	952	963	973	983

Source: Arizona Department of Economic Security, Research Administration, Population Statistics Unit, 12/01/06.

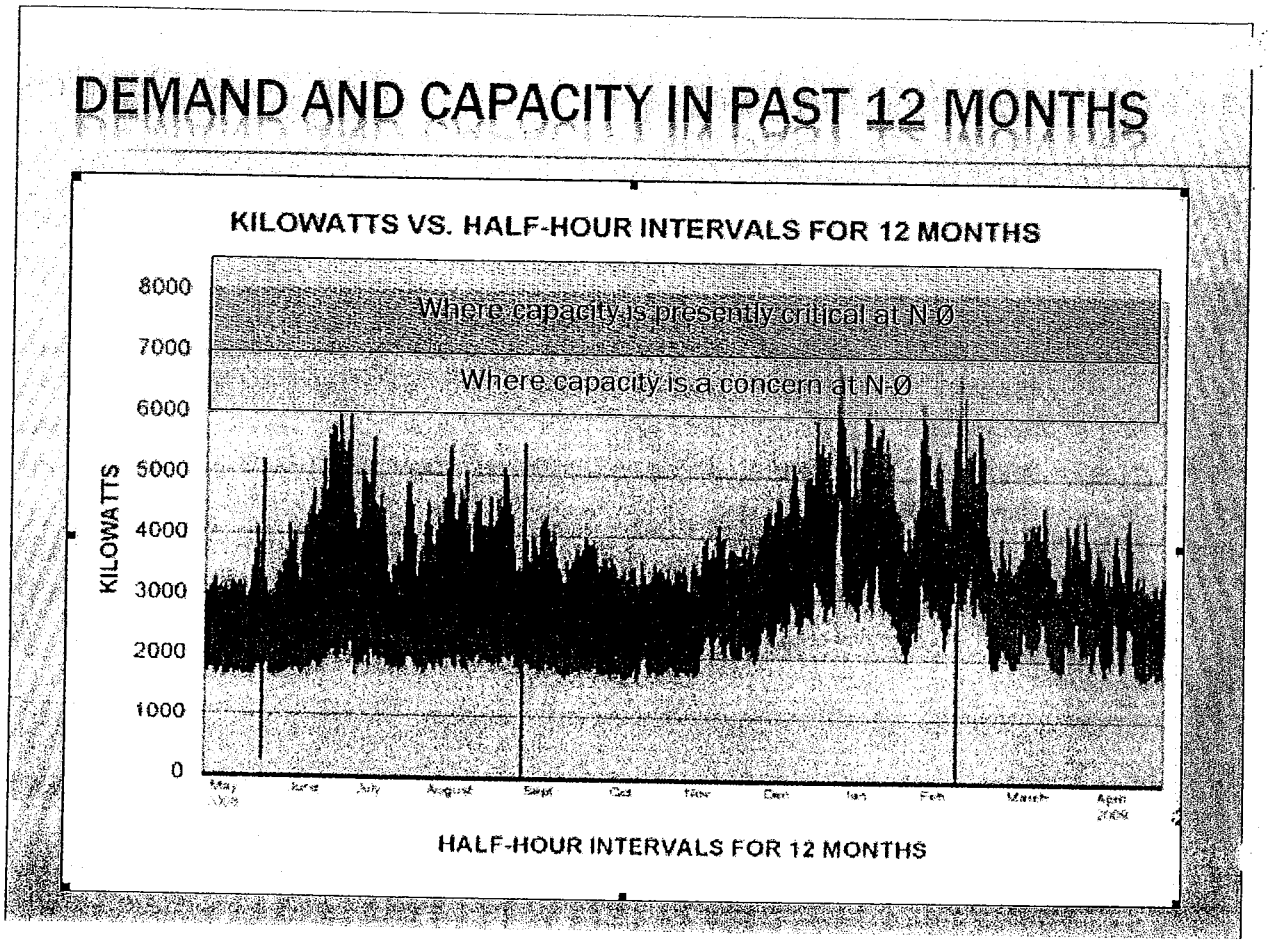
Seago / DES Population Statistics approved June 6, 2007

Even without considering the present economic decline, the future growth is slow for the entire V-7 feeder area.

When looking at the official Arizona population projections for each community in the V-7 feeder area, the existing 3325 total population last year is not expected to reach 4,000 persons until 2018. This is about 70-80 persons per year. These numbers include the "Remainder of the Patagonia CCD" which includes San Rafael Valley most of which is in the UNS Electric service area; thus these estimates are higher than the actual population.

Using the ratio used by SSVEC of 2.7 persons per household, then less than 30 homes per year are the anticipated growth for the whole area. No major industries now exist or plan to move into an area, that already has a serious shortage of water resources for its existing population.

Based on electric demand, installation of large numbers of single-home PV systems, larger 20-100 MW commercial PV systems, and two or three 1-3 MW renewable energy "plant" systems (with backup for sunless periods of time), there is NO URGENCY for the proposed 69 kV project. The numbers just are not there.

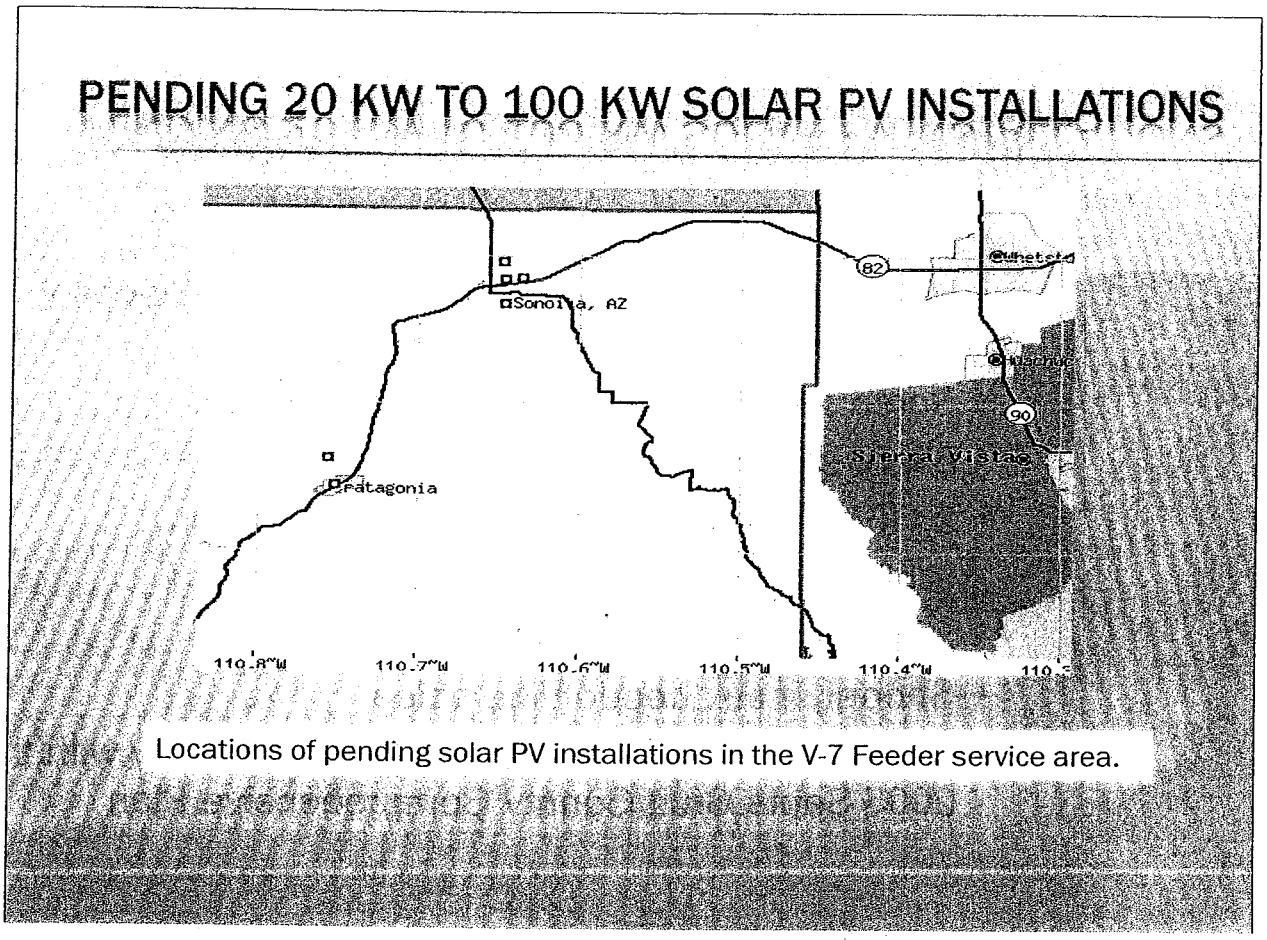


This shows the measured demand at the V-7 Feeder at Mustang Corner substation. It is obvious the existing situation needs a solution.

The V-7 Feeder 25~~23~~ kV distribution line is reported to have a 7 MW capacity which was not reached in the past 12-months.

Only on a few days in January and February, did the demand exceed 6 MW from the Mustang Corner. There are three probable service outages to this substation when generation or transmission to this point failed. During these time periods, a TEP 46 kV backup connection would have reduced the outage time for V-7 feeder customers. Without that ability or any other backup, all customers on the V-7 Feeder lost power in early September and in mid-February and a great number in early June of 2008. These three outages were NOT caused by anything in the V-7 Feeder's service area but were external "service" outages.

Since the present 25 ~~23~~kV line to Mustang Corner is not being retained, there will be NO reliability connectivity improvements by replacing the 23 kV with one of a higher capacity, as a single radial line will remain to service these customers.



A little over two months ago, the Cross-Roads Forum and other community organizations sponsored the Second Santa Cruz County Renewable Energy EXPO at the county fairgrounds in Sonoita. Over 350 attended, mostly from the V-7 Feeder service area. Result: High local interest in renewable energy

Eighteen solar and renewable energy vendors had booths and made presentations. As a result of the EXPO, community interest has greatly increased. Dozens appear to now be filling out applications for SSVEC solar rebates for home/business PV systems.

There are presently seven large, but local, PV arrays being planned between 20 kW and 100 kW, independent of the two or three 1-3 MW solar "plants" in the V-7 area. These are shown above.

As of this date, the Renewable Energy Committee feels that some ~~300-500 kW~~ 2MW of solar systems applications plus another 2+MW are in the works, all since the EXPO.

Robbie Richards can update us on solar progress in the V-7 feeder area.

BENEFITS OF "DOWNTOWN" SUBSTATION

- Hub for four (N, S, W, E) 25 kV distribution loops to improve reliability and for sectionizing
- Same as for either 23 kV or 69 kV sources
- 69 kV substation costs are $3 million
- 23 kV is less costly, about $1.5-$2.0 million
- Walls can be a lower, smaller transformer
- Smaller area
- Shorter, if any, feeder line poles
- New underground distribution lines to comply with the 2005 Santa Cruz County Comprehensive Plan

The communities understand the benefit of having a substation with distribution feeders that can improve reliability. These need to loop or tie so that two connectivity paths exist.

The SSVEC substation is being designed for a 14 MW capacity with five connections, four for feeder loops and one for a local renewable energy connection.

Four distribution loops have been discussed, going W (Sonoita), East (Elgin), North and South (Sonoita). At least two if not three of these could have a RE plant connected to their 25~~23~~ kV feeder line. A connection to a 1 to 3 MW RE generator will not overload these distribution lines and will add reliability due to adding reactive power and reducing costs when far from remote generations.

We understand that SSVEC is planning a 2MW Renewable Energy Plant at the Sonoita substation but have nothing to confirm this possibility.

The new voltage controllers and related substation equipment can use this locally generated power for the other three feeders. This, in fact, becomes a micro-grid, and at some future date, could be used as a SSVEC test bed for the newest "smart grid" implementations, which also should make this feeder more efficient.

A discussion concerning making V-7 a "smart grid" would provide many additional capabilities but feel these 21st century features can be added if including "smart grid" capabilities as a later upgrade in its design.

HOW TO REASONABLY MEET CAPACITY FOR CONTINUITY OF SERVICE

~~SSVEC MUST MEET CAPACTIY FOR N-1 (SINGLE ELEMENT OUTAGE)?~~

1. ~~MUST~~ CAPACITY TO MEET PEAK DEMANDS UP TO AND ABOVE 7 MW
2. ~~MUST~~ CAPACITY TO BE CONTINUOUSLY AVAILABLE (24/7)
3. ~~MUST~~ CAPACITY TO BE FOR ALL CUSTOMERS DURING AN OUTAGE

Does the proposed 69 kV meet capacity?

1. Yes, up to 14 MW, the Sonoita substation single transformer limit
2. No, if the radial 69 kV line is out ~~not the outage element~~.
3. No. If the 69 kV fails, all customers go dark, no backup lines to substation

69 kV APPROACH DOES NOT MEET ~~N-1~~ CONTINUITY OF SERVICE

Can the existing 25kV line plus ~~two~~ Renewable Energy Sources with 46kVs meet 7MW capacity demand?

1. Yes. During a ~~69~~ 25 kV outage, TEP can provide 18 MW+ several MW from RE
2. Yes. With "peaker" local generation for above 7 MW, 2 MW initially proposed
3. Yes, ~~three~~ backup interconnections are proposed ~~2~~ with TEP, ~~1~~ and with UNSE)

THIS MEETS ~~N-1~~ CONTINUITY OF SERVICE

There needs to be two ways to deliver power to the V-7 Feeder Customers. At present , the 25~~23~~ kV line is the only one.

Under the proposed 69 kV solution, the existing 23 kV line will be a "reliability loop" from the new Sonoita substation, without any connection to Mustang Corner.

This removes this tie to a SECOND power from Mustang Corner, thus leaving ONE radial 69 kV line connecting the V-7 customers. This still inhibits meeting ~~NERC N-1 Criteria~~continuity of service. If the 69 kV line goes down, the situation is the same as when the existing 25~~23~~ kV line goes down. There is NO change in reliability when this happens!!

The proposed two backup interconnections with the TEP 46 kV and one with the UNS Electric system provides for ~~three~~ two NEW sources for the V-7 Feeder customers. This will always have adequate power, especially, from the TEP 46 kV source. ~~NERC N-1reliability~~Continuity of Service criteria will be achievable wit this approach, definitely better than that with a single radial 69 kV line.

DOES SSVEC want to ~~meet N-1 Reliability Criteria~~reasonably provide Continuity of Service?

HOW TO REASONABLY MEET CONNECTIVITY FOR CONTINUITY OF SERVICE

~~HOW TO MEET CONDUCTIVITY FOR N-1 RELIABILITY CRITERIA~~

1. ~~MUST~~ SHOULD PROVIDE A ~~SECOND PATH TO A~~ DIFFERENT GENERATION SOURCE,
2. ~~MUST~~ SHOULD HAVE A SECOND INDEPENDENT TRANSMISSION PATH, and
3. ~~MUST~~ SHOULD HAVE A SECOND TRANSFORMER

Does ~~the proposed~~ 69 kV ~~provide these to meet N-1 conductivity~~ reasonably provide connectivity for continuity of service?

1. No. ONE LINE from Huachuca Substation to generation sources.
2. No. Only ONE transmission path for V-7 Feeder customers
3. No. One 69 kV transformer at Sonoita and Huachuca Substations.

Can ~~two~~ TEP 46 : 25 kV taps ~~provide these to meet N-1 conductivity~~ reasonably provide near continuous connectivity?

1. Yes.
2. Yes.
3. Yes.

NOTE: UNS ELECTRIC backup is a bonus, without a 2-county rule, with potential reliability improvements for Patagonia and San Rafael Valley.

There are several ways to reasonably meet connectivity~~solve maintaining a connection~~ when there is a single element contingency outage; however, having access to a second generation (via a transmission line) source is necessary for the V-7 Feeder area to meet Connectivity necessary for Continuity of Service~~N-1 Reliability Criteria~~.

The proposed 69 kV solution does not meet any of these for Continuity of Service~~the three N-1 Reliability Criteria~~.

An~~Two~~ interconnection with the TEP 46 kV can meet continuity of service~~all three N-1 Reliability Criteria~~. One~~Two~~ 46 kV connection provides connectivity~~s are necessary~~ in case the 23 kV outage is between the 46 kV connection and the Sonoita substation~~;~~, except when between the 46 kV connection and the substation ~~however, only one would be used~~.

HOW CAN WE KNOW WHAT'S BEST?

Options to be evaluated

1. 69 kV line with 69 kV Substation (as proposed) (connectivity ~~continuity,~~ capacity, cost)
2. One ~~Two of several~~ 46 kV taps (continuity, emergency capacity, cost)
3. One to three 1 to 3 MW RE system projects, with alternative backup (sunless hours) (continuity, capacity, cost)
4. Compare best mix of Options #2 plus #3 versus Option #1

A Feasibility analysis can provide Best Answers for all

1. To objectively evaluate all options including renewable energy and
2. To make quantitative, best value decision recommendations to this board
3. Limit to 60 days, to not delay 69 kV plan, if appropriate
4. To use an independent evaluator (organization) to consider all sides
5. To use team collaboration and open study to community participants
6. To use web-based development and collaboration processes
7. To deliver in four evolving reports covering (1) technical, (2) cost schedules information, (3) Public Relations, and (4) Short ~20-page Feasibility Study with an attached draft RFP for the recommended Option, if not the 69 kV line
8. Study Cost est. $70k or less, maybe <$50k

What are the options:

- **Construct a 69 kV that does not meet reliability criteria or**
- **Connect with 2 ~~or more~~ TEP/UNSE locations for backup (second line), use smaller Sonoita substation with feeders, with one or three renewable energy systems (with access to gas-powered electric generation), with many local private RE systems**

Resolve by conducting a FEASIBILITY STUDY

Conduct a Feasibility Analysis (Trade-Off Study) to provide the answer. Should be fast, so as not to delay 69 kV if that's the result (but really urgency isn't an issue)

See FEDERAL REGISTER announcement (29 May) for "Inviting Applications for Renewable Energy Systems and Energy Efficiency Improvements Grants and Guaranteed Loans and Renewable Energy **FEASIBILITY STUDIES GRANTS** Under the Rural Energy for American Program [Act of 2008, in Farm Bill] (handout)

AND

See Arizona Department of Commerce Energy Office, "American Recovery and Reinvestment Act of **2009 State Energy Program**" of 12 May 2009. (handout)
BOTH can provide funds to determine the best V-7 Feeder Option

WHICH OPTION IS LESS EXPENSIVE?

69 kV solution has an estimated cost is $ 13.5 M including $3 M substation

1. Does not provide reasonable continuity of service ~~meet NERC N-1 Reliability Criteria~~
2. Does not improve reliability

Proposed Renewable Energy approach

1. Saves SSVEC capital funds with private investment
2. Can qualify for various Stimulus funding to save SSVEC capital $$
3. Maybe less expensive to meet V-7 Feeder growth needs
4. May have significantly lower life-cycle ratepayer costs

Additional Benefits of Renewable Energy

1. Benefits of distributed generation (voltage stability, less line loss, etc)
2. Helps meet future ACC Renewable Energy Standard goals for SSVEC
3. Provides reasonable continuity of service with ~~Meets NERC N-1 Reliability Criteria with associated~~ improved reliability

Estimated costs for components for an alternative to the 69 kV line.

Substation	
One 25~~23~~ kV relay substation in Sonoita, present "downtown" location:	$2,250,000~~$1.5 M to $2 M~~
Reliability Loop Equipment and lines	$450,000
Peaker Plant:	
two 1.1 MW @ 375,000 = -2.2 MW Natural Generators:	$750,000
~~1 MW Natural Gas Genset (1,000 to 1900kW) Peaker Back up:~~	~~$158,000 to $335,000~~
46kV backup Interconnection:	
One~~Two~~ 46:25 kV ~~to 23 kV~~ transformers and substation (TEP ownership):	$200,000 to $300,000
One three ring breaker switch for 46 kV backup (@ TEP substation)	$800,000 to 1.2 M
UNSE Interconnnection:	
SSVEC: UNSE Transformer and associated equipment	$100,000
One mile of distribution lines (Patagonia-UNSE)	$100,000

Total cost **from** $4,650,000 to $5,150,000*
~~$2.4 mil to $3.7M*~~

* Cost ranges is due to variable Substation costs for distribution loops, number and size of Generator sets, and three-ring breaker switch

POSSIBLE COSTS FOR RELIABILITY OPTIONS

Substation

One 25 kV relay substation in Sonoita, "downtown" location: $2,250,000

~~Sonoita Substation Cost = $ 2,550K (1.5M + 500 + 50 breakers = 2,550)~~

Reliability Loop Equipment and lines $450,000

~~Plus some line for Loops = $450K~~

Peaker Plant:

Two 1.1 MW @ 375,000 Natural Generators (2.2 MW): $750,000

~~Two 1.1 MW gensets @ $350k each = $ 700K (natural gas generators)~~

~~(2.2MW for sunless periods, when over 7MW capacity on 23 kV)~~

46 kV backup Interconnection:

46:25 kV transformer, substation (TEP owns): $300,000

~~Two: 46-23kV transformers, @ $300k = $ 600K (Sonoita TEP-SSVEC)~~

One three ring breaker switch for 46 kV backup TEP $800,000 to 1.2 M

UNSE Interconnnection:

SSVEC: UNSE Transformer and associated equipment $100,000

One mile of distribution lines (Patagonia—UNSE) $100,000

~~One: 23:13.2 kV transformer @100k = $ 100K (for San Rafael Valley-Patagonia)~~

~~1 mile of 23 kV line to connect above lines = $ 100K~~

Total $4,700,000 to $5,100,000

~~$4,500,000~~ Plus solar PV (minus stimulus = ??)

Here are some estimated costs for components being discussed, quotes from various sources

46 to 25~~23~~ kV transformer @ $300k x 2 = interconnections) includes remote switching	$300k~~600k~~ (at Sonoita TEP-SSVEC
46 kV 3-ring breaker switch	$800,000-1,200,000 (@ TEP substation)
25~~23~~ to 13.2 kV transformer @ $100k x 1 includes remote switching	$100k (at Patagonia-SRV interconnection)
25~~23~~ kV line to connect @$100k / mile	$100k (between Patagonia and SRV interconnection)
UNSE/TEP estimate	**$1,300,000 to $1,700,000 ~~800k~~**
Sonoita substation ($1.5M + $50 breakers + $500k other)	$2,250k
For reliability loops **from substation**	**$450k**
SSVEC estimate	**$2,700k**
Generation Sets (1.1 MW @350k x 2 peak)	$700k (for 2.2 MW of backup for over 7 MW at
TBD (PPA or SSVEC)	**$700k**
Total	$4,650,000 ~~$4,500,000~~

PLUS Solar MINUS Stimulus = $$

COSTS FOR SYSTEM RELIABILITY IS NOT SO BAD

Cost Summary to Reasonably Meet ~~Continuity~~ Connectivity & Capacity ~~N-1~~ ~~Requirements~~ Needs

- TWO ~~Natural Gas Gensets~~ Generation (gas, biogas, other)(2.2 MW on-call and dispatchable)
- ~~THREE~~ Emergency Backup~~s~~ (TEP) with 3-ring breaker
- ONE 25 ~~23~~kV Substation with Reliability Loops
- Plus On-call Tie to UNSE ~~Additional Line~~

$4,700,000 ~~$4,500,000~~

(May 27th = 3, 500, 000)

~~Two: 46 transformers, @ $300k = $ 600K~~

~~One: 23:13.2 kW transformer @100k = $ 100K for San Rafael Valley Sonoita~~

~~1 mile of 23 kV line to connect above = $ 100K for 1 mile line to connect~~

~~Two 1.1 MW gensets @$350k = $ 700K (2.2MW for sunless periods, when over (natural gas generators) 7 MW on 23 kV)~~

~~Sonoita Substation = $ 2,550K (1.5M + 500 + 50 breakers = 2,550~~

~~TOTAL = $ 4,050 plus solar PV (minus stimulus = $$)~~

~~Plus some line for PV = $450K~~

~~**Total $4,500,000 Plus solar PV (minus stimulus = $$)**~~

Summary Slide:

NOTE:

1. The generators are dispatchable and will be designed for deliver electricity as FIRM Delivery, peak and non-peak)
2. To be used when demand gets close to 7 MW, such as spinning reserves at 6.8 MW demand.

~~CONTINUITY~~ CONNECTIVITY AND CAPACITY (C&C) ~~WITH~~ PLUS RENEWABLE ENERGY

C&C $4,700,000 ~~$4,500,000~~ + 1MW Solar $5,500,000* = $10, 200,000 ~~$10,000,000~~ total cost

C&C $4,700,000 ~~4,500,000~~ + 2x1 MW Wind $2,000,000* = $6,700,000 ~~$6,500,000~~ total cost

C&C $4,700,000 ~~$4,500,000~~ + 2x1 MW BioMass $200,000** = $4,900,000 ~~$4,700,000~~ total cost

Total savings for SSVEC after adding a Renewable Energy Component

Savings could be from $3,300,000 TO $8,600,000 ~~$3,500,000 to $8,800,000~~

(*)(**) - estimates

This does NOT reflect stimulus funds or grants to reduce or eliminate the cost of the Renewable Energy Systems

~~New Slide since the SSVEC BOD Presentation May 27, 2009:~~

Conclusion: After obtaining information from another presenter, Environmental Technology Assistance Co. LLC, (ETAC) who is investigating putting in renewable generating station in the Willcox Area. And information from the SSVEC Board who reported on a 1MW BioMass Generator that was operating in their service area that only cost $98,000** to build.

Have now added the costs of installing Renewable generating stations to the CONNECTIVITY and CAPACITY (C&C) costs listed above.

Several Possibilities all saving the SSVEC millions of dollars *(from $4.5 mil to $9,804,000):*

C&C $4,700,000~~$4,500,000~~ + 1MW Solar $5,500,000* = $10,200,000~~$10,000,000~~ (1 MW RE)

C&C $4,700,000~~$4,500,000~~ + 2 x 1 MW Wind $2,000,000* = $6,700,000~~$6,500,000~~ (2 MW RE)

C&C $4,700,000~~$4,500,000~~ + 2 x 1 MW BioMass $200,000** = $4,900,000~~$4,700,000~~ (2 MW RE)

* ETAC data

** Data presented by Jack Blair at the SSVEC 27 May BOD meeting

NO Stimulus funds are included

UPGRADE 25 ~~23~~ KV FEEDER TO SONOITA (BARE BONES)

~~UPGRADE EXISTING V7 FEEDER LINE TO ELGIN/SONOITA~~

Option: Re-conductor existing line with 336 conductors
Purpose: To increase capacity of existing line from 7 MW to 20 MW

1) Upgrade can take place when SSVEC upgrades the existing poles:
   Cost : 5280 ft x 19miles = 100,320 ft x $25 / foot = $2,508,000
~~1) Re-conductor existing line with 336 conductors:~~
   ~~To increase capacity of existing line from 7 MW to 20 MW~~
   Saving compared to 69 kV (13.52.508)= $9,992,000

Add below to increase reliability
2) One ~~Two~~ 46:25kV transformers for TEP Emergency Backup = $600,000
3) One 3-way ring breaker switch for automated backup= $800,000-$1.2 M)
~~3) One 23kv Transformer in Patagonia = $100,000~~
4) Sonoita Substation plus 4 Reliability Loops = $2,700,000
~~4) One mile of 23kV line for Patagonia Connection = $100,000~~
5) SSVEC-UNSE tie including lines and equipment = $200,000

Totals (#1-#5) $6,800,000 to $7,200,000 ~~$3,308,000~~ (#1 includes labor, hot job) ~~(#2 includes labor)~~

Another plan the "Feasibility Study" could evaluate, would be bringing a 2nd line into Sonoita on the existing line to double the capacity on that line and establish a loop using the existing line.

This gives us

(1) a 7 MW line from the Sonoita substation to serve existing customers between Sonoita and Mustang Corners and
(2) A 14 MW (new line) from Mustang Corners to Sonoita as the main V-7 feeder to the new substation.
(3) Adding in the TEP 46 kV interconnections, UNSE interconnection and line, then
(4) This plan would reduce the need for a large transformer substation in Sonoita for the 69kV line to be a 23 kV hub for reliability loops as SSVEC may want a smaller substation to introduce loops into this plan.

~~Guess what,~~ This gives backups for lines, poles and transformers but not remote generation to meet the ACC Continuity of Service ~~NERC N-1~~ reliability criteria. ~~Almost, but not quite there.~~ Adding two 1.1 MW~~gensets~~ would meet the criteria for an additional $700,000+ (2.2 MW) with a 9.2 MW capacity.

Only pole conductor and replacements as a routine upgrade process should meet the NEPA Exclusion Category to replace and upgrade distribution lines on BLM lands, if required at all.

If there are problems with the NCA, we feel local support, including by former Congressman Kolbe should assist in keeping this in the Exclusion Category. We can try to arrange, if that helps.

OVERVIEW OF RFP FOR FEASIBILITY ANALYSIS

We prepared a draft RFP for SSVEC's consideration as a way to make an objective decision.

1)Collaborative: Project working papers are shared with SSVEC and Cooperators

2)Interactive: Online reports allow for SSVEC and Cooperator input

3)Four reports: Addressing multiple levels of concern; (a) technical, (b) cost and schedule, (c) Public Relations, and (d) Recommended Action (Summary Study)

4) Frequently base-lined: Data collection for all prospective alternatives

5) Action items: Clear action items for construction, funding, and implementation

TEAMWORK GETS BEST RESULTS!!

Please see our proposed RFP that is a TEAMWORK approach to putting together the BEST OPTION for the V-7 Feeder cooperators.

All of us want to work with the company to ensure we understand each other. That the BEST is best for all. The details in the proposed RFP cover, we believe, all key issues that should be summarized in a 20 or so page FEASIBILITY STUDY that will give the BOD with confidence that funds are being wisely spent in the best interest of SSVEC's customers.

Our initial funding approach, with discussions with TEP and others all recommend that we show 'feasibility' as a real option to significantly benefit both SSVEC and UNS Electric customers.

When two companies want to work together, completing "cross boundary agreements" become easy, teamwork breeds teamwork. Let's get started.

Our three Communities are motivated and eager to participate doing their part with home and business-oriented solar PV systems. Companies are eager to provide Renewable Energy on their properties, landowners are agreeable for "plant" systems (1-3 MW solar arrays), community citizens want this on their land, and with leadership and assistance from SSVEC, we see a "bright" future for our feeder area that may have been burdensome in a former years.

SSVEC could create the model for many other "end of the line" rural systems that face growing capacity issues. Our issues aren't unique but solving with modern technologies can benefit so many others in the same situation.

RECOMMENDATIONS

Today, we recommend that SSVEC Staff

1.Seriously consider all these Options
2.Work with our Committee and collaborate details necessary to better understand the renewable option(s) and how to foresee and overcome local issues.
3.Provide an RFP for a FEASIBILITY STUDY by a competent third party for the July SSVEC BOD meeting for review and approval decision. Include at least six independent, qualified Arizona organizations to receive the RFP with a 14-day turnaround, 5-day evaluation period for award NLT 20 August with completion NLT 20 October.
4.Vigorously pursue the USDA and AZ Energy Office Stimulus programs, including funding for a Feasibility Study. We can help!
5.Understand the urgency to complete and present the FEASIBILITY STUDY to the BOD prior to starting any construction of the proposed 69 kV line.
6.Provide periodic Feasibility Study Status Reports to BOD.

Our DRAFT FEASIBILITY RFP provides a consensus of our team's work to provide SSVEC with a rather comprehensive outline that should lead best practices inpreparation of a joint Report using our Committee, consultants, volunteers and a selected, third party, independent organization to work with our TEAM to review technical information, local and regional electrical information, environment, economic and energy demands necessary.

We want to work closely with and not apart or opposing SSVEC in this process. We feel the final results will benefit all of us in many ways it is hard to imagine at this time.

Please give this approach your most serious attention.

Our communities need Continuity of ServiceN-1 reliability, need backups and fully supports use of renewable energy to solve our continuity and capacity needs, instead of a 1982 solution.

We all Thank you!!!

SSVEC

Analysis Rebuttal

Sulphur Springs Valley Electric Cooperative, Inc.

A Touchstone Energy® Cooperative

SSVEC REBUTTAL OF 3SEG PROPOSAL

The following is a page-by-page and, in many cases, a line-by-line rebuttal of the latest submittal to the Arizona Corporation Commission by the Save the Scenic Sonoita Elgin Grasslands (3SEG) group. The format used takes each slide from the presentation and, using this font, rebuts statements made. Text presented in "*italic quotes*" is taken directly from the 3SEG presentation.

Explanation of Slide Modifications: The slides are from the July 13, 2009 3SEG/SSVEC Staff discussion. This document was submitted to the ACC on July 22, 2009 and contains modifications from the July 13 document as indicated by: UNDERLINED BLUE text added by 3SEG; ~~RED STRIKETHROUGH~~ deleted by 3SEG. EXAMPLE BELOW:

HOW TO REASONABLY MEET CAPACITY FOR CONTINUITY OF SERVICE

~~**SSVEC MUST MEET CAPACTIY FOR N-1 (SINGLE ELEMENT OUTAGE)?**~~

1. ~~MUST~~ CAPACITY TO MEET PEAK DEMANDS UP TO AND ABOVE 7 MW
2. ~~MUST~~ CAPACITY TO BE CONTINUOUSLY AVAILABLE (24/7)
3. ~~MUST~~ CAPACITY TO BE FOR ALL CUSTOMERS DURING AN OUTAGE

Does the proposed 69 kV meet capacity?

1. Yes, up to 14 MW, the Sonoita substation single transformer limit
2. No, if the radial 69 kV line is out ~~not the outage element~~.
3. No. If the 69 kV fails, all customers go dark, no backup lines to substation

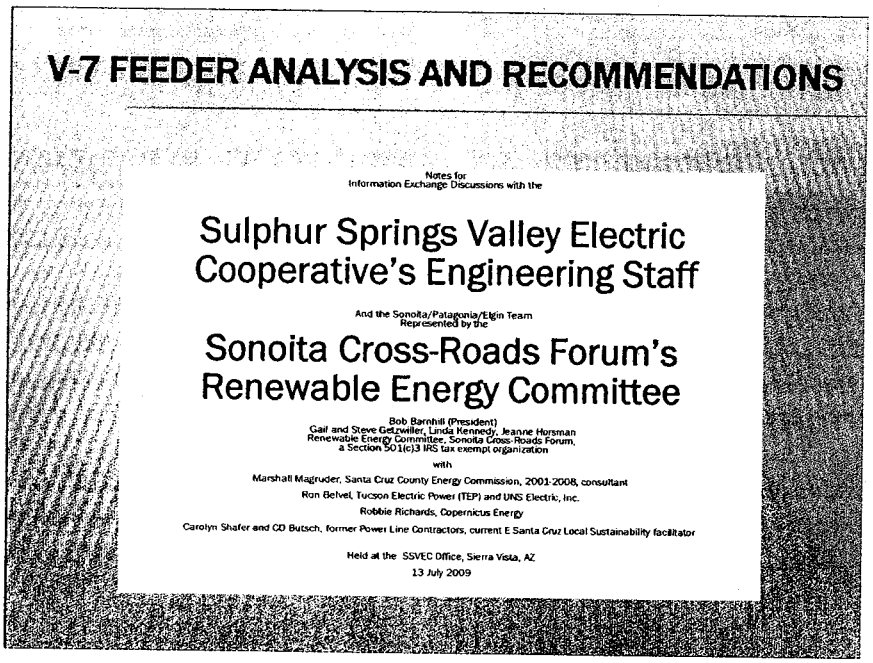
69 kV APPROACH DOES NOT MEET ~~N-1~~ CONTINUITY OF SERVICE

Can the existing 25kV line plus ~~two~~ Renewable Energy Sources with 46kVs meet 7MW capacity demand?

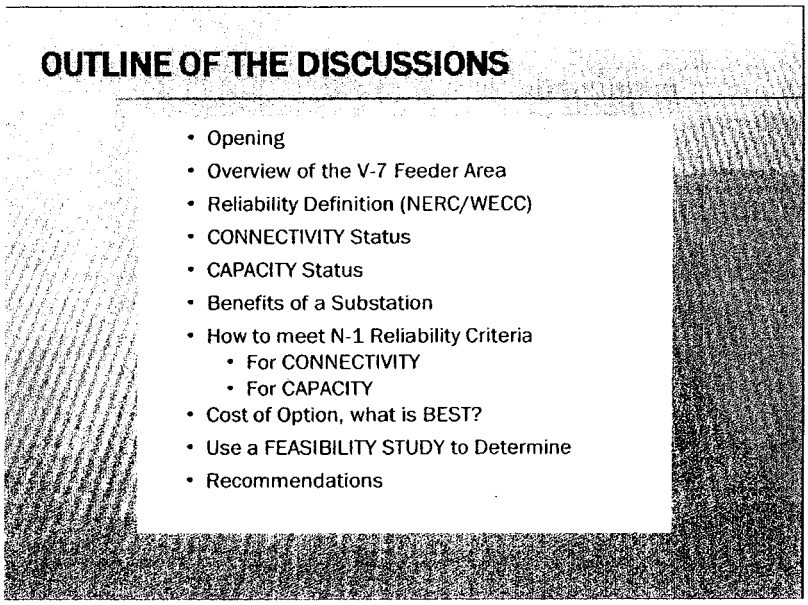
1. Yes. During a ~~69~~ 25 kV outage, TEP can provide 18 MW+ several MW from RE
2. Yes. With "peaker" local generation for above 7 MW, 2 MW initially proposed
3. Yes, ~~three~~ backup interconnections are proposed ~~2~~ with TEP, ~~1~~ and with UNSE)

THIS MEETS ~~N-1~~ CONTINUITY OF SERVICE

Page numbers coordinate with July 22, 2009 ACC Submittal by 3SEG. SSVEC response over-runs are added to page numbers by an alpha-character. Example: Page 10, to Page 10-A



- ❑ **With all due respect to those involved, no qualified Engineers are presented as collaborators on the 3SEG proposal, with the exception of Mr. Ron Belval**
- ❑ **Mr. Ron Belval of Tucson Electric Power (TEP) has stated his role is as a representative of TEP and not necessarily a supporter of the 3SEG proposal**
- ❑ **SSVEC has a staff fully capable of evaluation, design and construction of such projects – this is our business. SSVEC's staff includes:**
  - **Five registered Professional Engineers,**
  - **Two Engineers-in-Training,**
  - **A full Right of Way acquisition staff including a Senior Member of the International Right of Way Association (SR/WA) with Certifications in Right of Way Negotiation and Acquisition,**
  - **An Engineering Planning division with state-of-the-art computer modeling programs including MilSoft Windmil and PowerWorld Simulator for complex load flow analysis,**
  - **A Substation/Transmission Line Engineer with a Masters degree in Electrical Engineering,**
  - **An Engineering Manager with extensive experience in both conventional and renewable energy technologies, polices and assessments dating from 1979 to present and ranging from solar and wind system installations in Alaska to renewable energy assessments throughout Latin America and Africa,**
  - **Among other qualified personnel.**



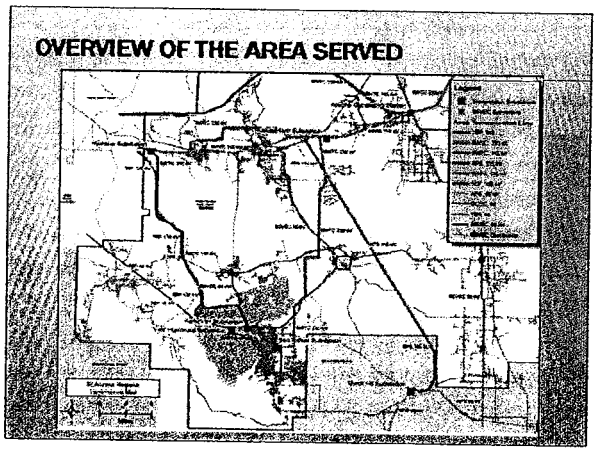
❑ *"The USDA has announced a stimulus package just for this purpose we would like to work with the company in obtaining and implementing."*

SSVEC has submitted two Stimulus-related proposals

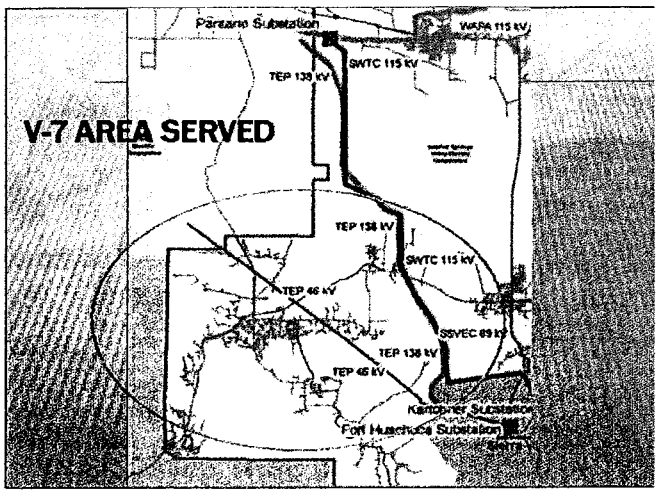
1. **To the Department Of Energy (DOE) for <u>Smart Grid</u> enhancements including:**
   - **Installation of fiber optic cable to the new Sonoita Substation**
   - **Sonoita Substation automation that will facilitate automatic operation of substation apparatuses**
   - **Automation of all feeder breakers including the dedicated renewable energy feeder**
   - **Metering to support local generation of renewable energy and possible Power Purchase Agreement (PPA) for private renewable energy development in the area**
   - **SCADA equipment to allow full remote monitoring and control of all equipment at the Sonoita Substation**
2. **United States Department of Agriculture (USDA) /Rural Utility Service (RUS) Clean Renewable Energy Bonds (CREBS) proposal**
   - **7/7/09 - Issued a Request for Proposal (RFP) to 14 companies for up to 750 kW of renewable energy at Sonoita**
   - **7/21/09 – Evaluated 10 bids for Purchase Power Agreement (PPA) and Design/Build options**
   - **8/3/09 – Submitted a $6M proposal for CREBS funding to RUS**

❑ *"We will agree with the results of such a FEASIBILITY STUDY."*

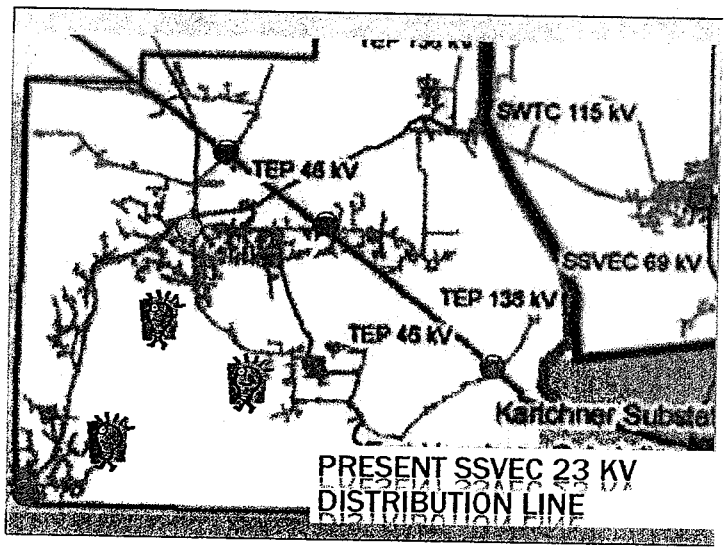
- **SSVEC addresses the issue of a Request for Proposal (RFP) for a Feasibility Study in a separate document.**



❑ **No comment from SSVEC**



- *"...TEP has IRS furnishing bond restrictions that permit it to only serve customers in two counties, namely Pima and Cochise Counties, thus TEP can not directly serve SSVEC customers in Santa Cruz County"*
  1. **This is a correct statement. TEP is currently restricted from load serving in Santa Cruz county for two reasons:**
     - **The Bond Council restriction**
     - **SSVEC has a Certificate of Convenience and Necessity to serve this area**



- *"There are at least three points where the TEP 46 kV backup line to Fort Huachuca crosses the V-7 feeder. These are shown as small red circles. Only the middle red circle is a 3-phase connection, necessary for a tie with SSVEC's 25 kV. If a 46:23 kV transformer was installed, at two locations, then the V-7 feeder would always have backup power."*
  - **Two of the suggested interconnect points are single-phase – not adequate for any significant back-up. This is recognized in the 3SEG statement above yet throughout the presentation they continue to refer to multiple interconnection points.**
  - **The statement goes on to say that if two points of interconnect are established, back-up power would be available. If one of the points is single-phase, this statement is not accurate. SSVEC is unclear in the proposed design at this point.**
  - **In 2003, SSVEC submitted a formal request to our power supplier, Arizona Electric Power Cooperative (AEPCO), for interconnection to TEP's 46kV line to serve the Sonoita area.**
    - **A formal reply from TEP stated that the 46 kV line is of limited capacity (20MW)**
    - **The line is fully committed to serving Fort Huachuca**
    - **Any service would be subject to disconnect at any time and**
    - **The 2-county rule was sited.**
    - **<u>POINT IS, SSVEC LOOKED AT THE TEP TIE OPTION BACK IN 2003!</u>**
  - **Again in 2007, SSVEC approached TEP regarding the 46 kV line. Similar response to 2003.**

- To have any significant capacity, the 46kV line would have to be upgraded from TEP's South Loop substation - approximately 23 miles away.
  - At a cost of approximately $350,000 to $450,000 per mile, or about <u>$9M</u> - not including any ROW or legal expenses.
- Additionally, the TEP line crosses SSVEC's V7 feeder within the Las Cienegas National Conservation Area and likely would not be approved by Bureau of Land Management (BLM) or Arizona State Land (ASLD) office or the Santa Cruz County Board of Adjustment(SSC BOA).

❑ *"TEP could build and maintain these transformers as SSVEC does not use 46 kV."*

- Hanging step-down transformers on poles with fuses for protection will not be allowed by TEP
- TEP stated that a three-breaker ring bus would be required to tap the 46 kV line. Estimated cost approximately $1-1.5M
  - A 10 MVA 3-phase transformer costs $230K
  - 3 voltage regulators each at $40K cost $120K
  - 2 breakers (one for each feeder out of the new substation) at $100K
  - TEP would undoubtedly want breakers and controls similar to what SSVEC would need
  - Structural steel, insulators, switches, buswork, etc at a cost of $300K
  - A small control house to accommodate the relays, Supervisory Control And Data Acquisition (SCADA) and communications equipment is additional at $300,000
  - A reliable communications path would be required (fiber optic, radio, or microwave) (not cost estimated at this time)
  - Metering as required by the Arizona Corporation Commission (ACC) for utility interconnects would also be required (not cost estimated)
  - A minimum of 350' X 350' (approximately 3 acres) would be required at $60K/acre is approximately $170K (IF YOU CAN EVEN ACQUIRE LAND IN THIS AREA!)

SSVEC / TEP 46kV Back-Up Interconnection	
Item	SSVEC Estimated Cost
Switching Station: 3 Breaker Ring Bus	$1,500,000
46:25kV Transformer	230,000
Set of 3-Voltage Regulators	120,000
2 – Distribution Automatic Circuit Reclosures (SCADA Controlled)	100,000
Substation Structure	350,000
Control House	300,000
Construction	500,000
Interconnect Location Substation Site	170,000
SSVEC Cost (does NOT include costs for TEP line upgrades)	$3,270,000

Details available upon request by the ACC

- *"In the SW corner is shown a green circle shows where a possible tie to the UNS Electric might be considered. Less than 1 mile of line will be required plus a transformer plus remote disconnect switches to make islands then interconnect either Patagonia or San Rafael Valley with the other. Obviously both utilities will have to established an operational protocols and procedures, have a cross-boundary agreement and PPAs".*

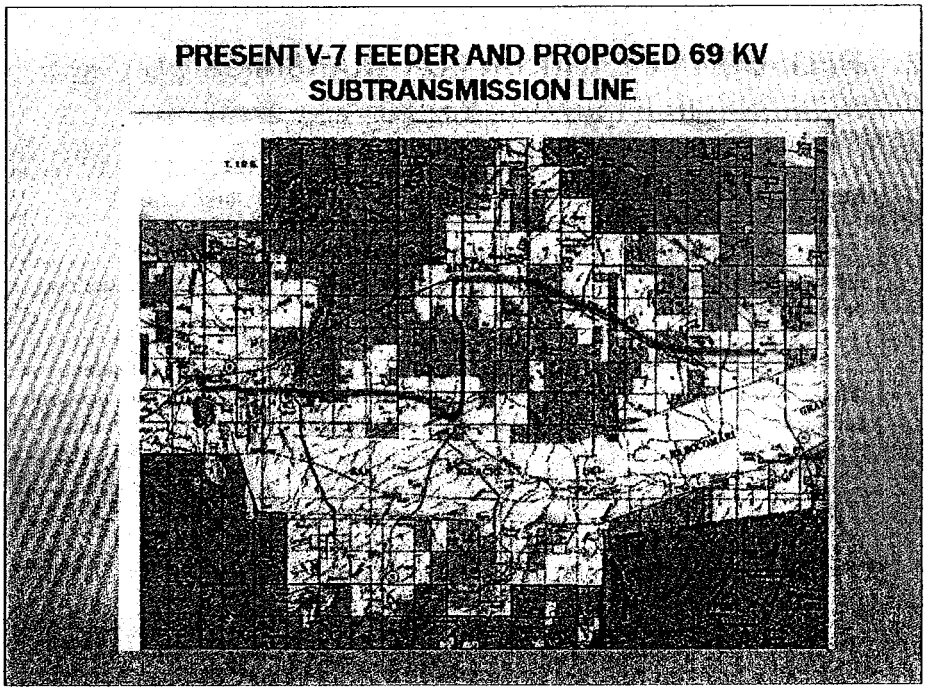
  - **The suggested interconnection offers several challenges:**
    - **UNS is 13.8kV, SSVEC is 25kV**
    - **UNS is 2-Phase, SSVEC is 3-Phase**
      - **Phase shifting equipment required**
    - **Communication for equipment cannot be maintained on SSVEC's existing radio system due to terrain issue / new system must be obtained**

  - **FOREMOST: This is SSVEC's service area as per approved ACC Certificate of Convenience and Necessity – if this tie is ANYTHING OTHER than Back-Up, then ACC must rule regarding service boundary modifications**

SSVEC / UNS Distribution Connection	
Item	**SSVEC Estimated Cost**
New 3-Phase line (1 mile at Flux Canyon)	**$ 100,000**
Step-Down Transformers	**70,000**
Set of 3-Voltage Regulators	**60,000**
3 –Automatic Circuit Reclosures (SCADA Controlled)	**150,000**
1 mile ROW for new 3-Phase line on Private Property – Transformer Site	**40,000**
SSVEC Cost (does NOT include costs for UNS facility upgrades)	**$ 420,000**

"This is to show the physical relationships between these points".

"Also, shown are prospective locations for 2 or so, small Renewable Energy "plants" with backup generation, plus another site at the Nogales International Airport (with county leased land). Robbie will discuss these and other renewable options later."



- *"One distributed generation 1MW to 3 MW RE plant near downtown would provide power boost to the local area. Adjacent to or in the SSVEC substation could be ideal."*
  - **SSVEC agrees and has pursued this suggestion**
  - **SSVEC added an additional feeder bay in the new Sonoita Substation specifically to accommodate renewable energy (RE) injection at this point**
  - **A proposal was submitted to USDA/RUS for CREBS funding for a solar facility at the new Sonoita Substation**
  - **Installation of any renewable energy at this site is, of course, subject to approval by the Santa Cruz County Board of Adjustors (SCC BOA)**

RELIABILITY DEFINITION FOR TRANSMISSION LINES

(FROM WECC'S MINIMUM OPERATING RELIABILITY CRITERIA)

RELIABILITY. The combination of Security and Adequacy, as defined herein.

SECURITY. The ability of the ~~bulk~~ electric system to withstand sudden disturbances such as electric short circuits, anticipated loss of system components or switching operations.

ADEQUACY. The ability of a ~~bulk~~ electric system to supply the aggregate electrical demand and energy requirements of the customers at all times, taking into account schedule and reasonably expected unscheduled outages of system components.

In common terms, this means that CONNECTIVITY must be always maintained and that there must always be adequate CAPACITY to meet the demand.

- *"Shown is the electricity industry's definition for RELIABILITY used by the National Electricity Reliability Corporation (NERC) and implemented for the Western Connection by the WECC, in its Reliability Criteria and the Arizona Corporation Commission's criteria used in its Biennial Transmission Assessments."*
  - **As Mr. Damitzel, Head of Planning and Technical Services of TEP clearly stated in our July 13th meeting:**
    - **North American Electric Reliability Cooperation (NERC) /Western Electricity Coordinating Council (WECC) criterion DO NOT APPLY to 69 kV lines**

- *"It is possible for utilities to receive millions in fines when not meeting NERC criteria."*
  - **SSVEC is in full compliance with all NERC requirements through either:**
    - **Direct SSVEC filings with NERC or**
    - **Through our power suppliers and transmission service providers**

**ENTIRE PAGE ADDED*

RELIABILITY DEFINITION FOR DISTRIBUTION LINES

(FROM THE ARIZONA ADMINISTRATIVE REGULATIONS R14-2-208C AND D)

C. CONTINUITY OF SERVICE.

Each utility **shall make reasonable efforts to supply a satisfactory and continuous level of service.** However, no utility shall be responsible for any damage or claim of damage attributable to any interruption or discontinuation of service resulting from:

1. Any cause against which the utility could not have reasonably foreseen or made provision for.
2. Intentional service interruptions to make repairs or perform routine maintenance.

D. SERVICE INTERRUPTIONS

1. Each utility **shall make reasonable efforts to reestablish service within the shortest possible time when service interruptions occur.**
2. Each utility shall make **reasonable provisions to meet emergencies** resulting from failure of service, and each utility shall issue instructions to its employees covering procedures to be followed in the event of emergency in order to prevent or mitigate interruption or impairment of service.
3. In the event of a national emergency or local disaster resulting in disruption of normal service, the utility may, in the public interest, interrupt service to other customers to provide necessary service to emergency service agencies on a temporary basis until normal service...can be restored.

Summary: A utility shall make **reasonable efforts** to supply satisfactory and continuous service and reestablish service in the shortest possible time when interruptions occur. **CONNECTIVITY and CAPACITY are designed to meet demand.**

- ❑ **SSVEC is fully aware of its commitment to providing safe, reliable power at the least cost consistent with good utility practice.**
- ❑ **SSVEC is aware of our obligations under Arizona Administrative Code section R2-12-208 regarding:**
  - **Continuity of service**
  - **Service Interruptions**
- ❑ **THIS IS PRECISELY WHY SSVEC WOULD LIKE TO MOVE AHEAD AS QUICKLY AS POSSIBLE TO BUILD A 69 KV LINE AND ASSOCIATED SUBSTATION – TO IMPROVE THE CONTINUITY OF SERVICE IN THE AREA AND REDUCE POWER INTERRUPTIONS!**

V-7 FEEDER - PRESENT CONNECTIVITY STATUS

The ENTIRE V-7 feeder will fail ~~with the loss of ONE element~~ whenever:

- A remote generator fails to meet demand, there is no local generation or backup, or
- There is a transmission line fails prior to the eastern ~~Mustang Corners~~ Substation, or
- There is a transformer fails (69:25 kV) at the eastern ~~Mustang Corners~~ Substation

ENTIRE V-7 FEEDER FAILS

PROPOSED 69 kV LINE MAKES NO IMPROVEMENTS

Whenever there is a single pole failure on the V-7 between a customer there will always be an outage failure for that customer and ALL other customers further down the line, and up the line to a breaker that should have opened when a failure is observed.

REST OF V-7 FEEDER FAILS

PROPOSED 69 kV LINE MAKES A LITTLE IMPROVEMENT

~~PRESENT V-7 FEEDER CAN NOT MEET N-1~~

- *"NERC/WECC have four contingency categories:"*
  - **Again, 3SEG seems to confuse NERC/WECC requirements for transmission lines (>100 kV) with sub-transmission systems (69 kV) and distribution systems (25 kV)**

2008 V-7 AND OTHER FEEDERS (CONNECTIVITY) OUTAGE DATA

Feeder Line	Hours Off	Number of Customers	Customer Hours OFF	Hours OFF/customer
V-7 Sonoita/Patagonia	179.98	3057	3839.91	0.06
R-3 Ramsey	64.16	1006	2988.66	0.06
K-2 Chri	239.75	1828	4299.75	0.13
O-5 Mescal	392.22	2639	4657.97	0.15
J-3 Kansas Settlement	197.05	1202	3409.05	0.16

1. Three feeder lines have higher outages than V-7, with twice the outage hours per customer.
2. Only 1 V-7 outage was due to "overload" impacting 1 customer.

Analysis prepared by Jeanne Horsmann and Gail Getzwiller, Sonoita.
Ref: SSVEC 2008 Feeder Outage Data (without November)

In 2008, there were 80 outages for total of 180 hours on the V-7 feeder. Note November data was not provided; however, 12 months of data are shown as January 2008 and 2009 were provided.

- *50 Outages (63%) impacted 1 meter (Causes: 18 unknown, 11 birds, 11 lightning, 3 animals, 3 wind, 3 other, 1 overload)*
- *7 Outages (9%) impacted 2 meters (Causes: 3 lightning, 2 birds, 2 unknown, 1 Other)*
- *5 Outages(6%) impacted 3 meters (Causes: 2 lighting, 1 birds, 1 tree, 1 unknown)*

ONLY 3 Outages (4%) impacted a significant number of people on the main line with causes as indicated:

- *1 impacted 1,700 meters– cause "Other"*
- *1 impacted 580 meters – cause wind*
- *1 impacted 450 meters – cause wind*

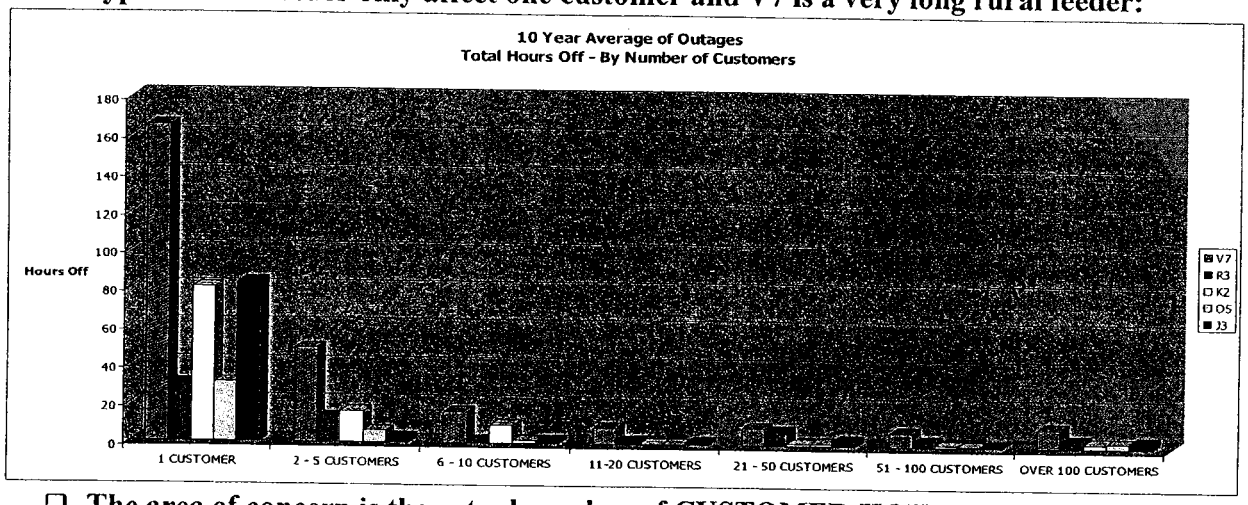
Others, 1 impacted 60 meters (cause "accident"), 1 impacted 45 meters (wind), 1 impacted 40 meters (lightning), 1 impacted 20 meters (birds), 1 impacted 12 meters (underground fault)
The causes for V-7 outages in 2008 were as follows:

Cause	*No. of Outages*	*Hours*
Overload	*1*	*2.0*
Tree	*1*	*2.0*
Underground Fault	*2*	*10.0*
Accidents	*3*	*10.5*
Animals	*3*	*25.0*
Other	*5*	*6.5*
Wind	*7*	*21.0*
Birds	*15*	*22.3*
Lightning	*21*	*39.9*
Unknown	*25*	*42.8*

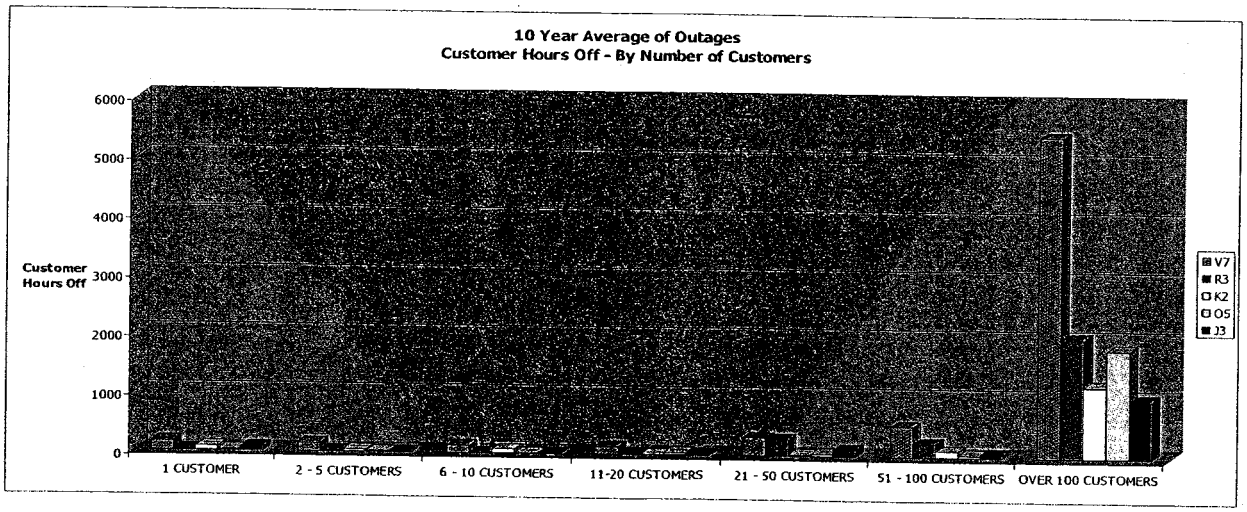
- The above data is correct for 11-months in 2008. HOWEVER, industry standards followed by SSVEC typically analyze outage data for 5 or 10-year periods in order to identify trends and statistics for problem feeders.
- The Outage Data for a 10-year period indicates the V7 Feeder is has the highest outage rate on the SSVEC System.

FEEDER	AVG Hours Out	AVG No. Customers Effected	AVG Consumer Hours Out
V7	270.7	2735.95	6883.131
R3	63.05	1134.81	2675.756
O5	43.86	2054.60	2004.006
K2	113.63	676.45	1568.918
J3	98.25	759.90	1332.726

- Outage types stated are consistent with system configuration. Majority of outages on typical rural feeder only affect one customer and V7 is a very long rural feeder:



- The area of concern is the actual number of CUSTOMER HOURS affected by the outages. Although there are over 160 HOURS OFF affecting one customer, that is diminutive compared to the number of CONSUMER HOURS affected by the HOURS OFF of >100 Customers:



WHAT IS THE V-7 GROWTH FORECASTS

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Patagonia CCD	**3,323**	**3,394**	**3,464**	**3,533**	**3,602**	**3,671**	**3,738**	**3,806**	**3,872**	**3,937**	**4,000**	**4,063**	**4,124**
Elgin CDP	441	458	475	492	509	525	542	558	574	590	605	621	636
Patagonia town	946	954	962	971	979	987	995	1,003	1,011	1,019	1,026	1,034	1,041
Sonoita CDP	1,084	1,117	1,151	1,184	1,217	1,249	1,281	1,314	1,345	1,376	1,406	1,436	1,465
Remainder of Patagonia CCD	853	864	876	887	898	909	920	931	942	952	963	973	983

Source: Arizona Department of Economic Security, Research Administration, Population Statistics Unit, 12/01/06.

Seago / DES Population Statistics approved June 6, 2007

Even without considering the present economic decline, the future growth is slow for the entire V-7 feeder area.

When looking at the official Arizona population projections for each community in the V-7 feeder area, the existing 3325 total population last year is not expected to reach 4,000 persons until 2018. This is about 70-80 persons per year. These numbers include the "Remainder of the Patagonia CCD" which includes San Rafael Valley most of which is in the UNS Electric service area; thus these estimates are higher than the actual population.

Using the ratio used by SSVEC of 2.7 persons per household, then less than 30 homes per year are the anticipated growth for the whole area. No major industries now exist or plan to move into an area, that already has a serious shortage of water resources for its existing population.

Based on electric demand, installation of large numbers of single-home PV systems, larger 20-100 MW commercial PV systems, and two or three 1-3 MW renewable energy "plant" systems (with backup for sunless periods of time), there is NO URGENCY for the proposed 69 kV project. The numbers just are not there.

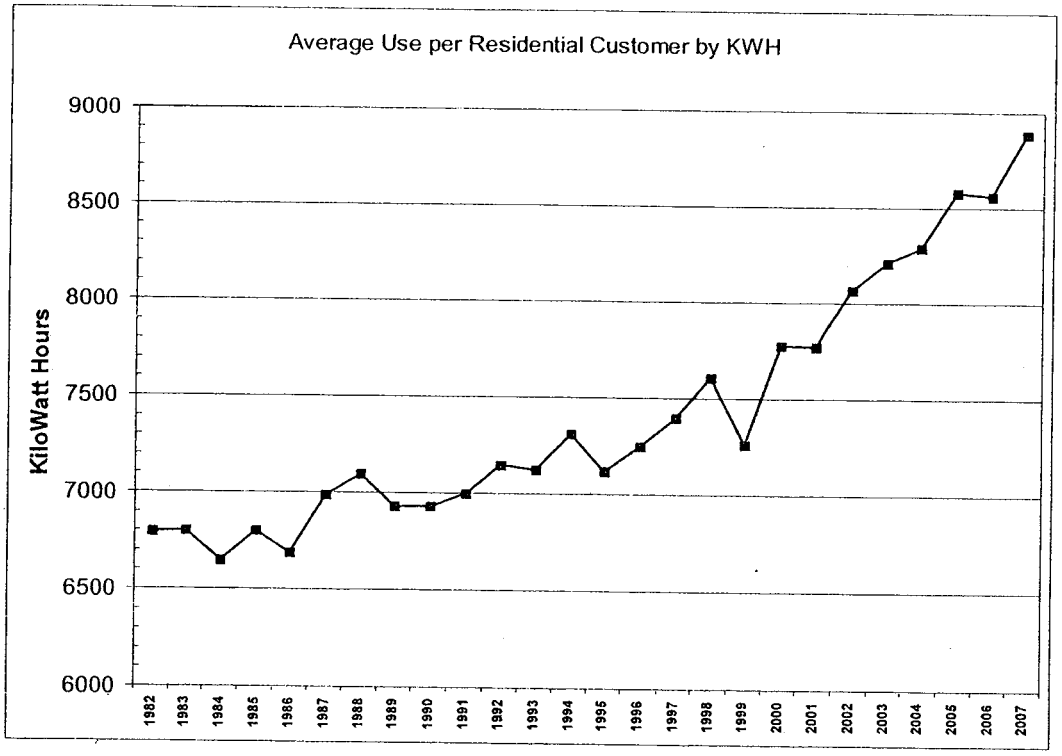
- ❑ **The growth forecast above shows an average annual percentage rate increase of approximately 1.82% for the entire Patagonia Census County Division, which does not seem significant; however this does equate to 801 people in the next twenty**

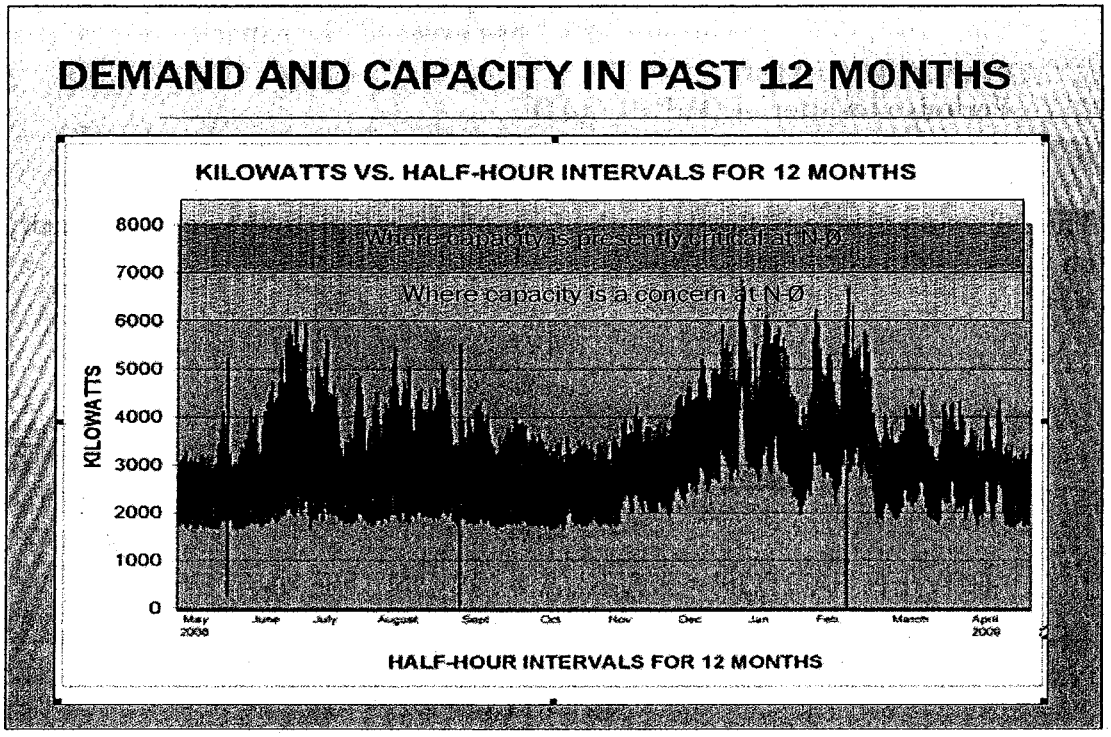
years. Using an average of 2.33 persons per household (City-Data) the following table indicates the number of homes the projected growth will likely incur:

TERM - YRS	PROJECTED POPULATION INCREASE	NUMBER OF HOMES
20	801	344
5	344	147
2	139	59

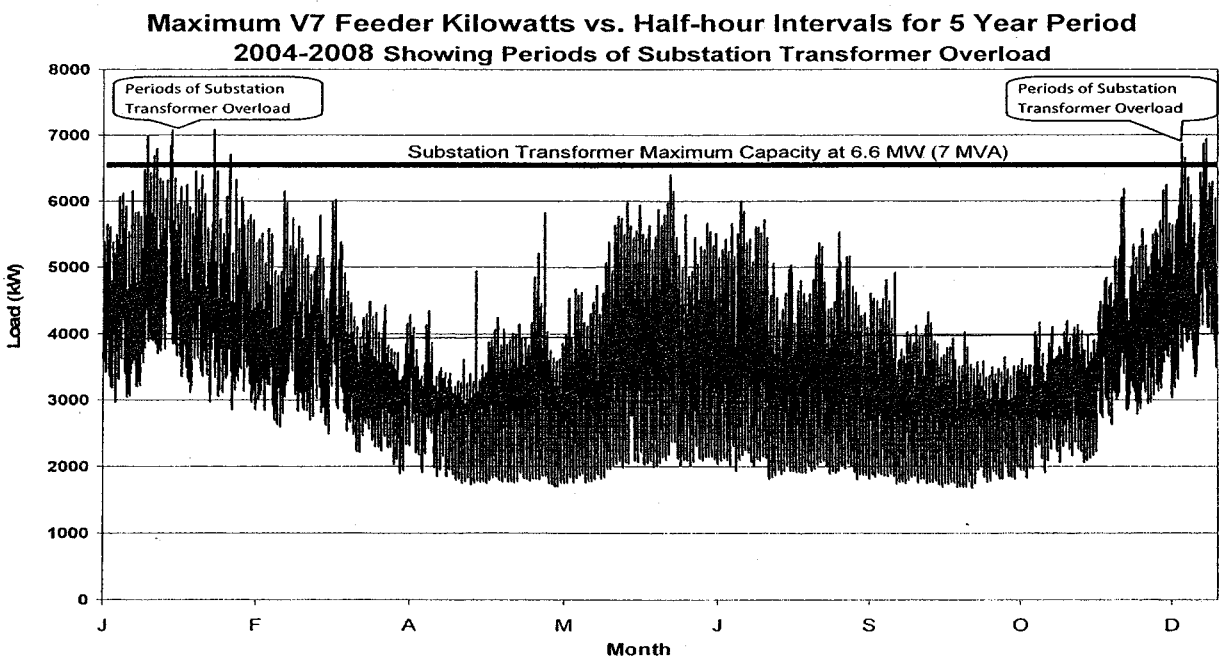
In SSVEC's analysis of the EXPRESS feeder option, the additional DEMAND LOAD upgrade would be 362kW, considering that each home uses 7KW per year, which will only allow for an additional 52 HOMES to be served. As the growth forecast above projects, this will be within the next TWO years!

Furthermore as the graph below indicates, the ACTUAL USE of electricity has also been on the rise. In 2007 the average USE per residential customer, considering a five-year period between 2003 and 2007, indicates an 8.26% increase, the same increase applied to the DEMAND LOAD would reduce the number of houses V7 is capable of serving to 47.



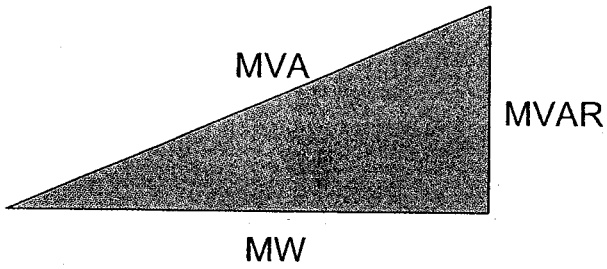


- *This shows the measured demand at the V-7 Feeder at Mustang Corner substation. It is obvious the existing situation needs a solution.*
- *The V-7 Feeder 25 kV distribution line is reported to have a 7 MW capacity which was not reached in the past 12-months.*



- **The substation transformer at V7 has exceeded its capacity several periods over the last 5-years**
- **Periods in winter of OVERLOAD**
- **Periods in summer near overload**

❑ **The following diagram illustrates the formula to calculate the actual capacity rating on the V7 Transformer:**



POWER FACTOR = KW/KVA = .98 ON THE V-7 FEEDER

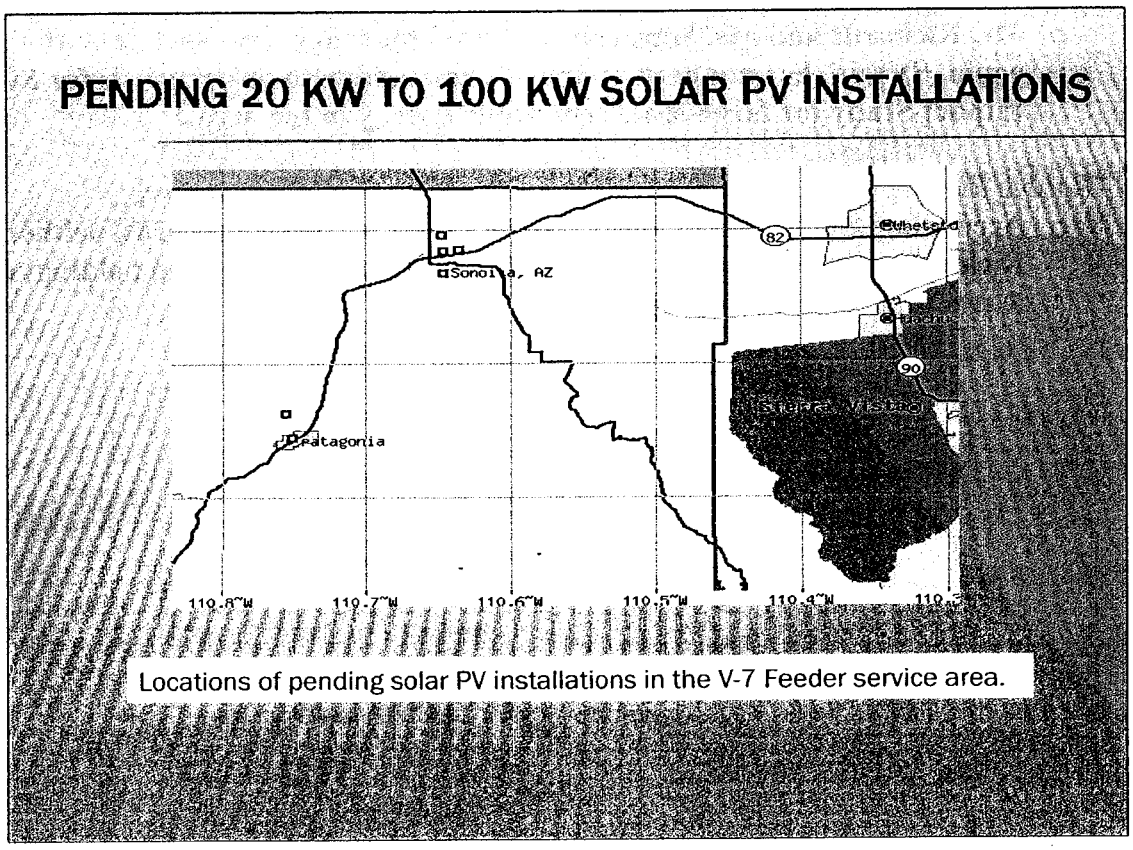
SUBSTATION TRANSFORMER CAPACITY = 7 MVA
@ .98 PF
= ONLY 6.6 MW

PEAK LOADS = 7.132 MW
@ .98 PF
= 7.5 MVA

SUBSTATION TRANSFORMER IS 7% OVERLOADED!!

❑ *Since the present 25 kV line to Mustang Corner is not being retained, there will be NO reliability connectivity improvements by replacing the 23 kV with one of a higher capacity, as a single radial line will remain to service these customers.*

- **SSVEC HAS NEVER REPRESENTED, NOR HAS ANY INTENTION, TO RETIRE THE EXISTING V-7 LINE FROM MUSTANG CORNER (HUACHUCA SUBSTATION) TO SONOITA!!**



- *"...community interest has greatly increased. Dozens appear to now be filling out applications for SSVEC solar rebates for home/business PV systems."*
  - **SSVEC applauds and supports those customers who have come forward and submitted applications to our SunWatts program.**
  - **Since the Renewable Energy Expo (which SSVEC helped sponsor) SSVEC has received only <u>four</u> applications which resulted in <u>4 kW</u> installed in the area since the Expo.**

- *"There are presently seven large, but local, PV arrays being planned between 20 kW and 100 kW, independent of the two or three 1-3 MW solar "plants" in the V-7 area. These are shown above."*
  - **SSVEC has no record of SunWatts applications for any such PV systems**
  - **SSVEC has not had a request to consider a single large PV project in the area**
  - **SSVEC welcomes developers to submit their intentions for consideration**

- *"As of this date, the Renewable Energy Committee feels that some 2MW of solar systems applications plus another 2+MW are in the works, all since the EXPO".*

- **Mr. Richards and Ms. Samsel have stated that they have such intentions but, again, SSVEC has not been formally presented with any requests for System Impact Study for large-scale renewable energy in the area.**

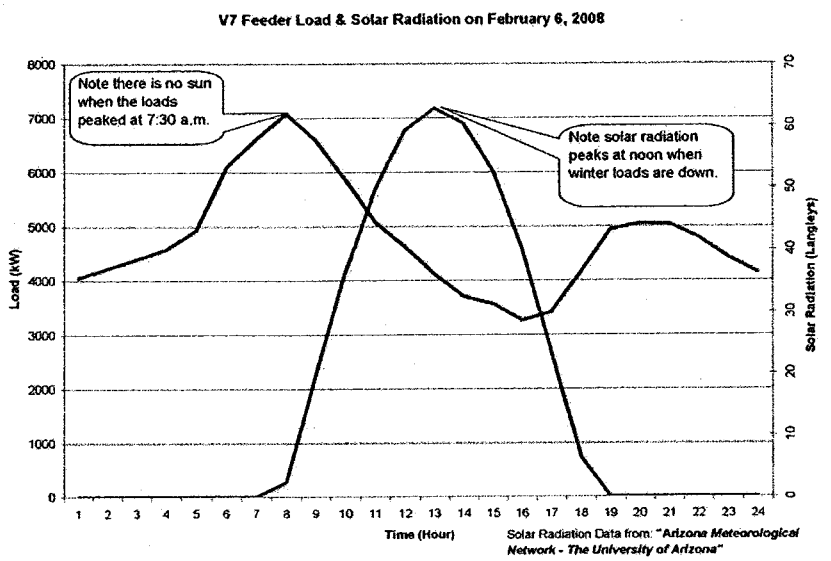
- ❑ *"Robbie Richards can update us on solar progress in the V-7 feeder area."*
  - **According to a search of Santa Cruz County Assessor's records, neither Mr. Richards nor Copernicus Energy, his company, have any and holdings or leases registered in the suggested areas.**

BENEFITS OF "DOWNTOWN" SUBSTATION

- Hub for four (N, S, W, E) 25 kV distribution loops to improve reliability and for sectionizing
- Same as for either 23 kV or 69 kV sources
- 69 kV substation costs are $3 million
- 23 kV is less costly, about $1.5-$2.0 million
- Walls can be a lower, smaller transformer
- Smaller area
- Shorter, if any, feeder line poles
- New underground distribution lines to comply with the 2005 Santa Cruz County Comprehensive Plan

- *"The communities understand the benefit of having a substation with distribution feeders that can improve reliability. These need to loop or tie so that two connectivity paths exist."*
  - **SSVEC abandoned plans to construct the substation at the Buchannan site in Sonoita Hills and purchased the new Sonoita Substation property ($335K) in a more commercial area.**
  - **The new Sonoita Substation has received a Conditional Use Permit from the Santa Cruz County Board of Adjustment.**
  - **Site plan and substation design are well underway.**
  - **The existing V7 feeder will be split in two with the Eastern portion fed from the existing Huachuca West substation and the Western portion, (roughly Elgin Rd turn-off to Sonoita) will be fed from the new Sonoita Substation.**
    - **This will provide a "feeder tie" between the new Sonoita Substation and the existing Huachuca West substation.**
    - **The capacity of this feeder tie will be limited.**

- *"The SSVEC substation is being designed for a 14 MW capacity with five connections, four for feeder loops and one for a local renewable energy connection."*
  - **No feeder 'loops' being considered. Otherwise correct**
- *"Four distribution loops have been discussed, going W (Sonoita), East (Elgin), North and South (Sonoita)."*
  - **No distribution 'loops' have been discussed. These are FEEDERS out of the substation, which may or may not have feeder 'ties'.**
- *"At least two if not three of these could have a RE plant connected to their 25 kV feeder line. A connection to a 1 to 3 MW RE generator will not overload these distribution lines and will add reliability due to adding reactive power and reducing costs when far from remote generations."*
  - **Placing large generators of any sort on a long radial line can cause technical problems such as:**
    - **Reverse current flow during periods of high generation and low power consumption. This reverse power flow can cause:**
      - **Line relays to trip**
      - **Voltage regulators to operate improperly**
      - **Line sectionalizers and automatic circuit reclosers to trip**
  - **The ideal injection point for these generators is at the new Sonoita Substation because:**
    - **Renewable power can be injected directly onto the bus, thus:**
      - **Reverse power flow issues mentioned above are eliminated**
      - **Allows renewable energy to go serve loads on any of the substation feeders – thus reducing load on the substation transformer**
      - **The renewable generation can be controlled via substation SCADA control and not require additional communication paths for automatic operation of the renewable energy (RE) system and its injection breaker**
    - **Line losses are minimized**
  - **Solar energy systems do not contribute energy during SSVEC's peak winter load period and would require energy storage.**



- *"We understand that SSVEC is planning a 2MW Renewable Energy Plant at the Sonoita substation but have nothing to confirm this possibility".*
  - **SSVEC submitted a proposal to the USDA/RUS for a large renewable energy facility at the Sonoita Substation site.**
- *"The new voltage controllers and related substation equipment can use this locally generated power for the other three feeders. This, in fact, becomes a micro-grid, and at some future date, could be used as a SSVEC test bed for the newest "smart grid" implementations, which also should make this feeder more efficient."*
  - **On August 6th, 2009 SSVEC submitted a proposal to the US Department of Energy (DOE) for Smart Grid enhancements including:**
    - **Installation of fiber optic cable to the new Sonoita Substation**
    - **Sonoita Substation automation that will facilitate automatic operation of substation apparatuses**
    - **Automation of all feeder breakers including the dedicated Renewable Energy feeder**
    - **Metering to support local generation of Renewable Energy**
    - **SCADA equipment to allow full remote monitoring and control**

- *"A discussion concerning making V-7 a "smart grid" would provide many additional capabilities but feel these 21st century features can be added if including "smart grid" capabilities as a later upgrade in its design."*
  - **Already completed by SSVEC staff**

HOW TO REASONABLY MEET CAPACITY FOR CONTINUITY OF SERVICE

~~SSVEC MUST MEET CAPACTIY FOR N-1 (SINGLE ELEMENT OUTAGE)?~~

1. ~~MUST~~ CAPACITY TO MEET PEAK DEMANDS UP TO AND ABOVE 7 MW
2. ~~MUST~~ CAPACITY TO BE CONTINUOUSLY AVAILABLE (24/7)
3. ~~MUST~~ CAPACITY TO BE FOR ALL CUSTOMERS DURING AN OUTAGE

Does the proposed 69 kV meet capacity?

1. Yes, up to 14 MW, the Sonoita substation single transformer limit
2. No, if the radial 69 kV line is out ~~not the outage element~~.
3. No. If the 69 kV fails, all customers go dark, no backup lines to substation

69 kV APPROACH DOES NOT MEET ~~N-1~~ CONTINUITY OF SERVICE

Can the existing 25kV line plus ~~two~~ Renewable Energy Sources with 46kVs meet 7MW capacity demand?

1. Yes. During a ~~69~~ 25 kV outage, TEP can provide 18 MW+ several MW from RE
2. Yes. With "peaker" local generation for above 7 MW, 2 MW initially proposed
3. Yes, ~~three~~ backup interconnections are proposed ~~2~~ with TEP, ~~1~~ and with UNSE)

THIS MEETS ~~N-1~~ CONTINUITY OF SERVICE

- *"There needs to be two ways to deliver power to the V-7 Feeder Customers. At present, the 25 kV line is the only one.*
- *Under the proposed 69 kV solution, the existing 23 kV line will be a "reliability loop" from the new Sonoita substation, without any connection to Mustang Corner.*
  - **How would the existing 25kV line be a "reliability loop" without a connection to MUSTANG CORNER?**
- *This removes this tie to a SECOND power from Mustang Corner, thus leaving ONE radial 69 kV line connecting the V-7 customers. This still inhibits meeting continuity of service. If the 69 kV line goes down, the situation is the same as when the existing 25 kV line goes down. There is NO change in reliability when this happens!!"*
  - **To clarify:**
    - **SSVEC HAS NEVER REPRESENTED, NOR HAS ANY INTENTION, TO RETIRE THE EXISTING V-7 LINE FROM MUSTANG CORNER (HUACHUCA SUBSTATION) TO SONOITA!!**
    - **This line will serve as a feeder line for customers in the Mustang Heights, Rain Valley, Elgin, and Sonoita East areas**
    - **There will be an open point near the Elgin turn-off on HWY 82 that will allow some load to be served off the existing Huachuca Substation and some load off the new Sonoita Substation**

- **This feeder tie will provide some back-up capability from the Huachuca West substation in the event of a failure at either the new Sonoita Substation or the 69 kV line**

- **THERE <u>WILL INDEED BE A SIGNIFICANT IMPROVEMENT</u> IN QUALITY AND RELIABILITY OF SERVICE ONCE THE 69 KV LINE AND NEW SONOITA SUBSTATION ARE BUILT**

- *"Yes. With "peaker" local generation for above 7 MW, 2 MW initially proposed"*
  - **<u>Since no viable energy storage options have been presented, this must be a FOSSIL FUELED GENERATOR AND, IF PLACED IN SONOITA, IT MUST BE DIESEL AS THERE IS NO NATURAL GAS AVAILABLE IN THE AREA.</u>**
  - **In June 2008, SSVEC commissioned a study to review the possibility of a 2MW fossil fuel generator in the Sonoita area:**
    - **Results showed:**
      - **Cost of $1M plus $700 per hour for Operations and Maintenance**
      - **80 db noise emission (exceeds SCC allowable limit)**
      - **Generator falls under EPA Tier 2 classification**
      - **A 20,000 Gallon fuel storage tank must be installed at generator site: 10'w x 33'l x 12'h**

- *"The proposed two backup interconnections with the TEP 46 kV ..."*
  - **See previous discussion that there is only one 3-phase interconnection possibility with TEP**
    - **The interconnection site is in the Las Cienegas National Conservation Area**
    - **Estimated cost of this inter-tie is $3.27M plus the upgrade extension cost**
    - **2-county IRS Bonding rule**
    - **Limited capacity on the 46 kV line**
    - **Upgrading the 46kV line from the proposed inter-tie point to the source at South Loop Substation is excessively expensive and not in SSVEC's best interest**

- *"..and one with the UNS Electric system provides for two NEW sources for the V-7 Feeder customers."*
  - **Both Unisource (UNS) and SSVEC lines in this area have very limited capacity as they are both long radial lines and the interconnection would be at the very end of each.**
  - **SSVEC completed a preliminary study on the UNS tie option and found that:**
    - **Operating voltage differs between UNS (13.8kV) and SSVEC (25kV)**
    - **The tie point will require a set of step down transformers**
    - **Voltage regulators will be required**

- **Three SCADA controlled Automatic Circuit Reclosers (ACR's) will also be required at the tie point, and at each end of the two load islands.**
  - ❑ **One located at the inter-connect point**
  - ❑ **One located at the open point on the UNS line**
  - ❑ **One located at the open point on the SSVEC line**

- **In addition, the UNS and SSVEC lines are approximately one mile apart, which will require a line upgrade for the UNS 2-phase, and a 3-phase line extension to a common inter-tie point at the boundary of the two service territories.**

SSVEC / UNS Distribution Connection	
Item	**SSVEC Estimated Cost**
New 3-Phase line (1 mile at Flux Canyon)	**$ 100,000**
Step-Down Transformers	**70,000**
Set of 3-Voltage Regulators	**60,000**
3 –Automatic Circuit Reclosures (SCADA Controlled)	**150,000**
1 mile ROW for new 3-Phase line on Private Property – Transformer Site	**40,000**
SSVEC Cost (does NOT include costs for UNS facility upgrades)	**$ 420,000**

❑ *"This will always have adequate power, especially, from the TEP 46 kV source."*
- **Not accurate**
- **TEP has stated they have limited capacity on the 46kV line, and can only be used for EMERGENCY BACK-UP**
- **UNS has limited capacity on their distribution line in Flux Canyon, and is not eligible for LOAD SERVING under SSVEC's CCN.**

❑ *" Continuity of Service criteria will be achievable wit this approach, definitely better than that with a single radial 69 kV line."*
- **False**
- **SSVEC's proposal for a new 69 kV line and associated substation, along with our plan to keep the 25kV distribution line between Huachuca West substation and Sonoita, will provide the best quality and service reliability that SSVEC can offer to this area that has suffered so long with less-than-standard power delivery.**

❑ *"DOES SSVEC want to reasonably provide Continuity of Service?"*
- **Of course SSVEC wants to provide the best electric service possible to the area.**
- **SSVEC studies clearly show that the best way to accomplish this is to build a new a new 69 kV line and associated new substation in Sonoita**

HOW TO REASONABLY MEET CONNECTIVITY FOR CONTINUITY OF SERVICE

~~HOW TO MEET CONDUCTIVITY FOR N-1 RELIABILITY CRITERIA~~

1. ~~MUST~~ SHOULD PROVIDE A ~~SECOND PATH TO A~~ DIFFERENT GENERATION SOURCE,
2. ~~MUST~~ SHOULD HAVE A SECOND INDEPENDENT TRANSMISSION PATH, and
3. ~~MUST~~ SHOULD HAVE A SECOND TRANSFORMER

Does ~~the proposed~~ 69 kV ~~provide these to meet N-1 conductivity~~ reasonably provide connectivity for continuity of service?

1. No. ONE LINE from Huachuca Substation to generation sources.
2. No. Only ONE transmission path for V-7 Feeder customers
3. No. One 69 kV transformer at Sonoita and Huachuca Substations.

Can ~~two~~ TEP 46 : 25 kV taps ~~provide these to meet N-1 conductivity~~ reasonably provide near continuous connectivity?

1. Yes.
2. Yes.
3. Yes.

NOTE: UNS ELECTRIC backup is a bonus, without a 2-county rule, with potential reliability improvements for Patagonia and San Rafael Valley.

- *"There are several ways to reasonably meet connectivity when there is a single element contingency outage; however, having access to a second generation (via a transmission line) source is necessary for the V-7 Feeder area to meet Connectivity necessary for Continuity of Service."*
  - **There WILL BE back-up capability to the Sonoita area via the existing V7 feeder tie from Huachuca West substation (though it may not be able to serve the entire load if the outage were to occur during a system peak).**
- *"The proposed 69 kV solution does not meet any of these for Continuity of Service."*
  - **In the event of an outage on the 69 kV line or the Sonoita Substation, the V7 feeder tie will be utilized to provide back-up capability until the outage is corrected**
- *"An interconnection with the TEP 46 kV can meet continuity of service. One 46 kV connection provides connectivity in case the 23 kV outage is between the 46 kV connection and the Sonoita substation, except when between the 46 kV connection and the substation."*
  - **TEP has clearly stated that any service off the 46 kV line is subject to interruption as Fort Huachuca has priority on the limited capacity of the line**

HOW CAN WE KNOW WHAT'S BEST?

Options to be evaluated

1. 69 kV line with 69 kV Substation (as proposed) (connectivity ~~continuity,~~ capacity, cost)
2. One ~~Two of several~~ 46 kV taps (continuity, emergency capacity, cost)
3. One to three 1 to 3 MW RE system projects, with alternative backup (sunless hours) (continuity, capacity, cost)
4. Compare best mix of Options #2 plus #3 versus Option #1

A Feasibility analysis can provide Best Answers for all

1. To objectively evaluate all options including renewable energy and
2. To make quantitative, best value decision recommendations to this board
3. Limit to 60 days, to not delay 69 kV plan, if appropriate
4. To use an independent evaluator (organization) to consider all sides
5. To use team collaboration and open study to community participants
6. To use web-based development and collaboration processes
7. To deliver in four evolving reports covering (1) technical, (2) cost schedules information, (3) Public Relations, and (4) Short ~20-page Feasibility Study with an attached draft RFP for the recommended Option, if not the 69 kV line
8. Study Cost est. $70k or less, maybe <$50k

- *FEASIBILITY STUDY*
  - **SSVEC has prepared a separate rebuttal to the proposed RFP for a Feasibility Study**

WHICH OPTION IS LESS EXPENSIVE?

69 kV solution has an estimated cost is $ 13.5 M including $3 M substation

1. Does not provide reasonable continuity of service ~~meet NERC N-1 Reliability Criteria~~
2. Does not improve reliability

Proposed Renewable Energy approach

1. Saves SSVEC capital funds with private investment
2. Can qualify for various Stimulus funding to save SSVEC capital $$
3. Maybe less expensive to meet V-7 Feeder growth needs
4. May have significantly lower life-cycle ratepayer costs

Additional Benefits of Renewable Energy

1. Benefits of distributed generation (voltage stability, less line loss, etc)
2. Helps meet future ACC Renewable Energy Standard goals for SSVEC
3. Provides reasonable continuity of service with ~~Meets NERC N-1 Reliability Criteria with associated~~ improved reliability

Estimated costs for components for an alternative to the 69 kV line.

Item	*3SEG Estimated Cost*	**SSVEC Estimated Cost**
Substation "downtown" location	*$2,250,000*	**$2,700,000**
Loop Equipment & Lines	*$450,000*	**N/A**
2.2 MW Natural Generators	*$750,000*	**1,000,000 + $750 hr O/M**
46kV Backup Interconnection		**$3,270,000**
▪ *46kV/25kV Transformer (TEP)*	*$200,000*	
▪ *Three ring Breaker Switch (TEP Substation)*	*$800,000 to $1,200,000*	
UNSE Interconnection:		**$420,000**
▪ *SSVEC/UNSE Transformer & Equipment*	*$100,000*	
▪ *1 Mile of Distribution Line*	*$100,000*	
Total	*$4,650,000 to $5,150,000*	**$7,390,000**
DIFFERENCE	**$2,740,000 - 2,240,000**	

SSVEC / TEP 46kV Back-Up Interconnection	
Item	**SSVEC Estimated Cost**
Interconnect Location Substation Site	**$ 170,000**
46:25kV Transformers	**230,000**
Set of 3-Voltage Regulators	**120,000**
2 – Distribution Automatic Circuit Reclosures (SCADA Controlled)	**100,000**
Substation Structure	**350,000**
Control House	**300,000**
Construction	**500,000**
Switching Station: 3 Breaker Ring Bus	**1,500,000**
SSVEC Cost (does NOT include costs for TEP line upgrades)	**$3,270,000**

SSVEC / UNS Distribution Connection	
Item	**SSVEC Estimated Cost**
New 3-Phase line (1 mile at Flux Canyon)	**$ 100,000**
Step-Down Transformers	**70,000**
Set of 3-Voltage Regulators	**60,000**
3 –Automatic Circuit Reclosures (SCADA Controlled)	**150,000**
1 mile ROW for new 3-Phase line on Private Property – Transformer Site	**40,000**
SSVEC Cost (does NOT include costs for UNS facility upgrades)	**$ 420,000**

POSSIBLE COSTS FOR RELIABILITY OPTIONS

Substation

One 25 kV relay substation in Sonoita, "downtown" location: $2,250,000

~~Sonoita Substation Cost = $ 2,550K (1.5M + 500 + 50 breakers = 2,550)~~

Reliability Loop Equipment and lines $450,000

~~Plus some line for Loops = $450K~~

Peaker Plant:

Two 1.1 MW @ 375,000 Natural Generators (2.2 MW): $750,000

~~Two 1.1 MW gensets @ $350k each = $ 700K (natural gas generators)~~

~~(2.2MW for sunless periods, when over 7MW capacity on 23 kV)~~

46 kV backup Interconnection:

46:25 kV transformer, substation (TEP owns): $300,000

~~Two: 46-23kV transformers, @ $300k = $ 600K (Sonoita TEP-SSVEC)~~

One three ring breaker switch for 46 kV backup TEP $800,000 to 1.2 M

UNSE Interconnnection:

SSVEC: UNSE Transformer and associated equipment $100,000

One mile of distribution lines (Patagonia—UNSE) $100,000

~~One: 23.13.2 kV transformer @100k = $ 100K (for San Rafael Valley-Patagonia)~~

~~1 mile of 23 kV line to connect above lines = $ 100K~~

Total $4,700,000 to $5,100,000

~~$4,500,000~~ Plus solar PV (minus stimulus = ??)

Item	*3SEG Estimated Cost*	**SSVEC Estimated Cost**
Substation "downtown" location	*$2,250,000*	**$2,700,000**
Loop Equipment & Lines	*$450,000*	**N/A**
2.2 MW Natural Generators	*$750,000*	**1,000,000 + $750 hr O/M**
46kV Backup Interconnection		**$3,270,000**
▪ *46kV/25kV Transformer (TEP)*	*$200,000*	
▪ *Three ring Breaker Switch (TEP Substation)*	*$800,000 to $1,200,000*	
UNSE Interconnection:		**$420,000**
▪ *SSVEC/UNSE Transformer & Equipment*	*$100,000*	
▪ *1 Mile of Distribution Line*	*$100,000*	
Total	*$4,650,000 to $5,150,000*	**$7,390,000**
DIFFERENCE	**$2,740,000 - 2,240,000**	

SSVEC / TEP 46kV Back-Up Interconnection	
Item	**SSVEC Estimated Cost**
Interconnect Location Substation Site	**$ 170,000**

46:25kV Transformers	230,000
Set of 3-Voltage Regulators	120,000
2 – Distribution Automatic Circuit Reclosures (SCADA Controlled)	100,000
Substation Structure	350,000
Control House	300,000
Construction	500,000
Switching Station: 3 Breaker Ring Bus	1,500,000
SSVEC Cost (does NOT include costs for TEP line upgrades)	$3,270,000

SSVEC / UNS Distribution Connection	
Item	SSVEC Estimated Cost
New 3-Phase line (1 mile at Flux Canyon)	$ 100,000
Step-Down Transformers	70,000
Set of 3-Voltage Regulators	60,000
3 –Automatic Circuit Reclosures (SCADA Controlled)	150,000
1 mile ROW for new 3-Phase line on Private Property – Transformer Site	40,000
SSVEC Cost (does NOT include costs for UNS facility upgrades)	$ 420,000

COSTS FOR SYSTEM RELIABILITY IS NOT SO BAD

Cost Summary to Reasonably Meet ~~Continuity~~ Connectivity & Capacity ~~N-1 Requirements~~ Needs

- TWO ~~Natural Gas Gensets~~ Generation (gas, biogas, other)(2.2 MW on-call and dispatchable)
- ~~THREE~~ Emergency Backups (TEP) with 3-ring breaker
- ONE 25 23kV Substation with Reliability Loops
- Plus On-call Tie to UNSE ~~Additional Line~~

$4,700,000 ~~$4,500,000~~

(May 27th = 3, 500, 000)

- *Summary Slide:*
- *NOTE: The generators are dispatchable and will be designed for deliver electricity as FIRM Delivery, peak and non-peak)*
- *To be used when demand gets close to 7 MW, such as spinning reserves at 6.8 MW demand.*

Item	*3SEG Estimated Cost*	**SSVEC Estimated Cost**
Substation "downtown" location	*$2,250,000*	**$2,700,000**
Loop Equipment & Lines	*$450,000*	**N/A**
2.2 MW Natural Generators	*$750,000*	**1,000,000 + $750 hr O/M**
46kV Backup Interconnection		**$3,270,000**
▪ *46kV/25kV Transformer (TEP)*	*$200,000*	
▪ *Three ring Breaker Switch (TEP Substation)*	*$800,000 to $1,200,000*	
UNSE Interconnection:		**$420,000**
▪ *SSVEC/UNSE Transformer & Equipment*	*$100,000*	
▪ *1 Mile of Distribution Line*	*$100,000*	
Total	*$4,650,000 to $5,150,000*	**$7,390,000**

~~CONTINUITY~~ CONNECTIVITY AND CAPACITY (C&C) ~~WITH~~ PLUS RENEWABLE ENERGY

C&C $4,700,000 ~~$4,500,000~~ + 1MW Solar $5,500,000* = $10, 200,000
~~$10,000,000~~ total cost

C&C $4,700,000 ~~4,500,000~~ + 2x1 MW Wind $2,000,000* = $6,700,000
~~$6,500,000~~ total cost

C&C $4,700,000 ~~$4,500,000~~ + 2x1 MW BioMass $200,000** = $4,900,000
~~$4,700,000~~ total cost

Total savings for SSVEC after adding a Renewable Energy Component

Savings could be from $3,300,000 TO $8,600,000 ~~$3,500,000 to $8,800,000~~

(*)(**) - estimates

This does NOT reflect stimulus funds or grants to reduce or eliminate the cost of the Renewable Energy Systems

- *Conclusion: After obtaining information from another presenter, Environmental Technology Assistance Co. LLC, (ETAC) who is investigating putting in renewable generating station in the Willcox Area. And information from the SSVEC Board who reported on a 1MW BioMass Generator that was operating in their service area that only cost $98,000** to build.*
- *Have now added the costs of installing Renewable generating stations to the CONNECTIVITY and CAPACITY (C&C) costs listed above.*
- *Several Possibilities all saving the SSVEC millions of dollars (from $4.5 mil to $9,804,000):*
- *C&C $4,700,000 + 1MW Solar $5,500,000* = $10,200,000 (1 MW RE)*
- *C&C $4,700,000 + 2 x 1 MW Wind $2,000,000* = $6,700,000 (2 MW RE)*
- *C&C $4,700,000 + 2 x 1 MW BioMass $200,000** = $4,900,000 (2 MW RE)*
  - *ETAC data*
- *** Data presented by Jack Blair at the SSVEC 27 May BOD meeting*
- *NO Stimulus funds are included*

UPGRADE 25 ~~23~~ KV FEEDER TO SONOITA (BARE BONES)

~~UPGRADE EXISTING V7 FEEDER LINE TO ELGIN/SONOITA~~

Option: Re-conductor existing line with 336 conductors
Purpose: To increase capacity of existing line from 7 MW to 20 MW

1) Upgrade can take place when SSVEC upgrades the existing poles:
   Cost : 5280 ft x 19miles = 100,320 ft x $25 / foot = $2,508,000
~~1) Re-conductor existing line with 336 conductors.~~
   ~~To increase capacity of existing line from 7 MW to 20 MW~~
   Saving compared to 69 kV (13.52.508)= $9,992,000

Add below to increase reliability
2) One ~~Two~~ 46:25kV transformers for TEP Emergency Backup = $600,000
3) One 3-way ring breaker switch for automated backup= $800,000-$1.2 M)
~~3) One 23kv Transformer in Patagonia = $100,000~~
4) Sonoita Substation plus 4 Reliability Loops = $2,700,000
~~4) One mile of 23kV line for Patagonia Connection = $100,000~~
5) SSVEC-UNSE tie including lines and equipment = $200,000

Totals (#1-#5) $6,800,000 to $7,200,000 ~~$3,308,000~~ (#1 includes labor, hot job) ~~(#2 includes labor)~~

- *Another plan the "Feasibility Study" could evaluate, would be bringing a 2nd line into Sonoita on the existing line to double the capacity on that line and establish a loop using the existing line.*
- *This gives us*
  1. *a 7 MW line from the Sonoita substation to serve existing customers between Sonoita and Mustang Corners and*
  2. *A 14 MW (new line) from Mustang Corners to Sonoita as the main V-7 feeder to the new substation.*
  3. *Adding in the TEP 46 kV interconnections, UNSE interconnection and line, then*
  4. *This plan would reduce the need for a large transformer substation in Sonoita for the 69kV line to be a 23 kV hub for reliability loops as SSVEC may want a smaller substation to introduce loops into this plan.*
- *This gives backups for lines, poles and transformers but not remote generation to meet the ACC Continuity of Service reliability criteria. Adding two 1.1 MW would meet the criteria for an additional $700,000+ (2.2 MW) with a 9.2 MW capacity.*
- *Only pole conductor and replacements as a routine upgrade process should meet the NEPA Exclusion Category to replace and upgrade distribution lines on BLM lands, if required at all.*

- *If there are problems with the NCA, we feel local support, including by former Congressman Kolbe should assist in keeping this in the Exclusion Category. We can try to arrange, if that helps.*

Item	*3SEG Estimated Cost*	**SSVEC Estimated Cost**
Reconductor V7 477 ACSR (336 not used by SSVEC)	*$2,508,000*	**$ 13,361,000**

SSVEC / V7 477ACSR Express Feeder (Double Circuit)	
Item	**SSVEC Estimated Cost**
Direct Material	**$ 1,552,300**
Substation: Huachuca Upgrade Transformer add 600A Feeder Bay	**1,000,000**
Substation: Sonoita at 25kV	**2,700,000**
ROW Acquisition	**2,562,000**
Construction	**5,178,700**
Retirement	**368,000**
SSVEC Cost	**$ 13,361,000**
Difference between 3SEG & SSVEC	**$ 10,852,000**

Upgrade of 25kV Feeder to Sonoita		
Item	*3SEG Estimated Cost*	**SSVEC Estimated Cost**
Reconductor V7 477 ACSR (336 not used by SSVEC)	*$ 2,508,000*	**$ 13,361,000**
Sonoita 25kV Substation	*2,250,000*	**2,700,000**
TEP Emergency Backup	*1,400,000*	**3,270,000**
UNSE Interconnection	*200,000*	**420,000**
2.2MW Generators	*700,000*	**1,000,000+**
Total Cost	*$6,358,000*	**$ 20,751,000**

OVERVIEW OF RFP FOR FEASIBILITY ANALYSIS

We prepared a draft RFP for SSVEC's consideration as a way to make an objective decision.

1)Collaborative: Project working papers are shared with SSVEC and Cooperators

2)Interactive: Online reports allow for SSVEC and Cooperator input

3)Four reports: Addressing multiple levels of concern; (a) technical, (b) cost and schedule, (c) Public Relations, and (d) Recommended Action (Summary Study)

4) Frequently base-lined: Data collection for all prospective alternatives

5) Action items: Clear action items for construction, funding, and implementation

TEAMWORK GETS BEST RESULTS!!

SSVEC's rebuttal to the RFP for Feasibility Study is found under separate cover

RECOMMENDATIONS

Today, we recommend that SSVEC Staff

1. Seriously consider all these Options
2. Work with our Committee and collaborate details necessary to better understand the renewable option(s) and how to foresee and overcome local issues.
3. Provide an RFP for a FEASIBILITY STUDY by a competent third party for the July SSVEC BOD meeting for review and approval decision. Include at least six independent, qualified Arizona organizations to receive the RFP with a 14-day turnaround, 5-day evaluation period for award NLT 20 August with completion NLT 20 October.
4. Vigorously pursue the USDA and AZ Energy Office Stimulus programs, including funding for a Feasibility Study. We can help!
5. Understand the urgency to complete and present the FEASIBILITY STUDY to the BOD prior to starting any construction of the proposed 69 kV line.
6. Provide periodic Feasibility Study Status Reports to BOD.

SSVEC's rebuttal to the RFP for Feasibility Study is found under separate cover

UNITED STATES POSTAL SERVICE

Home

Express Mail Service Commitments FAQs

Express Mail Service Commitments

Search Results

Search Criteria

Origin ZIP Code™: **85644 (WILLCOX, AZ)**

Destination ZIP Code: **85004 (PHOENIX, AZ)**
Express Mail® Hold for Pickup is available for this destination.

Shipping Date: **September 22, 2009**

Service Commitment Information

All results are based on drop-off time.

Express Mail®
Express Mail® Hold for Pickup

Service Commitment	Drop-off By	Facility Type	Address
Next Day by 12:00 PM Express Mail®	4:45 PM	POST OFFICE	200 S CURTIS AVE WILLCOX, AZ 85643
Next Day by 12:00 PM Express Mail®	12:00 PM	POST OFFICE	FORT GRANT RD FORT GRANT, AZ 85644
Next Day by 12:00 PM Express Mail® Hold for Pickup	4:45 PM	POST OFFICE	200 S CURTIS AVE WILLCOX, AZ 85643
Next Day by 12:00 PM Express Mail® Hold for Pickup	12:00 PM	POST OFFICE	FORT GRANT RD FORT GRANT, AZ 85644

Page 1 Total (4 results)

< New Search Expand Search Radius >

What You Should Know

- Express Mail® service commitments are based on drop-off times.
- Express Mail may be paid by stamps, Postage Meter, PC Postage®, or Express Mail Corporate Account.
- Print Express Mail labels online with Click-N-Ship®.
- Learn more about Express Mail.
- Calculate postage with Domestic Rate Calculator.

Copyright© 2009 USPS. All Rights Reserved. No FEAR Act EEO Data FOIA

SSVEC

Constructive Point Paper

REVIEW

FROM [redacted]

THIS WAS HANDED OUT THE PATAGONIA TOWN COUNCIL MEETING 12/10/08

THANKS JOE

SONOITA-ELGIN-PATAGONIA RELIABILITY ALTERNATIVES

To resolve Important
Electrical Reliability Issues
While meeting the
Public Interest of
SSVEC and its Cooperative Ratepayers

A Constructive Point Paper

By
Local concerned citizens, ratepayers,
and customers

5 December 2008

Table of Contents

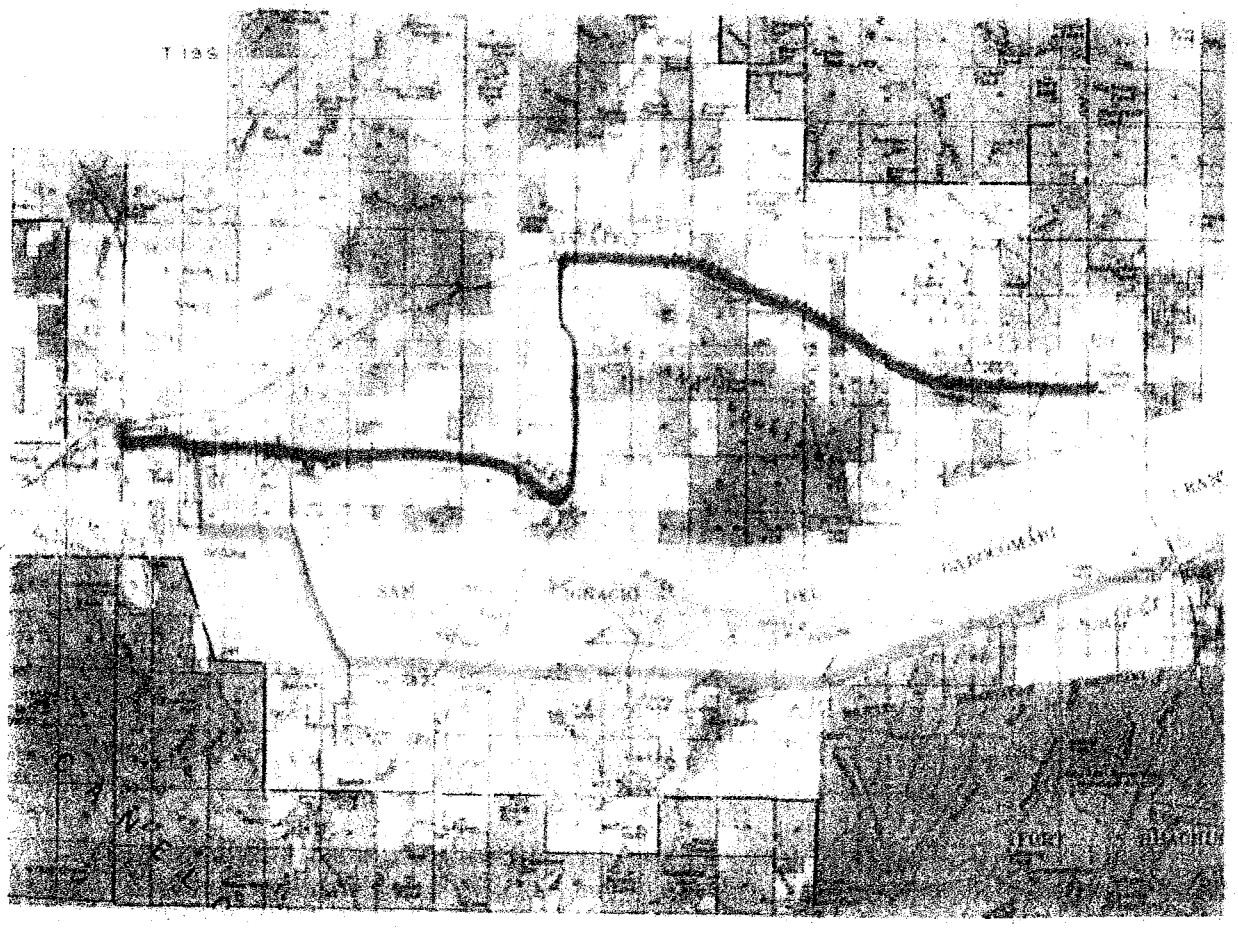
	Page
Cover page	1
Table of Contents	2
ISSUES	3
Discussion	3
Map 1. Existing 46 kV line in Green Serves Sonoita-Elgin and Patagonia.	3
Background	4
Map 2. The SSVEC Distribution System and other utilities in its service area	4
Constraints Considered.	5
Table 1. Peak Electrical Demands for SSVEC Customers and TEP at Ft Huachuca	5
Assumptions for Alternatives.	5
ALTERNATIVES	6
Alternatives for Primary Power for Sonoita-Elgin-Patagonia	6
Alternative 1 – Use Yellow Route.	6
Discussion	6
Alternative 2 – Use Green Route.	6
Discussion.	7
Alternative 3 – Use existing SWTC transmission lines as Source for Sonoita	7
Discussion.	7
Alternative 4 – Use TEP 46 kV (upgraded to 69 kV) as Source for Sonoita	7
Discussion.	7
BACKUP ALTERNATIVE POWER SOURCES	7
SECOND TRANSMISSION BACKUP ALTERNATIVES	8
Backup Alternative A – Emergency Backup from TEP's 46 kV.	8
Discussion.	8
Backup Alternative B – Emergency Backup from the UNS Electric Grid	8
Discussion.	8
CONCLUSIONS	8
RECOMMENDATIONS	8

SONOITA-ELGIN-PATAGONIA
ALTERNATIVES

ISSUES

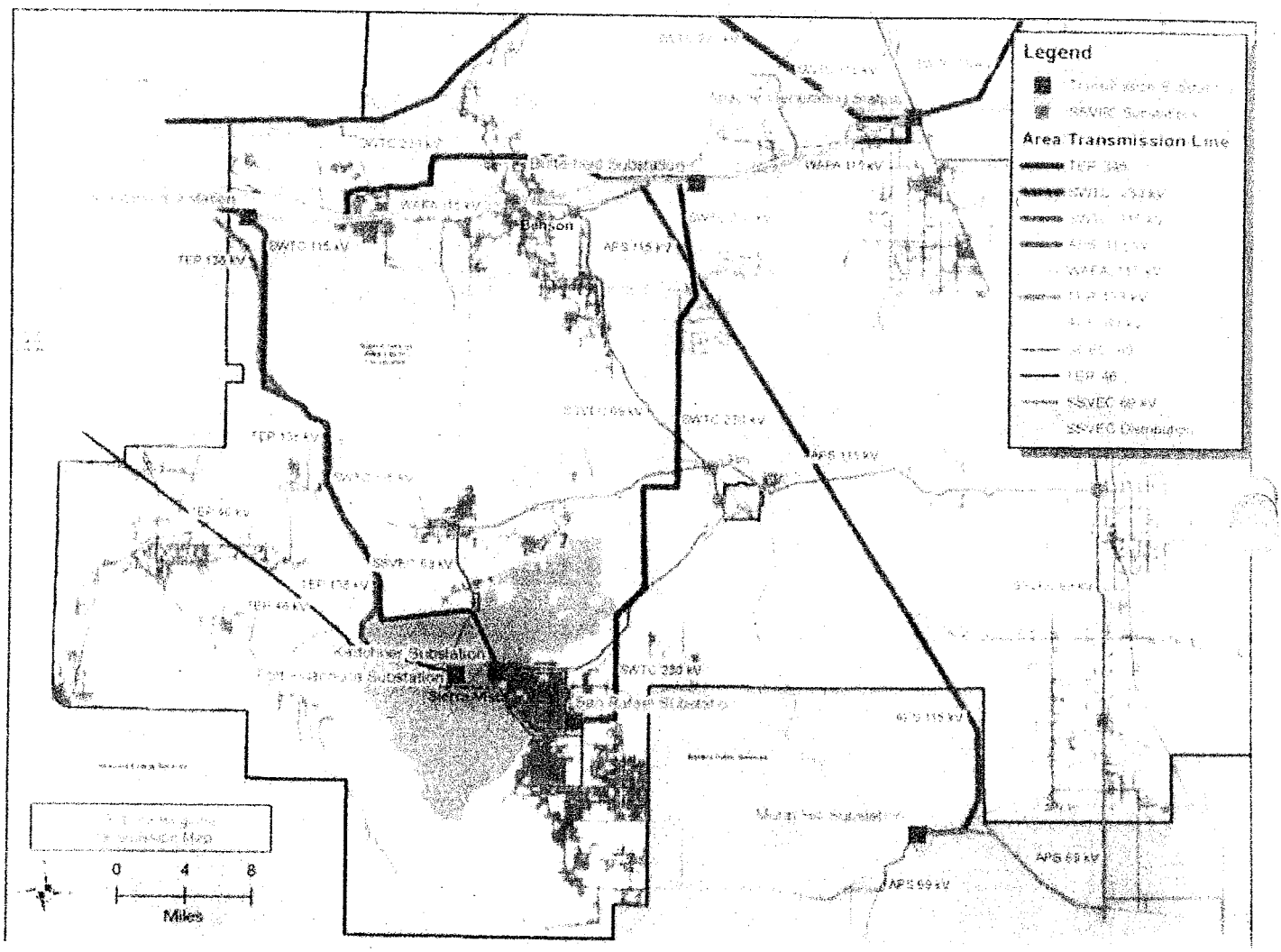
At present, there is one 23 kV distribution line serving SSVEC customers in Sonoita, Elgin, and Patagonia that is close to reaching its peak capacity. Another source of power is necessary to improve customer reliability on this 360-mile radial circuit. Without a substation in Sonoita, there are no distribution feeder lines to customer areas to provide local feeder loops and improve reliability. Backup emergency power is not available.

Discussion:
The present power demands for these customers is about 7 MW, this is met by a radial SSVEC 23 kV distribution line, shown in Map 1 in GREEN, from the SSVEC Mustang Corner Substation near the SR-82/90 intersection. There is no backup or second source for some 2,500 or so customers in Sonoita and another thousand in Patagonia areas.



Map 1. The Existing 23 kV line in Green Serves Sonoita, Elgin and Patagonia.
A SSVEC 23 kV distribution line presently serves Sonoita, shown in GREEN, goes from the Mustang Corner substation at SR 90 west via SR 82, then south on Elgin Road, continuing via SR 83 to Sonoita then to Patagonia via SR-82. A new substation in Sonoita for local feeder lines is proposed. The SSVEC plan (Alternative 2) installs a 69 kV line along a new route shown in YELLOW and the existing GREEN route used only for distribution. The ***Preferred Alternative 1*** *uses the existing GREEN route.*

Background.
SSVEC, an electrical distribution cooperative, provides electricity to service customers in Cochise, Santa Cruz and Pima Counties shown in Map 2. As a member of the Southwest Transmission Cooperative, SSVEC uses SWTC lines to its transmission substations. Also shown in this map are adjacent electrical utility companies service areas, including Tucson Electric Power Company (TEP) in yellow, UNS Electric (UNSE) in pink, TRICO in green, and Arizona Pubic Service (APS) in taupe. Since SSVEC is a distribution cooperative, it purchases power from other utilities for distribution to its customers, with SWTC for primary transmission of cooperative power generated at the Apache Power Plant.



Map 2. The SSVEC Distribution System and Other Utilities in its Service Area.
SSVEC operates all the light blue distribution lines shown and distribution substations (orange squares). The SWTC transmission lines from Pantano (115 kV in purple) and Butterfield (230 kV in green) substations bring in power so SSVEC can distribute to its customers. The SWTC Pantano-Huachuca transmission line crosses the existing 23 kV line from Mustang Corner substation (see Alternative 3). Fort Huachuca is served by TEP by a primary 115 kV line (in pink) and a 46 kV backup line (in blue). This 46 kV TEP line passes just north of Sonoita (see Alternative 4). Both TEP lines also cross the existing 23 kV line from Mustang Corner substation.

environmental impacts including negating decades of grassland research with severe visual impacts in virgin grasslands and adds miles of new power line service roads. There is widespread opposition to the YELLOW route that is preferred by SSVEC.

Alternative 3 – Use existing SWTC transmission lines as Source for Sonoita.
The SWTC 115 kV transmission line between Kartchner and Pantano SSVEC substations crosses the existing SSVEC 23 kV line to Sonoita.

Near this location, a small substation with a 115 to 69 kV transformer connects to the new 69 kV line that continues along the existing 23 kV west route to a new Sonoita Substation, and then continues along existing SSVEC 23 kV to Patagonia

Discussion. Map 2 shows where the existing SWTC Pantano 115 kV line crosses SR 82 a few miles east of where the TEP 46 kV crosses. If a substation with a 115 to 69 kV transformer was installed near this junction, then upgrading the SSVEC 23 kV line to 69 kV to the Sonoita substation also reduces additional 69 kV lines by many miles.

Alternative 4 – Use TEP 46 kV (upgraded to 69 kV) lines as Source for Sonoita.
Upgrade the present TEP 46 kV route to 69 kV from Greaterville to Ft Huachuca. Near to where this TEP line crosses SR-82 or SR-83, add a short 69 kV, using either Option, to the new Sonoita Substation and continue along existing SSVEC 23 kV to Patagonia

Option 4-82 - adds a new 69 kV line, from near where the TEP line crosses SR-82, to the new Sonoita Substation
Option 4-83 - adds a new 69 kV line, from near where the TEP line crosses SR-83, to the new Sonoita Substation

Discussion. The passing of the TEP 46 kV line near Sonoita appears to be a logical local source of power to meet the customer demands. Ongoing TEP plans to upgrade to 138 kV this line from TEP's South Substation in Sahuarita to Greaterville, could lead to upgrading this 46 kV to 69 kV or a higher voltage to meet the Ft. Huachuca backup peak demands, in Table 1. At 69 kV or higher, this line can adequately meet both Ft Huachuca and the SSVEC Sonoita-Elgin-Patagonia demands. Two options exist for tapping off an upgraded 69 kV line, where it crosses I-82 north of Sonoita or it crosses SR- 83 east of Sonoita in Map 2. A new 69 kV line from either location could continue to the new SSVEC 69 kV Sonoita substation. Either option would be the shortest "new" 69 kV route to Sonoita and the least expensive costs for the higher capacity necessary for this area if it is to be the primary source for SSVEC customers. It is assumed that TEP will need to solve the "two county" rule. A backup Alternative from this TEP 46 kV can avoid this issue.

BACKUP ALTERNATIVE POWER SOURCES

There is no second source of power for Sonoita or Patagonia. Without a "loop", continuity of service is not possible; however, Emergency Backup service, which means the switch is open unless there is an "emergency" (i.e. an outage), then a second source of power can easily be provided. This process is what TEP- and UNSE have accomplished with a TEP Conoa 46 kV substation in Pima County to serve UNSE customers via the Amado (Kantor) substation in Santa Cruz County. This satisfied IRS requirements for the "two county rule".

SECOND TRANSMISSION BACKUP ALTERNATIVES

These two Backup Alternatives provide second power sources for the SSVEC system supporting Sonoita, Elgin and Patagonia.

Backup Alternative A – Emergency Backup from TEP's 46 kV:
Add a transformer in a small substation on the present TEP 46 kV route (with or without an upgrade to 69 kV) between Greaterville and Ft Huachuca. This is near where the TEP line crosses SR-82 or SR-83, and a new 69 kV line continues to the new Sonoita Substation. This provides a second source for Sonoita and Patagonia.

Backup Option A-82 – Adds a new 69 kV line, from near where the TEP line crosses SR-82, to the new Sonoita Substation
Backup Option A-83 – Adds a new 69 kV line, from near where the TEP line crosses SR-83, to the new Sonoita Substation

Discussion. This Alternative provides a second power source and will improve reliability.

Backup Alternative B – Emergency Backup from the UNS Electric Grid:
UNS Electric has distribution lines within 1 mile of SSVEC lines in the southern part of the service area. Connections between these two systems can provide both higher reliable systems as continuity of service and be maintained since a loop will exist.

Discussion. This Alternative provides a second power source and will improve reliability for both SSVEC and UNSE customers.

CONCLUSION

The ongoing SSVEC "Yellow" approach needs higher level oversight or additional public reviews of all viable Alternatives.

RECOMMENDATIONS

A full and open discussion is necessary to review and evaluate options for the Sonoita-Elgin-Patagonia electrical situation. A higher capacity source, substation and preferably a second source is needed for this area. The "GREEN" solution is preferred. The proposed "YELLOW" solution, in many ways, is totally unacceptable but still needs to be included in this process.

SSVEC needs to reopen discussions, conduct an environmental assessment ASAP so that its present work on the Yellow route does not waste additional ratepayer's funds.

If SSVEC will not open up such a dialog with its cooperative ratepayers, then a formal request should be made to the Arizona Corporation Commission to appoint a Hearing Officer, preferably from the Siting Committee, to hear arguments leading to an environmental assessment and a recommendation for the best Alternative to resolve the issues herein.

Constraints Considered.
There are some facts that bound this issue.

First. The electrical load demands that need to be satisfied are summarized in Table 1 for the Sonoita-Elgin-Patagonia service area plus others that impact solutions.

Table 1. Peak Electrical Demands for SSVEC Customers and TEP at Ft. Huachuca.

Area	Number of customers	Present Peak Demand in Megawatts (MW)	Serving Electricity Company
Sonoita-Elgin	2,500	3-7 MW	SSVEC
Patagonia	1,000	1-2 MW	SSVEC
Fort Huachuca	1 Fort	10-20 MW	TEP

Second. The Alternatives herein meet these and other residential and small business demands. In general, the peak capacities for electrical conducting wires are about 7 MW for a 23 kV line, 20 MW for a 46 kV line, over 60 MW for a 69 kV line, over 110 MW for a 115 kV, and over 120 MW for a 138 kV line. The SSVEC 23 kV line serving Sonoita-Elgin-Patagonia is close to capacity. The TEP backup 46 kV line for Ft. Huachuca could be near capacity but is rarely used, only if there is an outage on the TEP 138 kV line to the Fort.

Third. Due to IRS "two county" rules, TEP is constrained to serve only customers in Pima and Cochise Counties. TEP, however, can provide power to customers in other counties during an emergency and could provide backup emergency services to SSVEC customers when SSVEC services are interrupted by an unexpected outage.

Fourth. Without a distribution substation in this area, local feeder lines are not used, thus total reliance on the existing SSVEC 23 kV severely constrains actions during any single outage. A substation permits SSVEC to isolate a distribution outage to one feeder and while continuing services to customers on other feeder lines. Several locations for a Sonoita distribution substation have been discussed and, in general, the community agrees a new substation off SR 83 in "downtown" Sonoita is the best location.

Fifth. The proposed upgrades between Sonoita and Patagonia re-build the existing 23 kV line without any routing changes along SR 82.

Assumptions for Alternatives.
The process of creating various Alternatives, involved looking at the above maps, and seeing potential connections with existing systems as preferred to avoid new expenses and to avoid additional environmental impacts. Some assumptions are always necessary.

Assumptions must consider ratepayer expenses as a key cost-driver but, "least expensive' solution may not meet customer expectations who feel a higher cost option is "worth" the expense.

In general, reusing existing easement is preferred when compared to creating a new one.

The Alternatives herein have high merit and should be considered to best serve the public's interest and concerns. Only the "YELLOW" Alternative 2 has been brought forth by SSVEC

for public review and consideration. It is assumed all Alternatives need consideration and public feedback before implementation. The preliminary "preferred" Alternative is number 1, the Green Line.

ALTERNATIVES

There are Alternatives and Options available not yet brought forth for public review and consideration. In our opinion, all are feasible, have merit, and should be considered to best serve the public's interest. The public prefers Alternative 1 as the best solution.

Alternatives for Primary Power for Sonoita-Elgin-Patagonia Options.
All these Alternatives propose radial lines. Alternative 1 is the easiest to implement and is preferred. Alternative 2 appears the most expensive, with ratepayer's costs decreasing for the other Alternatives. Alternative 3 gives greater future options for SSVEC, and Alternative 4 is simple and least expensive but requires an agreement between two companies to implement (more administrative issues than the others).

Alternative 1 – Use the GREEN Route. (preferred)
The existing GREEN route uses the location of the present 23 kV lines from the SSVEC 69 kV substation (near SR-82/SR-90 intersection), upgrades the 23 kV to 69 kV to the west, to the new Sonoita Substation, and continues along existing 23 kV route to Patagonia. Most of this route was installed prior to today's right of way requirements and is "grand-fathered" with upgrade rights that should facilitate the Alternative where permits do not exist. The Bureau of Land Management is expected to rule the upgrade as a NEPA Category Exception or require SSVEC to obtain a Land Use Permit.

Discussion. This is simply, a way to use the existing 23 kV line route as the basis for the upgrade to a new substation in Sonoita. It avoids the Alternative 2 (Yellow) issues including new power line service roads, new easements and rights of way through established subdivisions, and severe new environmental impacts. This is the preferred Alternative.

Alternative 2 – Use the YELLOW Route.
The YELLOW route goes from the SSVEC Huachuca City substation on 69 kV lines, via southern boundary of the Bacocomari Land Grant, up SR-83 to proposed SSVEC routes 1A or 3 to a new Sonoita Substation, and continues along existing SSVEC 23 kV route to Patagonia. There are two options:

Option 2A - Use SSVEC Route 1A (near Sonoita along SR-83)
Option 2B - Use SSVEC Route 3 (near Sonoita along North Boundary of Babocomari Land Grant and through Sonoita Hills Subdivision)

Discussion. This is the present SSVEC preferred Alternative that has resulted in local debates led by SSVEC for the community to chose between Route 1A and Route 3 in the Sonoita residential areas. Both these Options involve new lines and have caused unfortunate NIMBYisms throughout the community impacted by these lines.

The much larger issue, not discussed by SSVEC during these debates, is shown in YELLOW in Map 1. This involves cutting along the boundaries and through the Babocomari Land Grant that precedes both Options 2A and 2B. The YELLOW route has significant

Contents

1. Conservation Corridors between the San Pedro and Las Cienegas NCAs (Jeff Williams 11/08, Phoenix Zoo, Cienega Watershed Partnership)

   This is the corridor coming up from Mexico and correlates with the migration routes into ideal jaguar habitat. The Las Cienegas is the water source for Tucson.

2. Jaguar Habitat (Wildlands Project workshop 2007)

   Note the brick red (ideal habitat) and light blue (jaguar records) colors to the west of the pink arrow going into the Huachuca Mountains from reserves and habitat in Mexico.

3. SSVEC 69 kV Sub-Transmission Lines

   Green line indicates current 23 kV line from the substation at Mustang Corner to Sonoita. Yellow line indicates the new planned 69 kV line from Huachuca City through the Babacoari Ranch to Sonoita (~20 miles).

4. SSVEC 69 kV Sub-Transmission with Distribution Line Poles

   This is an example of what the poles will look like; 55' tall, 400-600' apart. It will take approximately 176-264 poles to cross 20 miles of the Babacomari.

5. SSVEC 69 kV Corner Pole

   This is an example of a corner pole. Note in comparison the size of the old wood pole.

6. South Boundary of the Babacomari Looking East

   The 55' power poles/lines will run down the left side of the fence (within a 75' easement), right over the home there.

7. South Boundary of the Babacomari Looking West

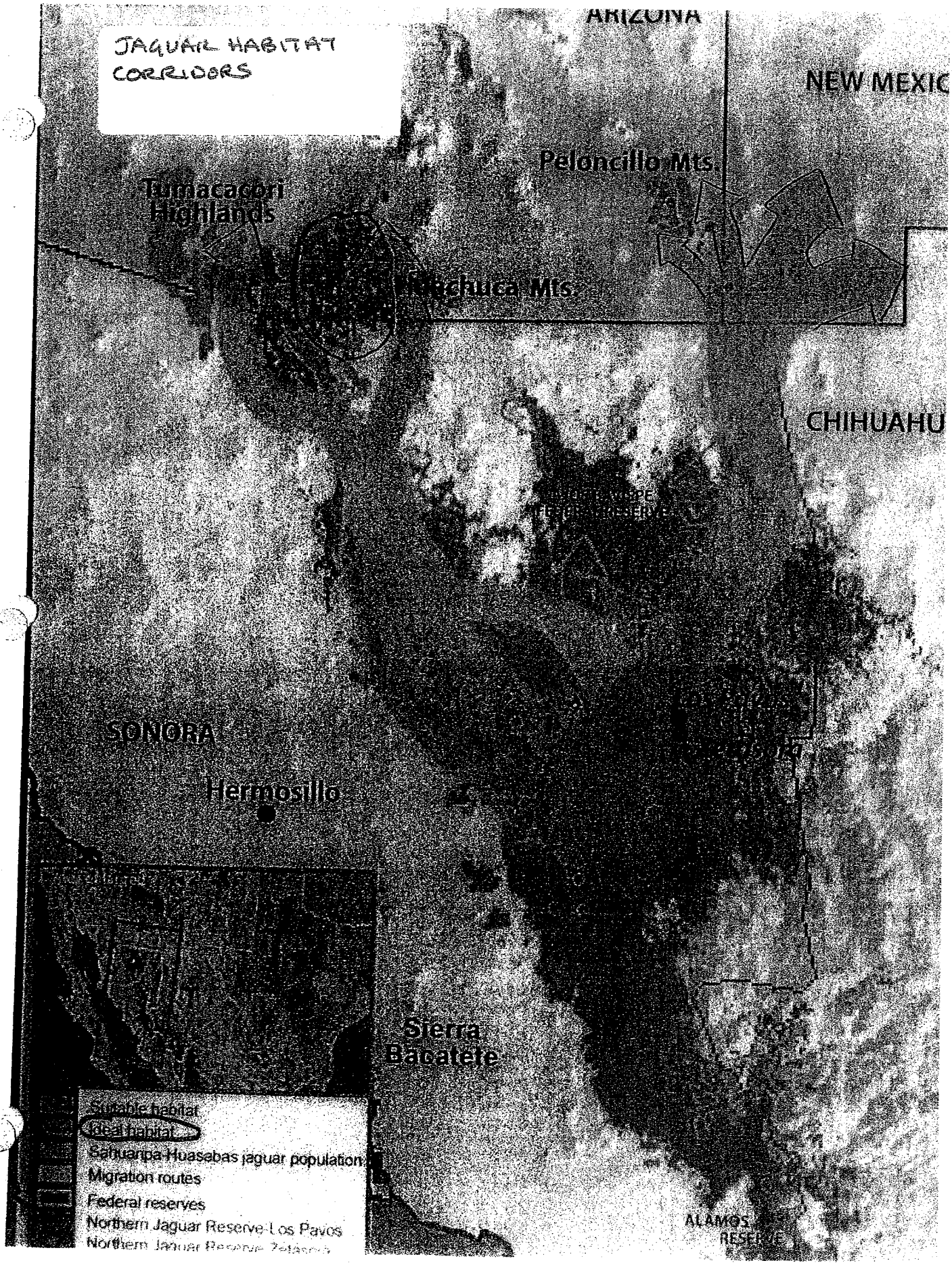
   The 55' power poles/lines will run down the right side of the fence (within a 75' easement)

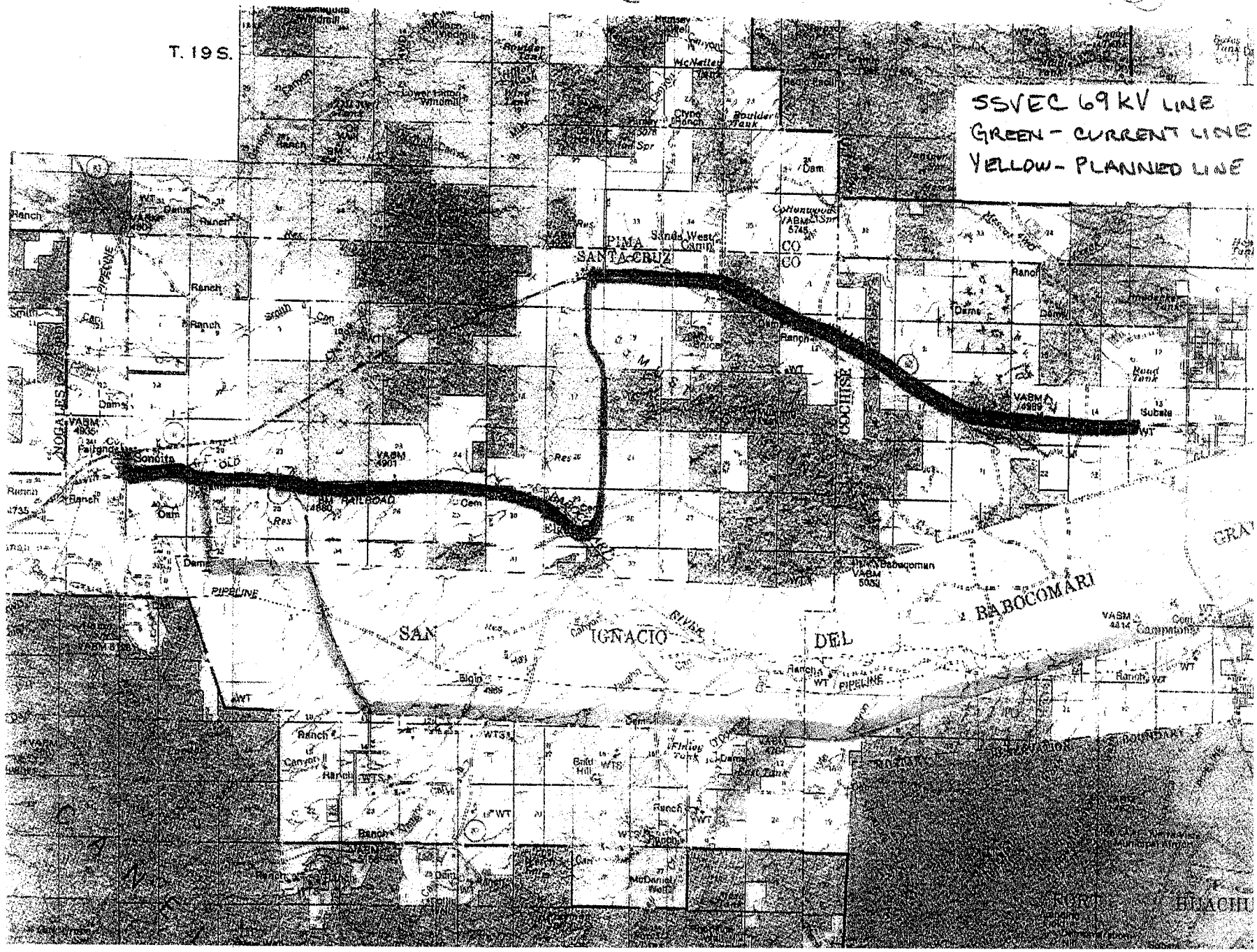
8. Boundary between the Audubon Research Ranch and the Babacomari Ranch

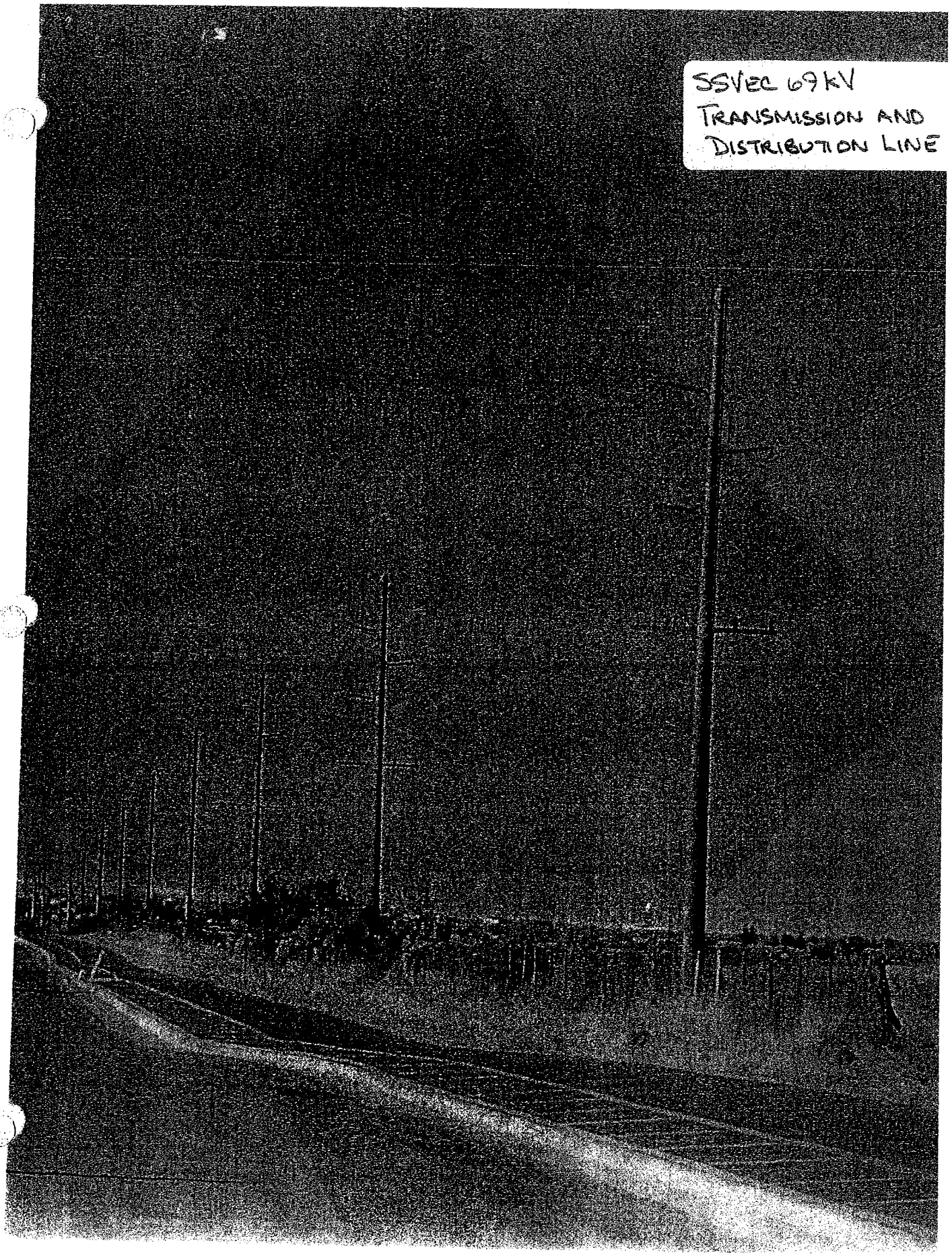
   This shows the destruction created just to site and prepare for the installation of the power pole. This does not show the additional damage that will result from 4-6 large cranes/trucks needed to install the 55' pole and string the power lines.

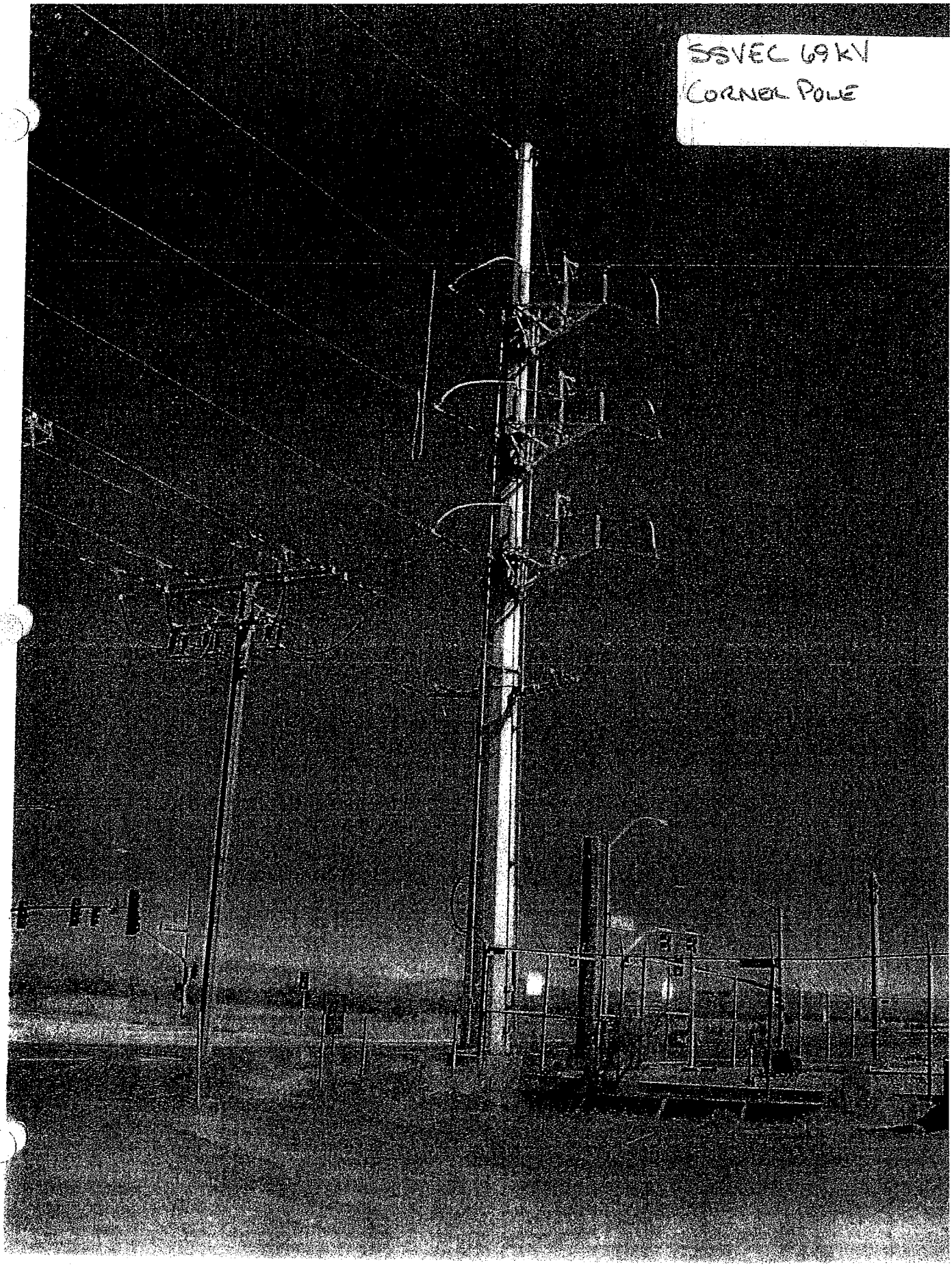
Conservation in Southeast Arizona
CONSERVATION CORRIDORS BETWEEN SAN PEDRO AND LAS CIENEGAS NCA
PIMA COUNTY
COCHISE COUNTY
SANTA CRUZ COUNTY
SONORA
SIERRA VISTA
Mexico
Surface Management
Conservation Managed Lands
Proposed for Conservation
Babacomari Ranch
State Trust Land 2006 Proposal
USBLM
USBOR
USFWS
N
0 2.5 5 10 Miles

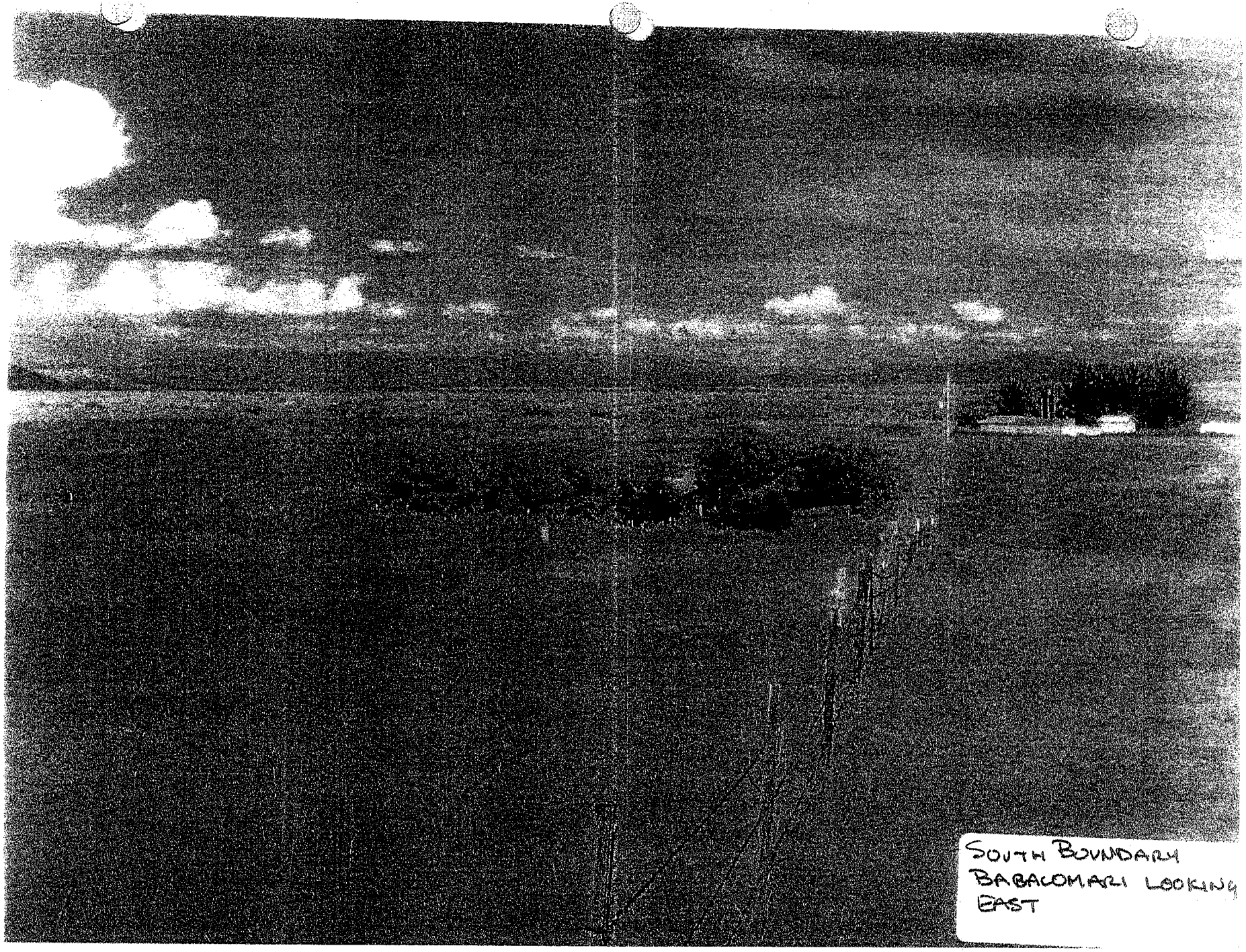
JAGUAR HABITAT
CORRIDORS




T. 19 S.
SSVEC 69 kV LINE
GREEN - CURRENT LINE
YELLOW - PLANNED LINE
PIMA
SANTA CRUZ
CO
CO
COCHISE
NOGALES
Sonoita
OLD
RAILROAD
PIPELINE
SAN
IGNACIO
DEL
RIVER
BABOCOMARI
Babocomari
Substa
Ranch
Dam
Res
Cem
Campground
Rancho
Bldg
Hill
Canyon
Windmill
Well
Tank
Spr
Camp
Cottonwood
Sonoita West
Boulder
McNelley
Clyde Branch
Lower Farmer
Wash
Creek
Road
Ranch
Dam
VABM
4935
4901
4880
4989
5745
5035
4414
4869
4735
WT
WTS
BOUNDARY
RESERVATION
BEACHU

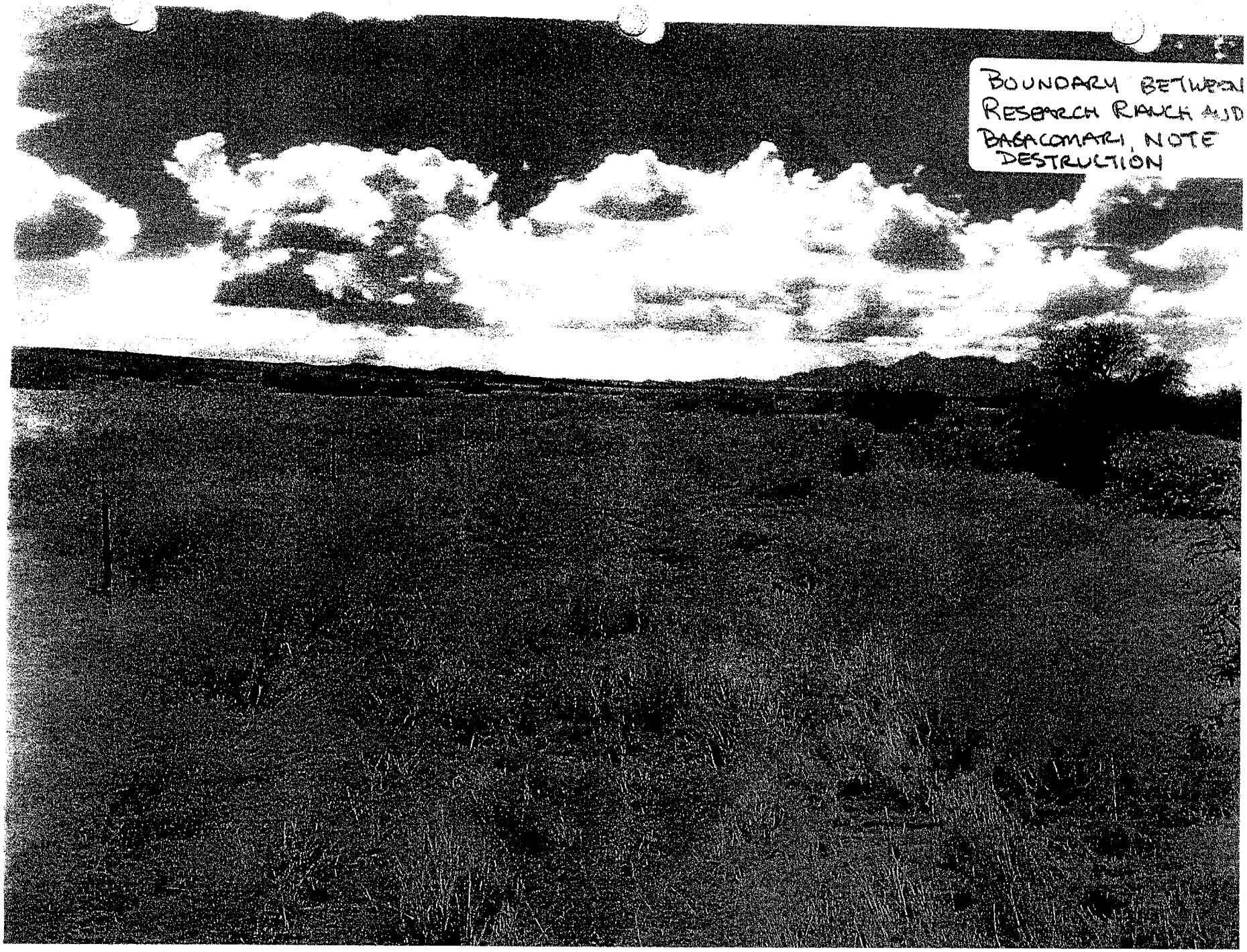

SSVEC 69 kV
TRANSMISSION AND
DISTRIBUTION LINE


SSVEC 69 kV
CORNER POLE



SOUTH BOUNDARY
BABACOMARI LOOKING
EAST

SOUTH BOUNDARY
BABACOMARI LOOKIN
WEST


BOUNDARY BETWEEN
RESEARCH RANCH AND
BAGACOMARI, NOTE
DESTRUCTION

SSVEC

Rebuttal

Sulphur Springs Valley Electric Cooperative, Inc.

A Touchstone Energy® Cooperative

Save the Scenic Sonoita/Elgin Grasslands Group (3SEG)

CONSTRUCTIVE POINT PAPER – SSVEC RESPONSE

ALTERNATIVES PRESENTED

* **ALTERNATIVE 1:** (3SEG: "easiest to implement and is preferred")
  - Upgrade existing 3ph distribution line to 69kV sub-transmission with underbuild
    - Work must be performed energized – construction cost increases 150%
    - Existing lines under 'grandfathered' rights – no 'upgrade' rights; new easement acquisition costs for approximately 23 miles / nearly 100 parcels
    - Additional environmental impact/burden to the Las Cienegas National Conservation Area - a FEDERALLY protected area. New environmental and permitting costs.
    - Cost factors – construction cost difference alone for Alternative 1 route vs SSVEC Chosen route (Alternative 2) is over $2.6 MILLION – DOES NOT INCLUDE right of way acquisition costs for 23 miles.
    - Somewhat reduces reliability as both power sources are on same pole line – if it goes down, no way to back-up service area.
      - With 69kV on a separate route, retain ability to back-up from Huachuca Sub.

* **ALTERNATIVE 2:** (3SEG: "most expensive" and "significant environmental impacts with severe visual impacts in virgin grasslands")
  - 69kV sub-transmission only along SSVEC existing easement on Babocomari Land Grant
    - 20-mile easement purchased in 1982
    - Least construction cost
      - Work performed de-energized
      - 69kV only : no under-build
    - No protected environmental areas – ALL PRIVATE PROPERTY
      - SSVEC voluntarily contracted environmental survey - NO IMPACT to threatened/endangered species or habitat
      - Easement cleared in 1991 for fiber-optic cable installation – maintenance traffic continues
      - Shared boundary with Audubon Society Appleton-Whittell Research Ranch of only 1-mile (of 20-mile easement)
      - Babacomari Ranch is a working cattle ranch: grasslands are fully grazed and managed.

* **ALTERNATIVE 3:** (3SEG: "greater future options for SSVEC")
  - Use existing Southwest Transmission Cooperative (SWTCO) transmission lines as Source for Sonoita
    - Requires significant investment by SWTCO
      - New 115kV to 69kV substation
      - Property purchase for joint substation site
    - Reduces 69kV line by only 7.5miles (not enough to offset cost of 115/69 sub)
    - Same construction / easement cost and reliability constraints as Alternative 1.

* **ALTERNATIVE 4:** (3SEG: "simple and least expensive but requires an agreement between two companies")
  - Use Tucson Electric Power (TEP) 46kV (upgraded to 69kV) lines as source for Sonoita
    - Requires significant investment by TEP
      - Upgrade existing 46kV line to 69kV from Greaterville to Hwy 83 intersection (appx 12 miles)
      - New 69kV substation
      - Property purchase for joint substation site
    - Significant additional burden on the Las Cienegas National Conservation Area
    - Impact to designated Scenic Highway area

- TEP is legally restricted from providing service to Santa Cruz County

* **BACKUP ALTERNATIVES:** (3SEG: "there is no second source of power for Sonoita or Patagonia. Without a 'loop', continuity of service is not possible")
  - The Sonoita area has received service from a single source of power since SSVEC began service in the 1960's. In rural areas it is common to have a radial transmission line to service a small substation / community.
  - Emergency backup from Tucson Electric Power (TEP) 46kV
    - Requires significant investment by TEP
      - Upgrade existing 46kV line to 69kV
      - New 69kV substation
      - Property purchase for joint substation site
  - Emergency backup from UniSource Energy Services **(115kV)**
    - Requires significant investment by UNS
      - New 115kV to 69kV substation
      - Add 115kV or 69kV transmission line to substation site
        - If 115kV - siting requirements
      - Property purchase for joint substation site

* **CONTENTS:** (3SEG: Exhibits attached to Constructive Point Paper)
  - Conservation Corridors between the San Pedro NCA and Las Cienegas NCA
    - Babacomari only PROPOSED for Conservation
  - Jaguar Habitat Map
    - The Wildlands Project is related to cross-border pathways between Arizona and Mexico for multiple species of wildlife, including Jaguars. The United States / Mexico 'Border Wall' Project is a major concern in regards to impact of corridors. There is no evidence that an overhead power line will impact jaguar migration corridors or habitat.
  - Map: Green Line (Alternative 1) vs Yellow Line (Alternative 2)
    - This map does not provide the location of the Las Cienegas National Conservation Area, the Appleton-Whittell Research Ranch, or the ~20-mile 69kV Sub-transmission easement across private land which SSVEC purchased in 1982.
  - Transmission Pole Photos
    - The photos presented are NOT representative of the type of pole configuration used on 95% of the Sonoita Reliability Project
  - Boundary Photos of the Babacomari
    - The Constructive Point Paper incorrectly states the easement is 75' in width – actual width is 50'.
    - The photos *"South Boundary Babacomari Looking East"* and *"South Boundary Babacomari Looking West"* demonstrates development within, and adjacent to, the Land Grant grasslands area. Effects of grazing are visible in the Westward photo.
    - The photo *"Boundary between Research Ranch and Babacomari, Note Destruction"* illustrates a minimal amount of ground disturbance with significant grasses remaining intact. SSVEC has stated that all disturbances will be reseeded with native grasses at the conclusion of the project.
    - SSVEC acquired GPS aerial photography for the project corridor on the Babacomari Ranch in January 2008. The aerial photography distinctly shows existing roads adjacent to the Appleton-Whittell Research Ranch, as well as along a significant percentage of the southern boundary of the entire Land Grant. These roads/cleared areas were in existence long before any clearing was performed.

SSVEC

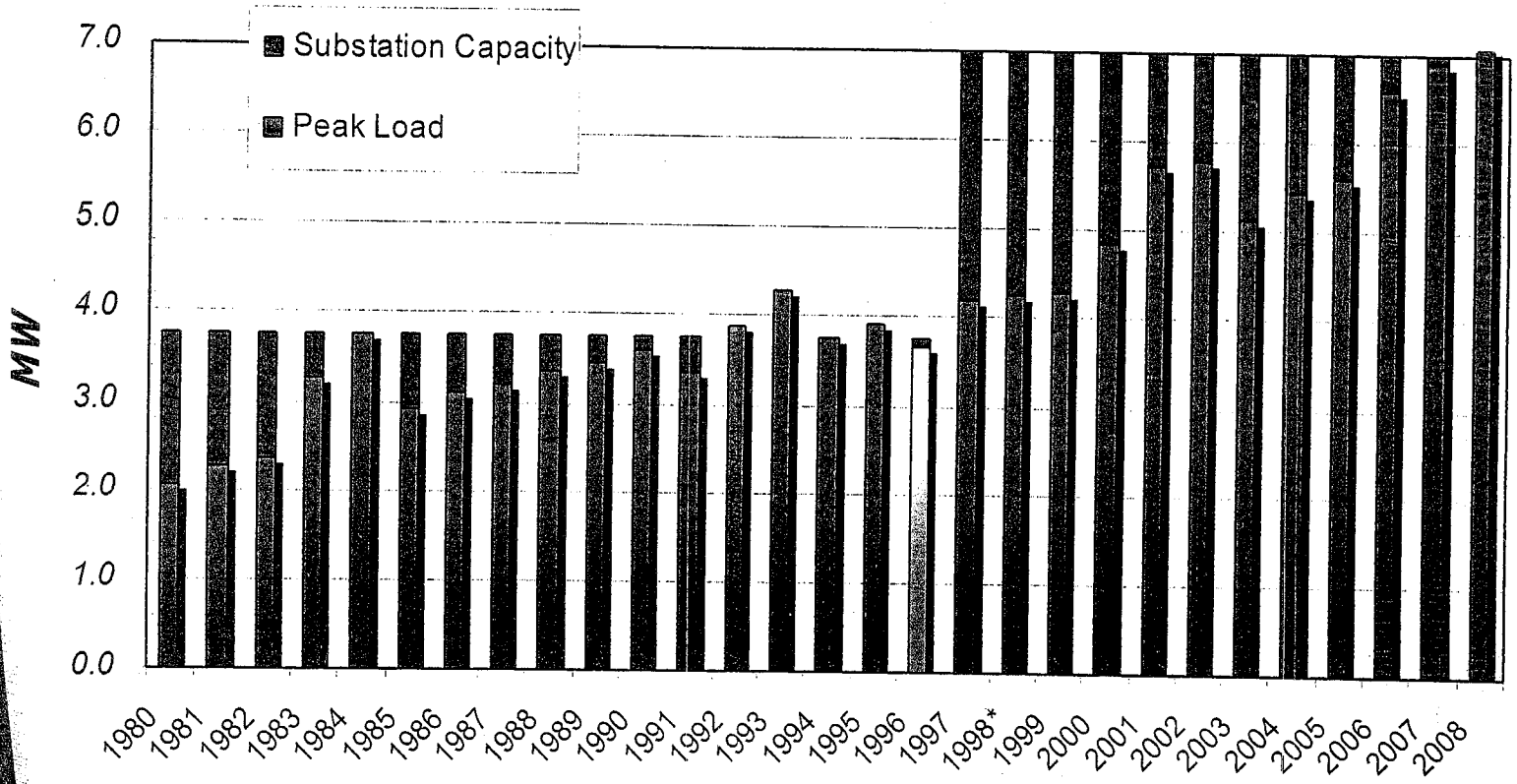
Transformer Capacity

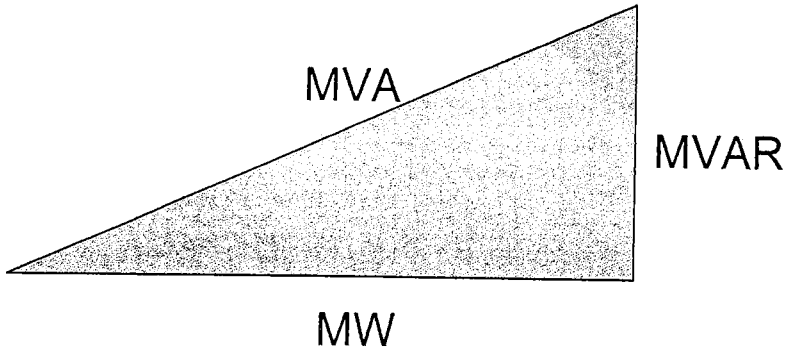
69 KV ANALYSES

- 477 has a thermal limit of 80MW but....
- 477 ACSR for 22 miles is good for 20MW @ 95% PF
- Upgrade Kartchner to Sonoita Tap increases capacity to 29MW @ 95% PF

Increasing Load vs. Capacity

Huachuca Substation at Capacity





POWER FACTOR = KW/KVA = .98 ON THE V-7 FEEDER

SUBSTATION TRANSFORMER CAPACITY = 7 MVA

@ .98 PF

= ONLY 6.6 MW

PEAK LOADS = 7.132 MW

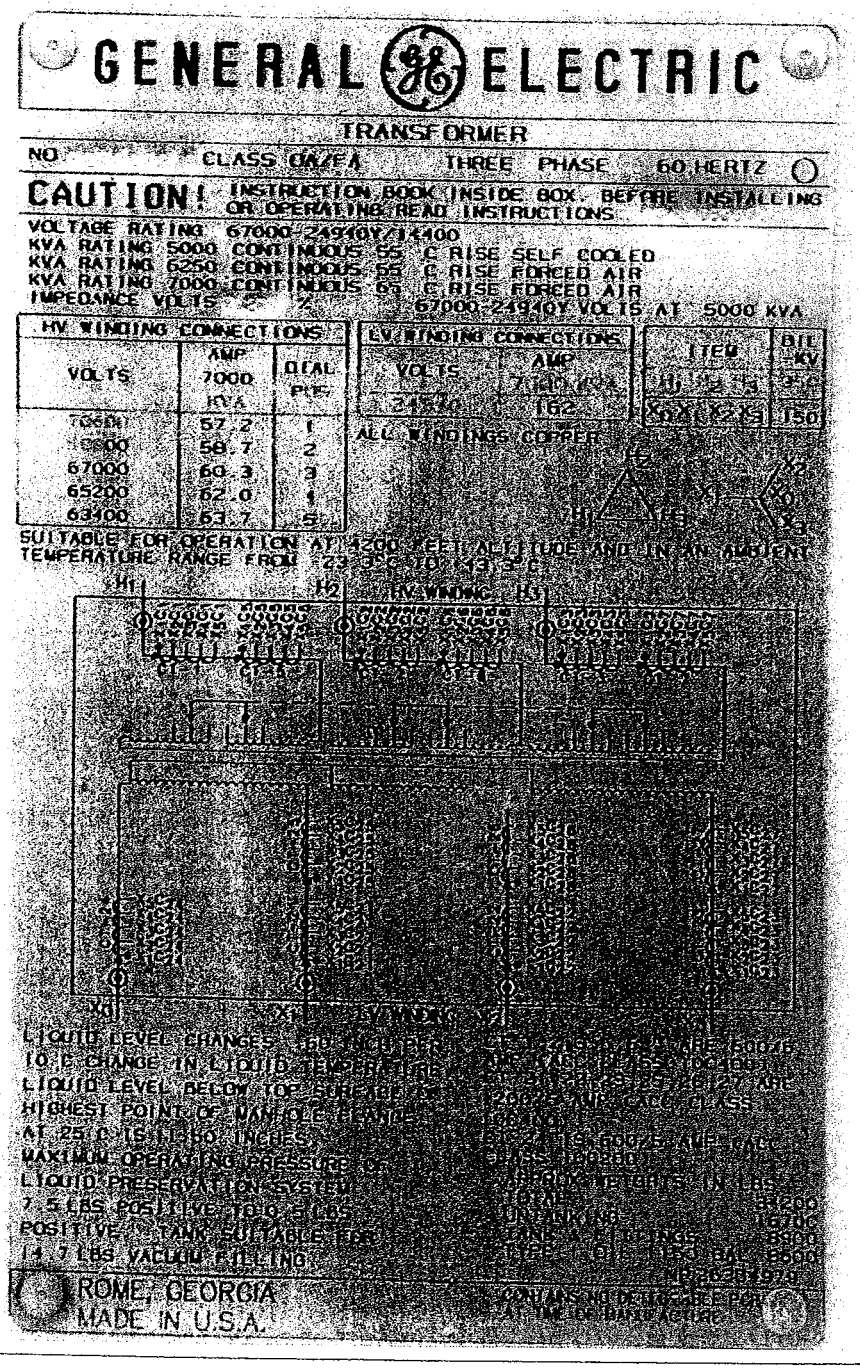
@ .98 PF

= 7.5 MVA

<u>SUBSTATION TRANSFORMER IS 7% OVERLOADED!!</u>

Huachuca West

Transformer Nameplate



GENERAL ELECTRIC

TRANSFORMER

NO CLASS OA/FA THREE PHASE 60 HERTZ

CAUTION! INSTRUCTION BOOK INSIDE BOX. BEFORE INSTALLING OR OPERATING READ INSTRUCTIONS

VOLTAGE RATING 67000-24940Y/14400
KVA RATING 5000 CONTINUOUS 55 C RISE SELF COOLED
KVA RATING 6250 CONTINUOUS 55 C RISE FORCED AIR
KVA RATING 7000 CONTINUOUS 65 C RISE FORCED AIR
IMPEDANCE VOLTS % 67000-24940Y VOLTS AT 5000 KVA

HV WINDING CONNECTIONS		
VOLTS	AMP 7000 KVA	DIAL POS.
70500	57.2	1
68600	58.7	2
67000	60.3	3
65200	62.0	4
63400	63.7	5

LV WINDING CONNECTIONS	
VOLTS	AMP 7000 KVA
24940	162

ITEM	BIL KV
H1 H2 H3	150
X0 X2 X3	150

ALL WINDINGS COPPER

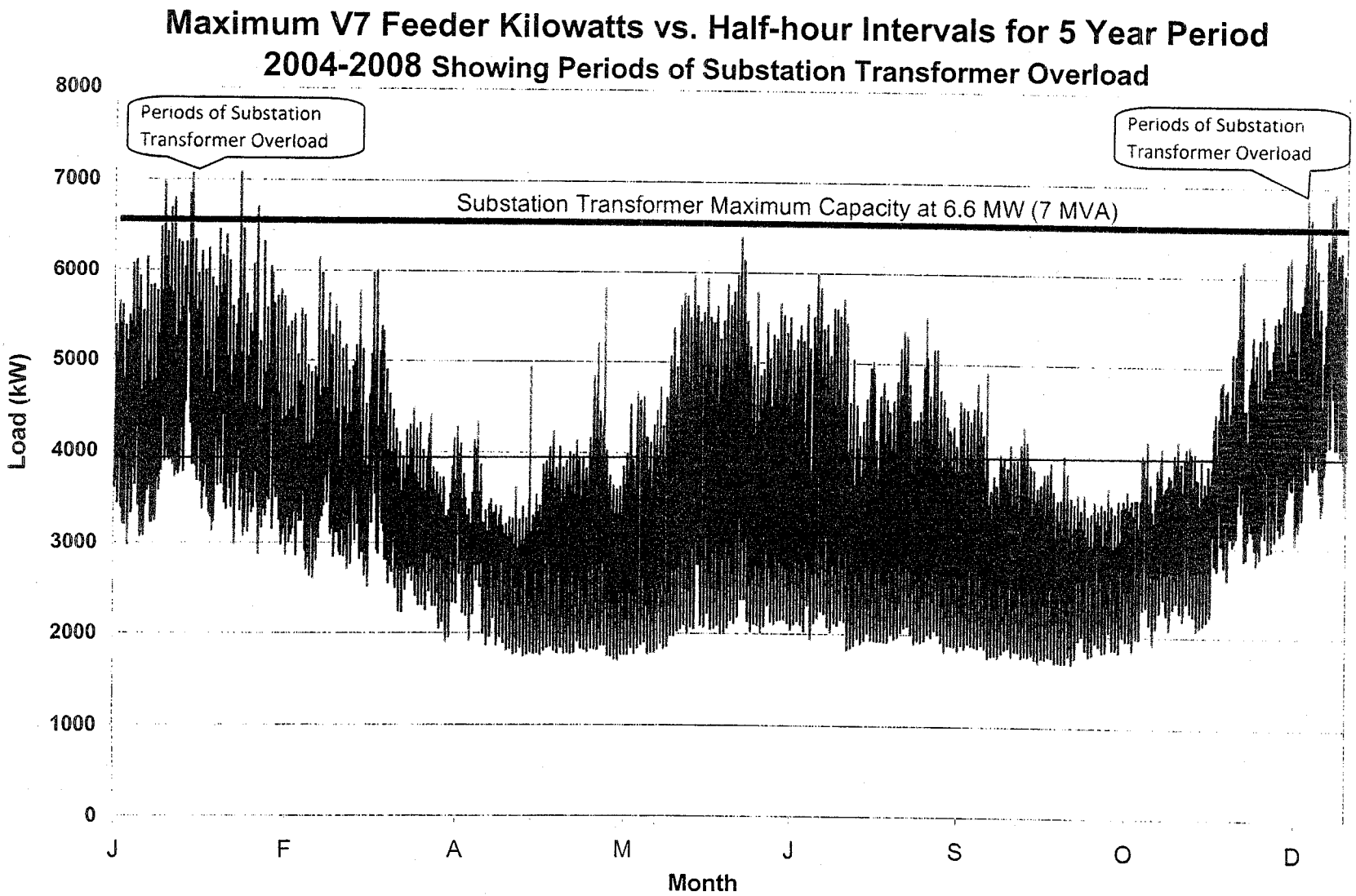
SUITABLE FOR OPERATION AT 4200 FEET ALTITUDE AND IN AN AMBIENT TEMPERATURE RANGE FROM -23.3°C TO 43.3°C

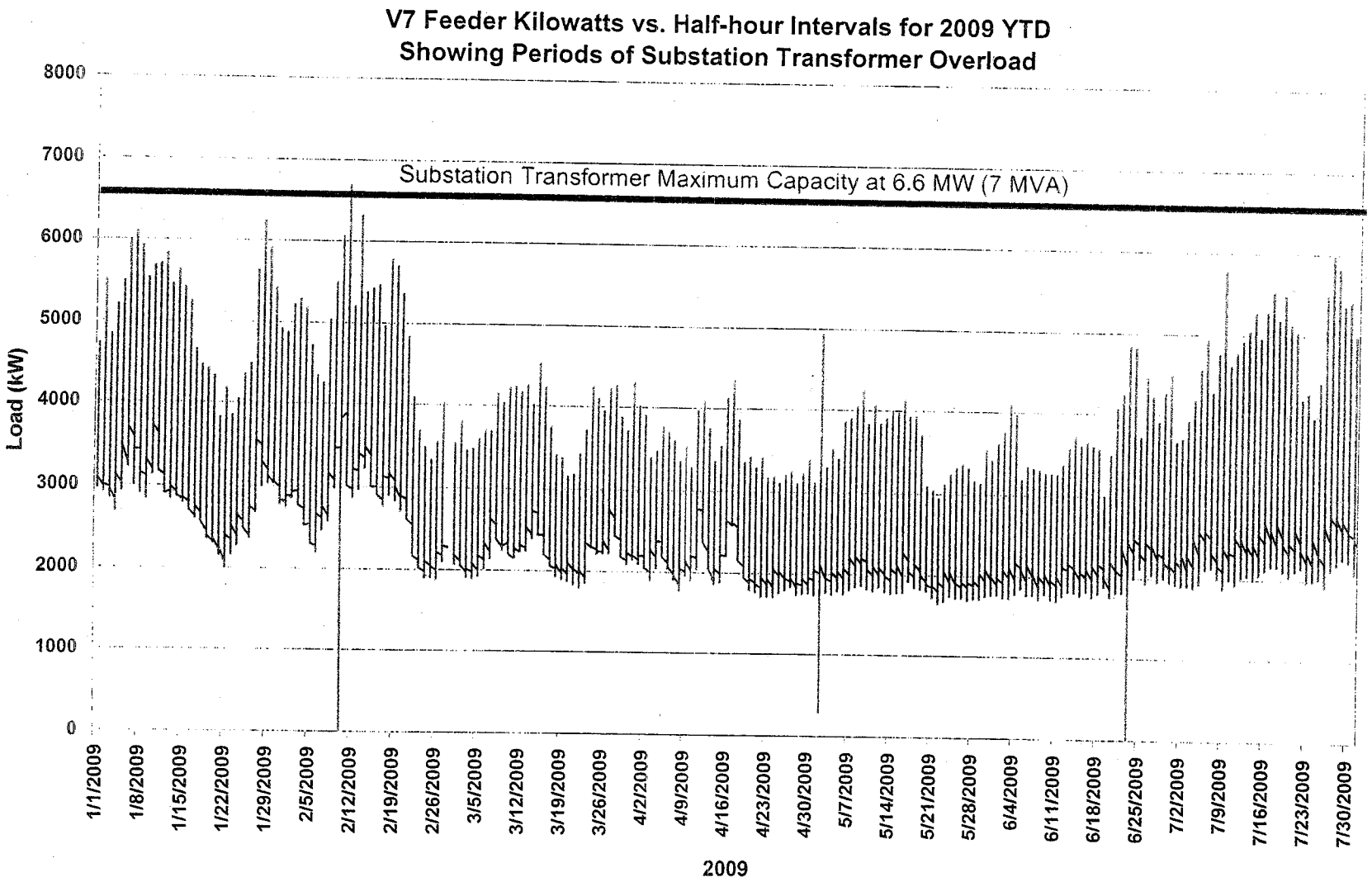
HV WINDING

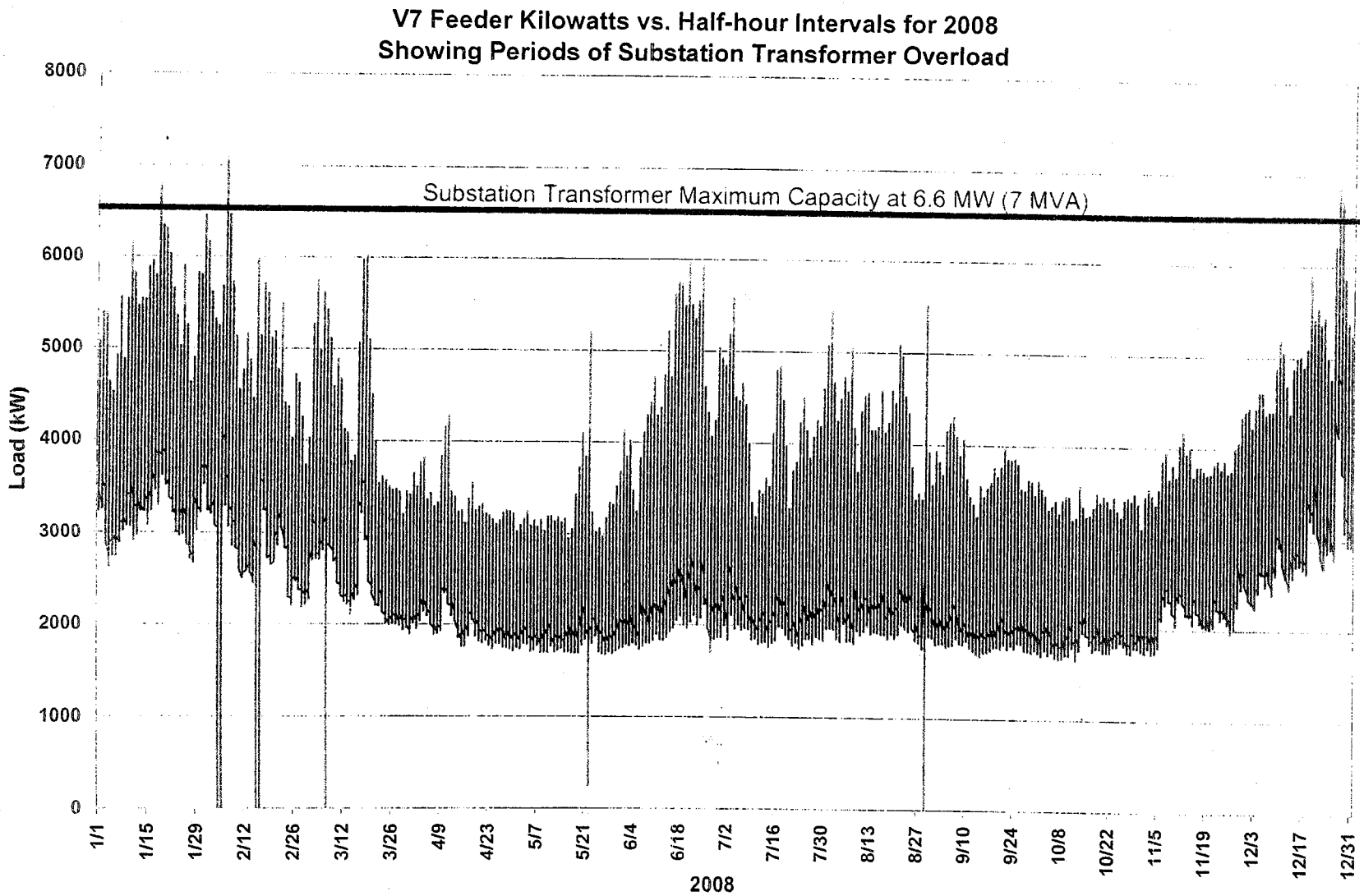
LIQUID LEVEL CHANGES [illegible]
10.5 CHANGE IN LIQUID TEMPERATURE [illegible]
LIQUID LEVEL BELOW TOP SURFACE [illegible]
HIGHEST POINT OF MANHOLE FRAME [illegible]
AT 25°C IS 1136.0 INCHES [illegible]
MAXIMUM OPERATING PRESSURE [illegible]
LIQUID PRESERVATION SYSTEM [illegible]
7.5 LBS POSITIVE TO 0.5 LBS [illegible]
POSITIVE TANK SUITABLE FOR [illegible]
14.7 LBS VACUUM FILLING [illegible]

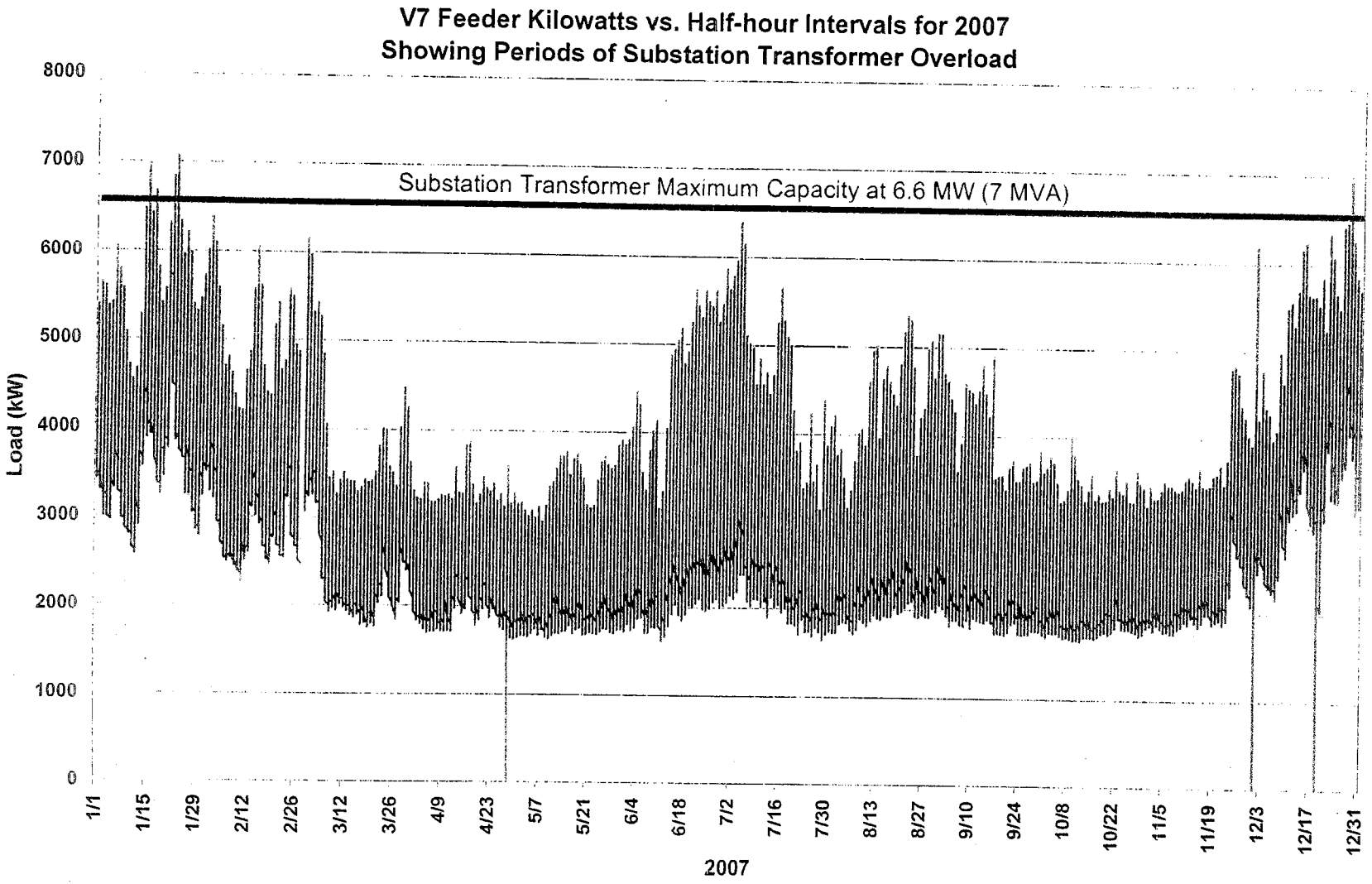
ROME, GEORGIA
MADE IN U.S.A.

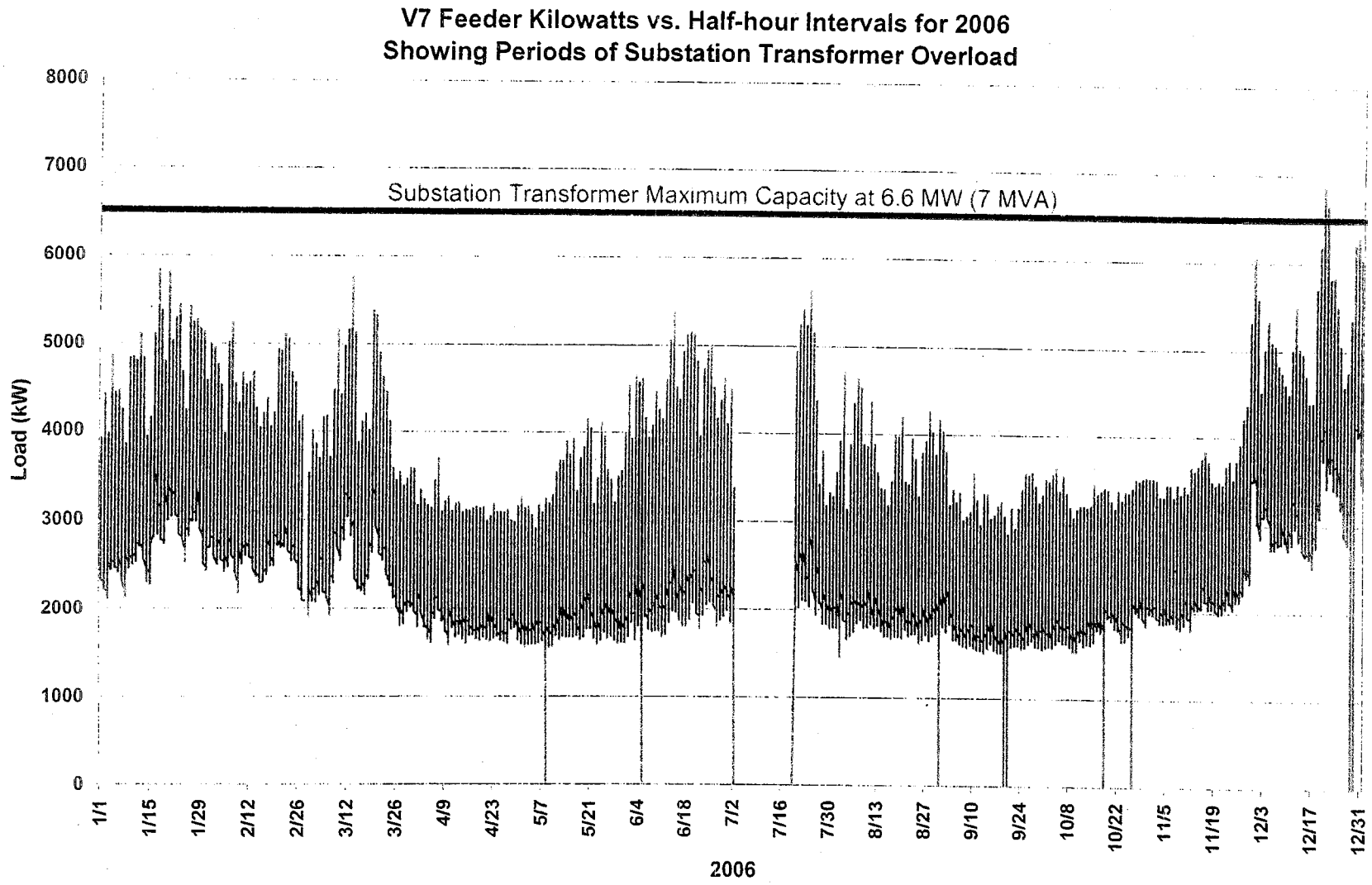
CONTAINS NO POLYCHLORINATED BIPHENYLS (PCB)

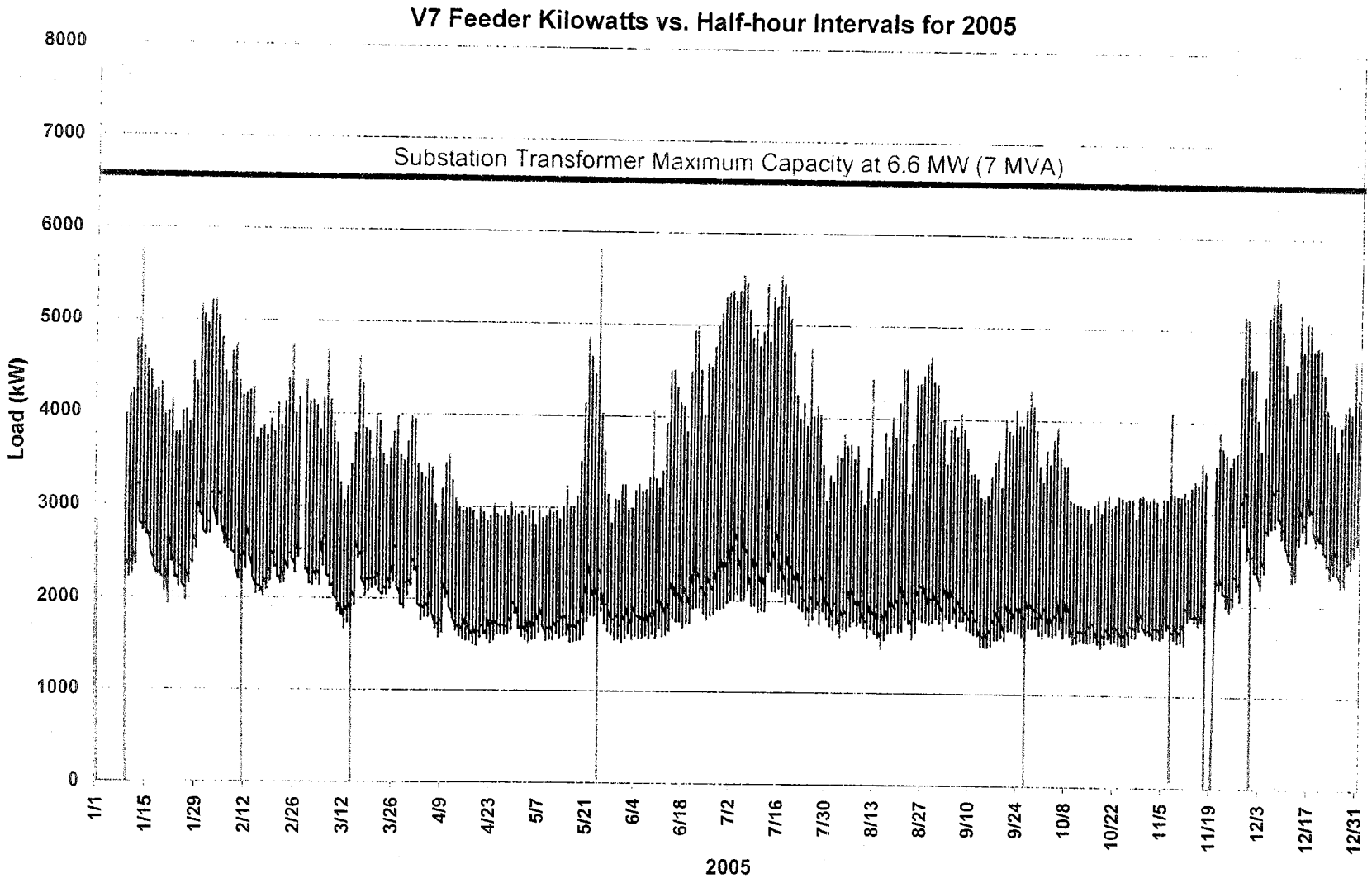

Maximum V7 Feeder Kilowatts vs. Half-hour Intervals for 5 Year Period
2004-2008 Showing Periods of Substation Transformer Overload
Periods of Substation Transformer Overload
Periods of Substation Transformer Overload
Substation Transformer Maximum Capacity at 6.6 MW (7 MVA)
Load (kW)
8000
7000
6000
5000
4000
3000
2000
1000
0
J
F
A
M
J
S
O
D
Month

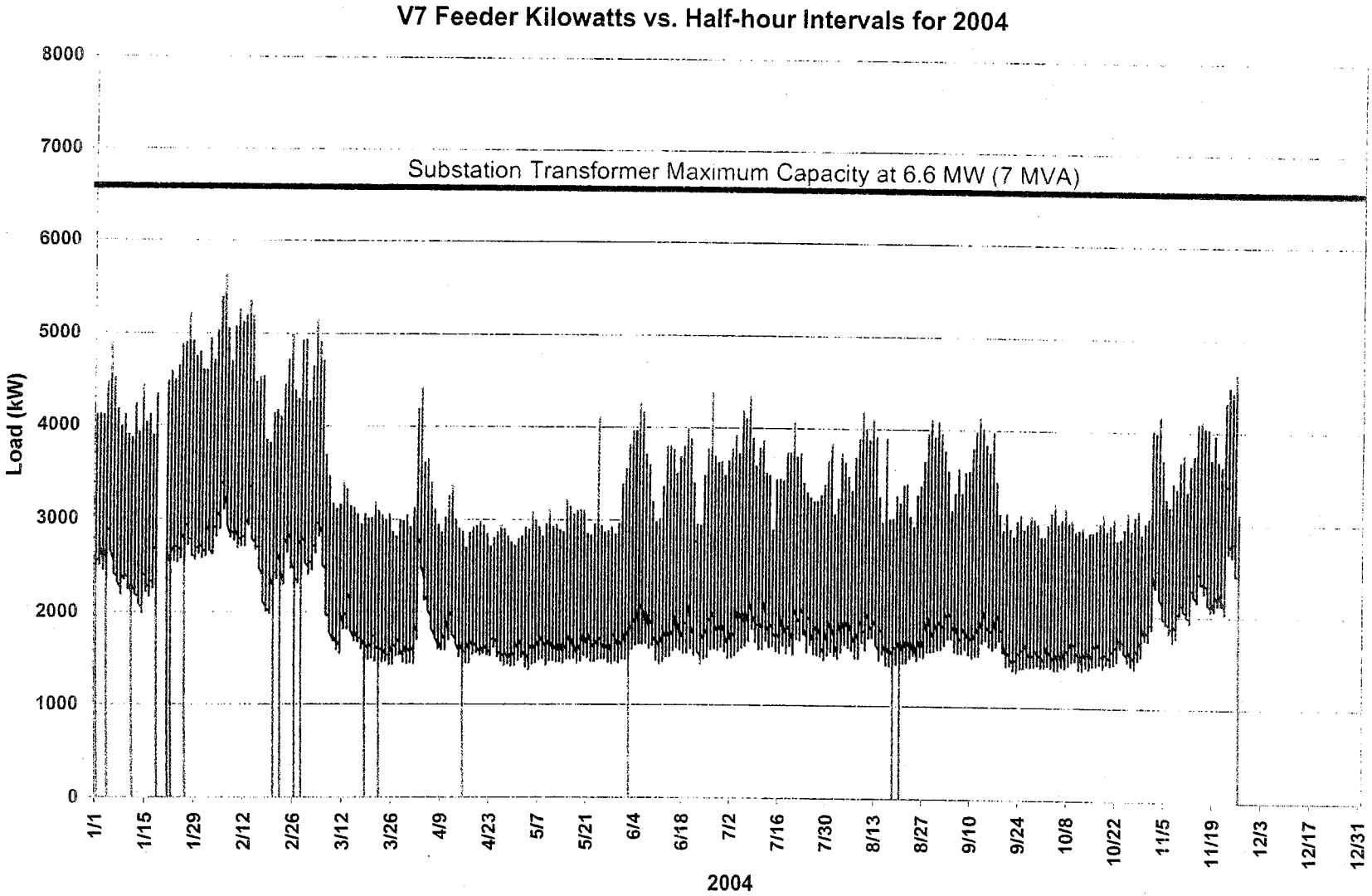

V7 Feeder Kilowatts vs. Half-hour Intervals for 2009 YTD
Showing Periods of Substation Transformer Overload
Substation Transformer Maximum Capacity at 6.6 MW (7 MVA)
Load (kW)
8000
7000
6000
5000
4000
3000
2000
1000
0
1/1/2009
1/8/2009
1/15/2009
1/22/2009
1/29/2009
2/5/2009
2/12/2009
2/19/2009
2/26/2009
3/5/2009
3/12/2009
3/19/2009
3/26/2009
4/2/2009
4/9/2009
4/16/2009
4/23/2009
4/30/2009
5/7/2009
5/14/2009
5/21/2009
5/28/2009
6/4/2009
6/11/2009
6/18/2009
6/25/2009
7/2/2009
7/9/2009
7/16/2009
7/23/2009
7/30/2009
2009

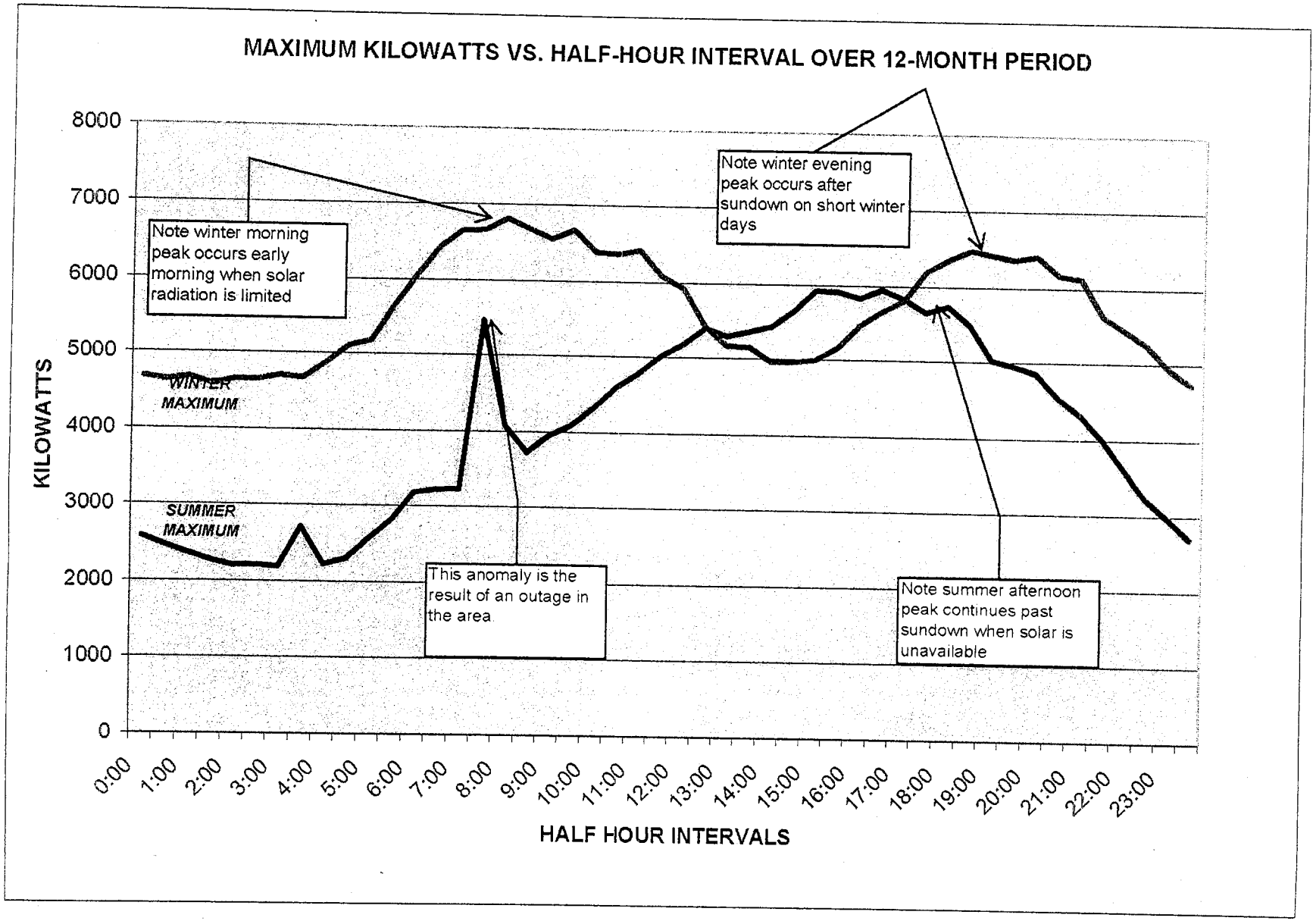

V7 Feeder Kilowatts vs. Half-hour Intervals for 2008
Showing Periods of Substation Transformer Overload
Substation Transformer Maximum Capacity at 6.6 MW (7 MVA)
Load (kW)
8000
7000
6000
5000
4000
3000
2000
1000
0
1/1
1/15
1/29
2/12
2/26
3/12
3/26
4/9
4/23
5/7
5/21
6/4
6/18
7/2
7/16
7/30
8/13
8/27
9/10
9/24
10/8
10/22
11/5
11/19
12/3
12/17
12/31
2008

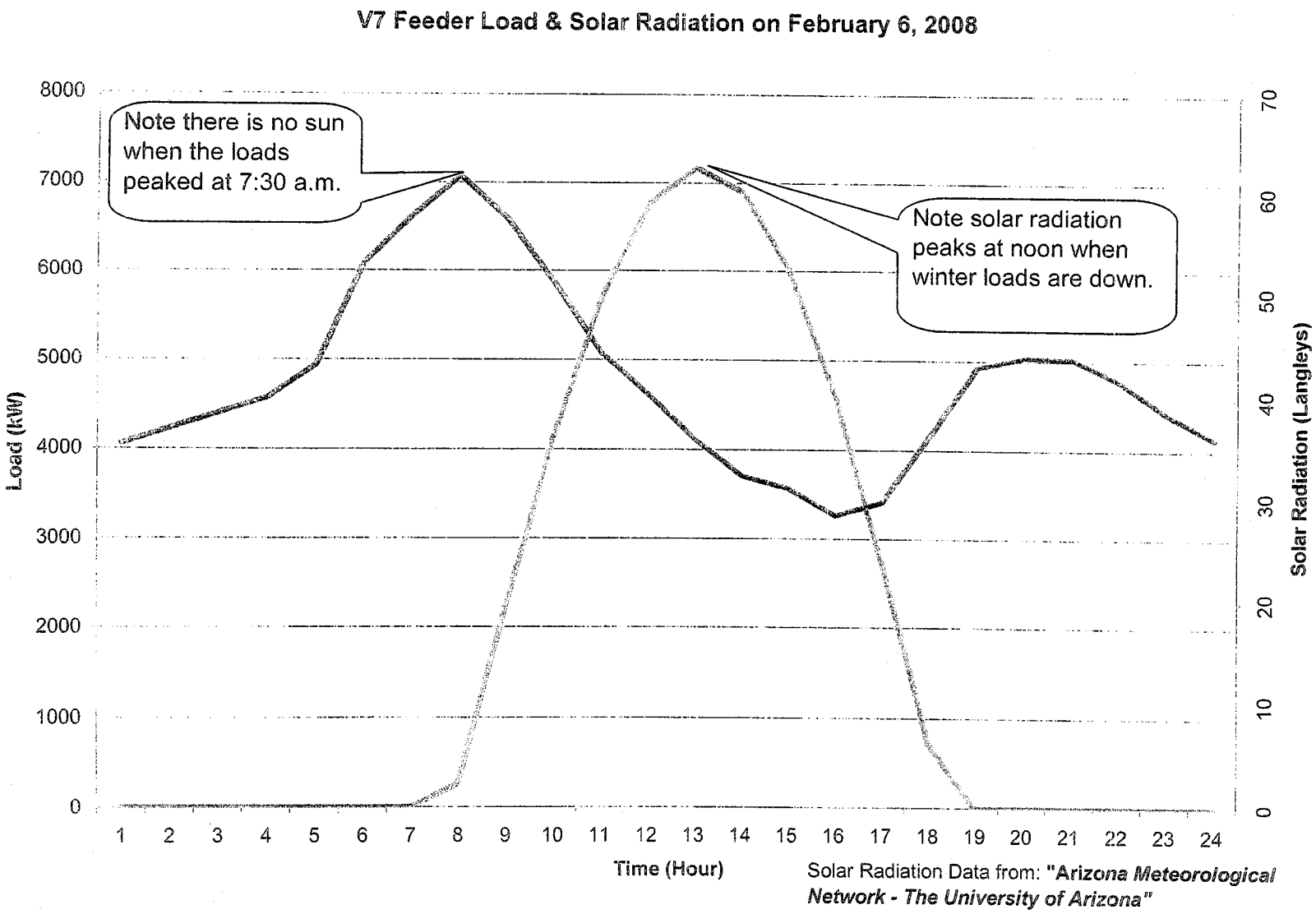

V7 Feeder Kilowatts vs. Half-hour Intervals for 2007
Showing Periods of Substation Transformer Overload
Substation Transformer Maximum Capacity at 6.6 MW (7 MVA)
Load (kW)
8000
7000
6000
5000
4000
3000
2000
1000
0
1/1
1/15
1/29
2/12
2/26
3/12
3/26
4/9
4/23
5/7
5/21
6/4
6/18
7/2
7/16
7/30
8/13
8/27
9/10
9/24
10/8
10/22
11/5
11/19
12/3
12/17
12/31
2007


V7 Feeder Kilowatts vs. Half-hour Intervals for 2006
Showing Periods of Substation Transformer Overload
Substation Transformer Maximum Capacity at 6.6 MW (7 MVA)
Load (kW)
8000
7000
6000
5000
4000
3000
2000
1000
0
1/1
1/15
1/29
2/12
2/26
3/12
3/26
4/9
4/23
5/7
5/21
6/4
6/18
7/2
7/16
7/30
8/13
8/27
9/10
9/24
10/8
10/22
11/5
11/19
12/3
12/17
12/31
2006


V7 Feeder Kilowatts vs. Half-hour Intervals for 2005
Substation Transformer Maximum Capacity at 6.6 MW (7 MVA)
Load (kW)
8000
7000
6000
5000
4000
3000
2000
1000
0
1/1
1/15
1/29
2/12
2/26
3/12
3/26
4/9
4/23
5/7
5/21
6/4
6/18
7/2
7/16
7/30
8/13
8/27
9/10
9/24
10/8
10/22
11/5
11/19
12/3
12/17
12/31
2005


V7 Feeder Kilowatts vs. Half-hour Intervals for 2004
Substation Transformer Maximum Capacity at 6.6 MW (7 MVA)
Load (kW)
8000
7000
6000
5000
4000
3000
2000
1000
0
1/1
1/15
1/29
2/12
2/26
3/12
3/26
4/9
4/23
5/7
5/21
6/4
6/18
7/2
7/16
7/30
8/13
8/27
9/10
9/24
10/8
10/22
11/5
11/19
12/3
12/17
12/31
2004


MAXIMUM KILOWATTS VS. HALF-HOUR INTERVAL OVER 12-MONTH PERIOD
KILOWATTS
8000
7000
6000
5000
4000
3000
2000
1000
0
WINTER MAXIMUM
SUMMER MAXIMUM
Note winter morning peak occurs early morning when solar radiation is limited
Note winter evening peak occurs after sundown on short winter days
This anomaly is the result of an outage in the area
Note summer afternoon peak continues past sundown when solar is unavailable
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
HALF HOUR INTERVALS


V7 Feeder Load & Solar Radiation on February 6, 2008
Note there is no sun when the loads peaked at 7:30 a.m.
Note solar radiation peaks at noon when winter loads are down.
Load (kW)
8000
7000
6000
5000
4000
3000
2000
1000
0
Solar Radiation (Langleys)
70
60
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (Hour)
Solar Radiation Data from: "Arizona Meteorological Network - The University of Arizona"

THE UNIVERSITY OF ARIZONA

Arizona Cooperative Extension

AZMET

The Arizona Meteorological Network

Turf Reports

Yesterday's Weather Summary

Crop Reports

About AZMET

Data Access

Documentation

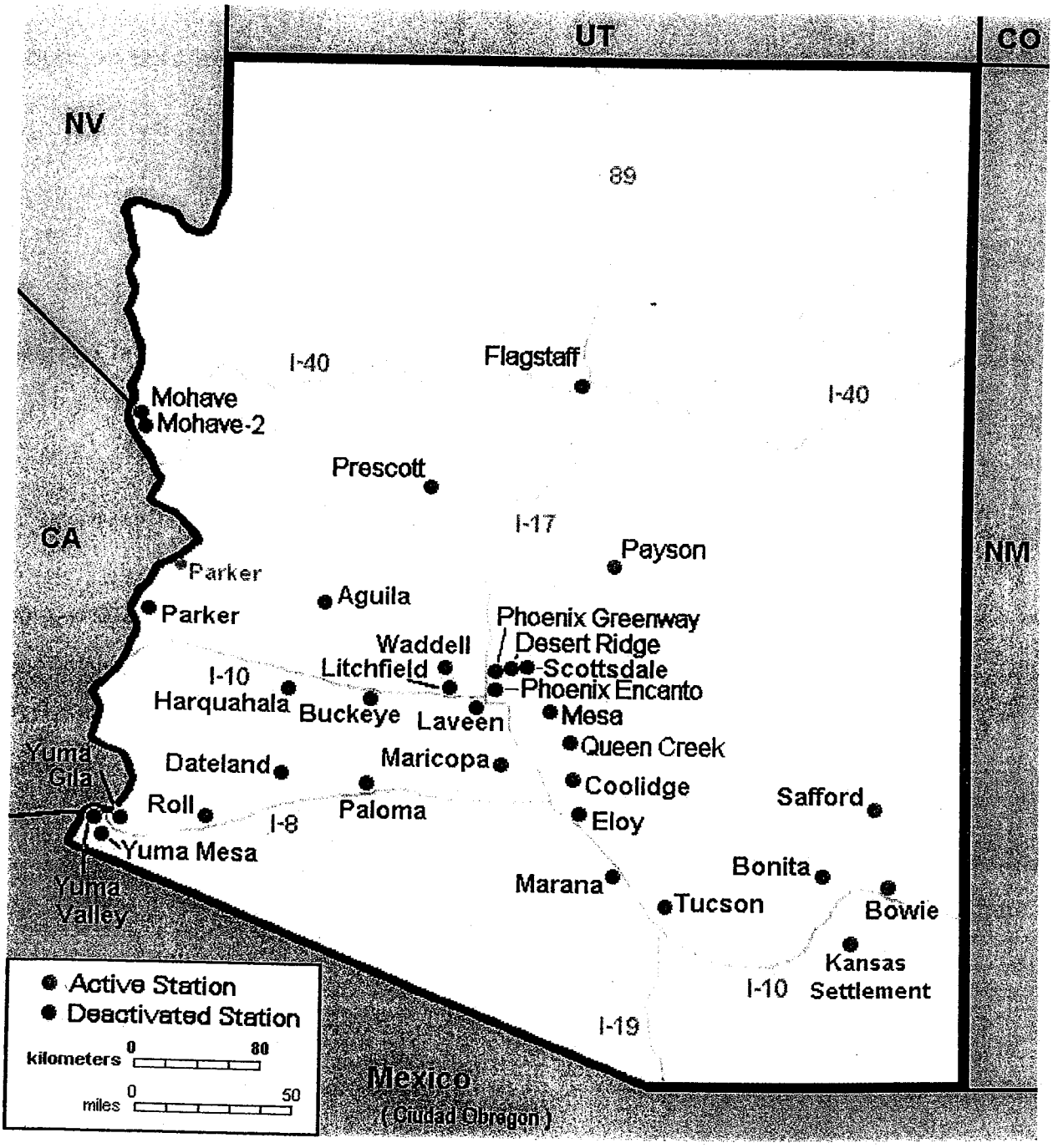
Other Sources of Weather Information

Disclaimer

Contact

Copyright © Arizona Board of Regents

AZMET : The Arizona Meteorological Network



- Latitude, Longitude, Elevation - All Stations
- Map of Arizona Landmarks
- Map of Arizona Counties

AZMET Hourly Weather Data : TUCSON : Feb 6 2008

HR	AT	TD	RH	VPD	SR	PPT	ST4	ST20	WS	WSX	WVM	WVD
1	31.8	31.1	97.1	0.0	0.0	0.00	41.5	48.7	1.1	2.7	1.1	96
2	31.8	30.9	96.0	0.0	0.0	0.00	40.6	48.7	1.3	2.7	1.3	97
3	30.9	30.2	97.3	0.0	0.0	0.00	39.7	48.6	0.9	2.0	0.9	63
4	29.5	29.1	98.7	0.0	0.0	0.00	39.0	48.6	0.9	2.0	0.9	53
5	28.4	28.4	99.7	0.0	0.0	0.00	38.5	48.4	0.9	2.0	0.7	80
6	27.7	27.7	99.8	0.0	0.0	0.00	37.9	48.4	0.9	2.0	0.9	98
7	27.3	27.3	99.8	0.0	0.0	0.00	37.4	48.2	1.1	2.5	1.1	97
8	28.4	28.0	98.3	0.0	2.4	0.00	37.2	48.2	1.6	2.7	1.6	93
9	34.5	30.2	84.0	0.1	19.8	0.00	37.0	48.0	2.2	4.5	2.2	90
10	39.9	31.1	70.7	0.3	36.3	0.00	39.0	47.8	2.7	4.3	2.5	53
11	45.5	31.3	57.3	0.4	49.7	0.00	42.8	47.7	2.2	6.0	1.3	67
12	49.3	29.7	46.6	0.6	59.3	0.00	46.6	47.5	2.5	6.7	1.3	79
13	51.3	28.2	40.7	0.8	62.8	0.00	50.0	47.3	4.7	11.0	4.0	299
14	53.4	27.3	36.3	0.9	60.4	0.00	52.7	47.3	4.3	9.4	3.4	270
15	55.2	24.8	30.7	1.0	52.6	0.00	54.3	47.3	3.6	8.9	2.7	309
16	57.4	22.6	25.7	1.2	40.1	0.00	55.2	47.3	2.5	7.2	1.8	296
17	56.7	25.0	29.2	1.1	23.6	0.00	54.7	47.3	6.5	10.3	6.0	287
18	54.5	28.6	37.0	0.9	6.4	0.00	52.7	47.5	7.6	13.2	7.4	293
19	50.7	30.4	45.6	0.7	0.0	0.00	50.7	47.7	3.4	7.6	3.1	297
20	43.5	33.8	68.5	0.3	0.0	0.00	48.7	47.8	1.1	2.0	0.9	101
21	40.1	34.9	81.4	0.2	0.0	0.00	46.9	48.0	0.9	2.5	0.7	101
22	37.6	34.3	88.4	0.1	0.0	0.00	45.5	48.2	1.3	2.7	1.1	58
23	36.1	33.8	91.8	0.1	0.0	0.00	44.4	48.2	0.9	2.2	0.7	125
24	34.2	33.1	95.4	0.0	0.0	0.00	43.3	48.4	1.3	3.8	1.3	75

AZMET Daily Weather Data : TUCSON : Feb 6 2008

	MAX.	MIN.	MEAN	TOTAL	UNITS
TEMPERATURE	58.6	26.2	40.6		DegF
RELATIVE HUMIDITY	100.0	18.7	71.5		%
DEWPOINT			29.7		DegF
ACTUAL VAPOR PRESS.			0.6		KPas
VAPOR PRESS. DEF.			0.4		KPas
SOIL TEMP. 4 in	55.2	37.0	44.8		DegF
SOIL TEMP. 20 in	48.7	47.1	48.0		DegF
WIND SPEED	13.2		2.5		MPH
WIND VECTOR MAG.			0.7		MPH
WIND VECTOR DIR.			334		Degrees
SOLAR RADIATION				413.5	Langleys
PRECIPITATION				0.00	Inches
AZMET REF. EVAPOTRANSPIRATION				0.10	Inches
STD. REF. EVAPOTRANSPIRATION				0.07	Inches

HEAT UNITS	86/55F		86/50F		86/45F	
----------	DAY	CUM	DAY	CUM	DAY	CUM
SINE CURVE	0.5	87	2.0	169	4.0	277

DEFINITIONS AND UNITS

AT : Air Temp (DegF)
TD : Dewpoint (DegF)
RH : Rel Humidity (%)
VPD : Vapor Pressure Deficit(KPas)
SR : Solar Rad (Langleys)
PPT : Precipitation (Inches)
DAY : Heat Units for Day
CUM : Heat Units Accumulated Since Jan 1, 2008

ST4 : Soil Temp 4in (DegF)
ST20 : Soil Temp 20in (DegF)
WS : Mean Wind Speed (MPH)
WSX : Max Wind Speed (MPH)
WVM : Wind Vector Magnitude (MPH)
WVD : Wind Vector Direction (Degrees)
or 999 : Missing Data

AZMET Hourly Weather Data : KANSAS SETTLEMENT : Feb 6 2008

HR	AT	TD	RH	VPD	SR	PPT	ST4	ST20	WS	WSX	WVM	WVD
1	21.7	18.3	85.8	0.1	0.0	0.00	36.5	48.7	3.6	6.0	3.4	118
2	19.9	17.4	89.2	0.0	0.0	0.00	35.4	48.7	2.5	5.6	2.2	120
3	18.5	15.6	88.6	0.0	0.0	0.00	34.3	48.7	1.6	5.8	1.3	164
4	19.0	16.7	89.9	0.0	0.0	0.00	33.6	48.7	2.7	5.6	2.5	113
5	17.1	14.7	90.1	0.0	0.0	0.00	32.9	48.6	3.6	6.7	3.6	136
6	17.1	14.7	90.2	0.0	0.0	0.00	32.4	48.6	1.6	3.8	1.1	48
7	16.0	13.8	90.4	0.0	0.0	0.00	31.6	48.6	1.3	4.0	0.7	140
8	17.4	15.1	89.6	0.0	4.5	0.00	31.3	48.6	1.8	3.6	1.6	46
9	26.1	20.5	78.6	0.1	21.7	0.00	30.9	48.4	0.9	2.7	0.7	350
10	31.1	24.1	74.9	0.2	37.3	0.00	31.3	48.4	2.5	6.5	2.2	331
11	36.9	25.0	62.2	0.3	50.4	0.00	32.9	48.4	2.0	5.4	1.6	327
12	41.7	21.9	45.2	0.5	59.0	0.00	38.1	48.2	2.9	8.1	2.0	315
13	45.0	16.9	31.9	0.7	62.1	0.00	43.2	48.2	3.1	8.5	2.2	301
14	47.8	15.1	26.5	0.8	59.5	0.00	47.5	48.0	5.1	10.7	4.5	321
15	50.5	19.4	28.7	0.9	50.9	0.00	50.7	48.0	5.6	12.1	4.5	290
16	52.9	19.4	26.4	1.0	38.0	0.00	52.9	47.8	5.1	11.6	4.7	254
17	53.6	15.8	22.1	1.1	22.7	0.00	53.2	47.8	6.9	12.1	6.7	285
18	50.5	17.1	26.3	0.9	6.0	0.00	52.3	47.7	8.3	11.6	8.1	296
19	44.8	18.0	33.8	0.7	0.0	0.00	50.2	47.7	7.6	10.1	7.6	294
20	40.1	18.5	41.5	0.5	0.0	0.00	48.0	47.7	3.4	7.2	2.0	265
21	38.5	19.9	46.8	0.4	0.0	0.00	45.9	47.7	1.6	4.9	0.2	24
22	37.6	20.5	49.5	0.4	0.0	0.00	44.1	47.7	2.0	5.4	1.6	3
23	34.0	20.3	56.7	0.3	0.0	0.00	42.4	47.7	2.7	4.9	0.4	227
24	32.7	20.1	59.3	0.3	0.0	0.00	41.0	47.7	3.1	6.0	0.4	148

AZMET Daily Weather Data : KANSAS SETTLEMENT : Feb 6 2008

	MAX.	MIN.	MEAN	TOTAL	UNITS
TEMPERATURE	55.0	12.6	33.8		DegF
RELATIVE HUMIDITY	93.8	20.9	59.3		%
DEWPOINT			18.3		DegF
ACTUAL VAPOR PRESS.			0.3		KPas
VAPOR PRESS. DEF.			0.4		KPas
SOIL TEMP. 4 in	53.4	30.9	40.5		DegF
SOIL TEMP. 20 in	48.7	47.7	48.2		DegF
WIND SPEED	12.1		3.4		MPH
WIND VECTOR MAG.			1.3		MPH
WIND VECTOR DIR.			296		Degrees
SOLAR RADIATION				412.3	Langleys
PRECIPITATION				0.00	Inches

AZMET REF. EVAPOTRANSPIRATION	0.10	Inches
STD. REF. EVAPOTRANSPIRATION	0.08	Inches

HEAT UNITS	86/55F		86/50F		86/45F	
----------	DAY	CUM	DAY	CUM	DAY	CUM
SINE CURVE	0.0	28	0.7	76	2.2	147

DEFINITIONS AND UNITS

AT : Air Temp (DegF)
TD : Dewpoint (DegF)
RH : Rel Humidity (%)
VPD : Vapor Pressure Deficit(KPas)
SR : Solar Rad (Langleys)
PPT : Precipitation (Inches)
DAY : Heat Units for Day
CUM : Heat Units Accumulated Since Jan 1, 2008

ST4 : Soil Temp 4in (DegF)
ST20 : Soil Temp 20in (DegF)
WS : Mean Wind Speed (MPH)
WSX : Max Wind Speed (MPH)
WVM : Wind Vector Magnitude (MPH)
WVD : Wind Vector Direction (Degrees)
or 999 : Missing Data

AZMET Raw Data Formats

Hourly and Daily Data Formats

AZMET provides edited data in comma delimited ASCII format for use in application and database programs.
There are two types of comma delimited data files:
1) Hourly and 2) Daily.
In all raw data files, the units of measurement are Metric.

1) Hourly summaries contain hourly means and totals for all weather parameters monitored or calculated by AZMET.
The Raw Hourly Data file will contain hourly data only.
These files can be loaded into programs and data bases.

2) Daily data files contain only the daily data summaries.
The summary format differs slightly from that presented in the hourly data files. (See below).

All data summaries (both hourly and daily) terminate with a carriage return line feed character sequence. The rest of this document identifies the sequence and units for individual data points within a given data summary. Data points are identified and described in the order in which they appear in the file (left to right). NOTE! Data declared bad by AZMET Editing routines will appear as the integer 9999 or 999.

In 1999 we changed the depths of our soil temperature sensors : 1999 Soil Temperature Depths .

1) HOURLY DATA FILES

```
DATA POINT
NUMBERS -->  1  2  3  4    5    6  7 8  9   10   11  12  13  14 15  16  17
             |  |  |  |    |    |  | |  |    |    |   |   |   | |   |   |
            92,254,1,20.9,42.2,1.4,0,0,25.5,27.6,1.6,1.3,147,33,2.6,.05,.34
DATA -->    92,254,2,19.5,49.8,1.1,0,0,24.8,27,1,.8,192,37,1.5,.03,.28
            92,254,3,19.1,51,1.1,0,0,24.2,26.5,1,.8,236,41,2.3,.03,.26
            92,254,4,18.1,55.1,.9,0,0,23.7,26,1.3,.8,289,48,2.5,.02,.22
```

Hourly Summaries

Data Point #	Explanation
1	Year of data. A two-digit number representing the last two digits of the year (e.g. 87 means 1987)
2	Day of year. This varies from 1 to 366 depending on the day of the year and whether the year is Leap Year.
3	Hour of day. Varies from 1 to 24 and represents the time of day the

subsequent data were obtained. For data representing means and totals, the time represents the end of the averaging or totalizing period (e.g. means and totals obtained at hour 12 represent means and totals over the 60-minute period ending at 12:00).

4 Mean air temperature in degrees Celsius.

5 Mean relative humidity in percent.

6 Mean vapor pressure deficit in kilo-pascals.

7 Total solar radiation in megajoules per square meter.

8 Total precipitation in millimeters.

9 Current soil temperature at 5cm depth in degrees Celsius. Soil surface is bare. Moved to 10cm in 1999.

10 Current soil temperature at 10cm depth in degrees Celsius. Soil surface is bare. Moved to 50cm in 1999.

11 Mean wind speed in meters per second.

12 Wind vector magnitude in meters per second.

13 Wind vector direction in degrees.

14 Standard deviation of the wind direction in degrees.

15 Maximum wind speed for hour in meters per second.

16 Reference crop evapotranspiration in millimeters.

17 Heat unit (degree day) total for hour. Heat unit limits are 30 and 12.8 C.

2) DAILY DATA FILES

```
DATA POINT
NUMBERS -->    1  2  3  4    5    6    7    8   9    10   11  12 13  14
               |  |  |  |    |    |    |    |   |    |    |   |  |   |
DATA -->      92,254,6,40.2,15.1,27.6,69.9,7.9,33.5,3.1,23.45,0,38,22.4,
                                29.3,34.1,24.7,29.1,1.3,.5,14,66,4.2,6.6,12
                                  |    |    |    |   |  |   |  |  |   |   |
DATA POINT NUMBERS -->           15   16   17   18  19 20  21 22 23  24  25
```

* NOTE: Daily data is actually all on one line per day, it has been put on two lines here to label each data point by number.

Data Point #	Explanation
1	Year of data. A two-digit number representing the last two digits of the year (e.g. 87 = 1987).
2	Day of year. This varies from 1 to 366 depending on day of year and whether year is a Leap Year.
3	Station number. Each station has an assigned number to aid data retrieval and database management. Listed below are the locations and their corresponding station numbers:

Station Number	Location	Station Number	Location
1	Tucson	14	Yuma North Gila
2	Yuma Valley	15	Phoenix Encanto
3	Yuma Mesa	16	Eloy
4	Safford	17	Dateland
5	Coolidge	18	Scottsdale
6	Maricopa	19	Paloma
7	Aguila	20	Mohave
8	Parker	21	Laveen
9	Bonita	22	Queen Creek
10	Waddell, Citrus Farm	23	Harquahala
11	Litchfield	24	Roll
12	Phoenix Greenwa	25	Ciudad Obregon
13	Marana	26	Buckeye

4	Maximum air temperature in degrees Celsius.
5	Minimum air temperature in degrees Celsius.
6	Mean air temperature in degrees Celsius.
7	Maximum relative humidity in percent.
8	Minimum relative humidity in percent.
9	Mean relative humidity in percent.
10	Mean vapor pressure deficit in kilopascals.
11	Total solar radiation in megajoules per square meter.
12	Total precipitation in millimeters.
13	Maximum soil temperature at 5cm depth in degrees Celsius. Bare soil surface.

Moved to 10cm in 1999.

14 Minimum soil temperature at 5cm depth in degrees Celsius. Bare soil surface. Moved to 10cm in 1999.

15 Mean soil temperature at 5 cm depth in degrees Celsius. Bare soil surface. Moved to 10cm in 1999.

16 Maximum soil temperature at 10cm depth in degrees Celsius. Bare soil surface. Moved to 50cm in 1999.

17 Minimum soil temperature at 10cm depth in degrees Celsius. Bare soil surface. Moved to 50cm in 1999.

18 Mean soil temperature at 10cm depth in degrees Celsius. Bare soil surface. Moved to 50cm in 1999.

19 Mean wind speed in meters per second.

20 Wind vector magnitude in meters per second.

21 Wind vector direction in degrees.

22 Wind direction standard deviation in degrees.

23 Maximum wind speed in meters per second.

24 Total reference evapotranspiration in millimeters.

25 Daily heat unit (degree day) total. Heat unit limits are 30 and 12.8 C.

Raw Data Formats : 2003 - Present

AZMET offers two types of comma delimited (ASCII format) data files: Hourly and Daily.
These raw data files can be loaded into spreadsheets
and databases such as Excel and Access, etc.
The raw files can also be read by advanced programming languages.
In all raw data files, the units of measurement are Metric.

In an effort to improve our service, we have made major changes
to the format of our raw data files from 2003 to present.
Both the Raw Hourly and Raw Daily files are altered.

All data for 2003 has been reprocessed and put into these new formats.
(Raw data files from 2002 and earlier, are still in the old original format.
Although, we are considering reworking past years into the new format.)

The Raw Hourly data has two new values added to the end of each line of data:
Actual Vapor Pressure (hourly average) at data point position 17
Dewpoint (hourly average) at data point position 18
The hourly integrated heat unit value which was at data point position 17
will be removed due to lack of use. The more widely accepted sine curve heat unit
value can still be found in the raw daily data.
Each hourly line will have a total of 18 values.

The Raw Daily data has three new values added to the end of each line of data:
Reference Evapotranspiration (ETo) by Penman-Monteith equation, at data point
position 26
Actual Vapor Pressure (daily mean at data point position 27
Dewpoint (daily mean) at data point position 28
Also note that the positions of the original AZMET ETo and heat unit values
have been transposed from the order of previous years.
Each daily line will have a total of 28 values.

In 1999 we changed the depths of our soil temperature sensors : 1999 Soil Temperature
Depths .

HOURLY FILES (2003 - Present) :

```
DATA POINT
NUMBERS --> 1  2  3  4    5    6  7 8  9   10   11  12  13  14 15  16  17  18
            |  |  |  |    |    |  | |  |    |    |   |   |   |  |   |   |   |
DATA --> 2003,254,1,20.9,42.2,1.4,0,0,25.5,27.6,1.6,1.3,147,33,2.6,.05,.34,-.3
```

Data Point		Description
1	A	Year
2	B	Day of Year (DOY)
3	C	Hour of Day
4	D	Air Temperature
5	E	Rel. Humidity
6	F	Vapor Pressure Deficit
7	G	Solar Radiation
8	H	Precipitation
9	I	4" Soil Temperature (= 2" prior to 1999)
10	J	20" Soil Temperature (= 4" prior to 1999)
11	K	Wind Speed (Ave)
12	L	Wind Vector Magnitude
13	M	Wind Vector Direction
14	N	Wind Direction Standard Deviation
15	O	Max Wind Speed
16	P	Reference Evapotranspiration (ETo) - Original AZMET
17	Q	Actual Vapor Pressure 'New' : 2003 to Present
18	R	Dewpoint, Hourly Average 'New' : 2003 to Present

DAILY FILES (2003 - Present) :

```
DATA POINT
NUMBERS -->    1  2  3  4    5    6    7    8   9   10   11  12 13  14
               |  |  |  |    |    |    |    |   |    |    |   |  |   |
DATA -->    2003,254,6,40.2,15.1,27.6,69.9,7.9,33.5,3.1,23.45,0,38,22.4,
                       29.3,34.1,24.7,29.1,1.3,.5,14,66,4.2,12,6.2,6,.4,.2
                        |    |    |    |   |  |   |  |  |   |   |  |  |  |
DATA POINT NUMBERS --> 15   16   17   18  19 20  21 22 23  24  25  26 27 28
```

* NOTE: Daily data is actually all on one line per day,
it has been put on two lines here to label each data point by number.

Data Point		Description
1	A	Year
2	B	Day of Year (DOY)
3	C	Station Number
4	D	Air Temp - Max
5	E	Air Temp - Min
6	F	Air Temp - Mean
7	G	RH - Max
8	H	RH - Min
9	I	RH - Mean

10	J	VPD - Mean	
11	K	Solar Rad. - Total	
12	L	Precipitation - Total	
13	M	4" Soil Temp - Max (= 2" prior to 1999)	
14	N	4" Soil Temp - Min (= 2" prior to 1999)	
15	O	4" Soil Temp - Mean (= 2" prior to 1999)	
16	P	20" Soil Temp - Max (= 4" prior to 1999)	
17	Q	20" Soil Temp - Min (= 4" prior to 1999)	
18	R	20" Soil Temp - Mean (= 4" prior to 1999)	
19	S	Wind Speed - Mean	
20	T	Wind Vector Magnitude for Day	
21	U	Wind Vector Direction for Day	
22	V	Wind Direction Standard Deviation for Day	
23	W	Max Wind Speed	
24	X	Heat Units (30/12.8 C) (86/55 F)	| positions
25	Y	Reference Evapotranspiration (ETo) = Original AZMET	| switched 2003
26	Z	Reference Evapotranspiration (ETo) = Penman-Monteith	'New' 2003-Present
27	AA	Actual Vapor Pressure - Daily Mean	'New' 2003-Present
28	AB	Dewpoint, Daily Mean	'New' 2003-Present

STATION NUMBERS

1 = Tucson	11 = Litchfield	21 = Laveen	31 = Prescott
2 = Yuma Valley	12 = Phx. Greenway	22 = Queen Creek	32 = Payson
3 = Yuma Mesa	13 = Marana	23 = Harquahala	33 = Bowie
4 = Safford	14 = Yuma N. Gila	24 = Roll	34 = Kansas Settleme
5 = Coolidge	15 = Phx. Encanto	25 = Ciudad Obregon	
6 = Maricopa	16 = Eloy	26 = Roll	
7 = Aguila	17 = Dateland	27 = Desert Ridge	
8 = Parker	18 = Scottsdale	28 = Mohave #2	
9 = Bonita	19 = Paloma	29 = Mesa	
10 = Citrus Farm	20 = Mohave	30 = Flagstaff	

AZMET Units of Measurement Conversion Factors

AZMET weather stations record and store data in metric units.
The data contained in our Raw Hourly and Daily files is in metric units.
The word 'English' here does not refer to the language.
'English' units are those units of measurements which were standardized

and used throughout Great Britain.

	METRIC UNITS	CONVERSION ----->	ENGLISH UNITS
Air Temperature	DegC	* 1.8 + 32	DegF
Relative Humidity	%	-none-	%
Vapor Pressure Deficit	KPas	-none-	KPas
Solar Radiation	MJ/Sq M	* 23.89	Langleys
Precipitation	MM	* .03937	Inches
Soil Temperature	DegC	* 1.8 + 32	DegF
Wind Speed	M/S	* 2.237	MPH
Wind Vector Magnitude	M/S	* 2.237	MPH
Wind Vector Direction	Deg	-none-	Deg
Wind Direction Standard Deviation	Deg	-none-	Deg
Reference Evapotranspiration	MM	* .03937	Inches
Heat Units	(C)	* 1.8	(F)

The '*' symbol means "multiply by"

METRIC	ABBR.	UNITS
Air Temperature	DegC	Degrees Centigrade
Relative Humidity	%	Percent
Vapor Pressure Deficit	KPas	Kilopascals
Solar Radiation	MJ/Sq M	MegaJoules per Square Meter
Precipitation	MM	Millimeters
Soil Temperature	DegC	Degrees Centigrade
Wind Speed	M/S	Meters per Second
Wind Vector Magnitude	M/S	Meters per Second
Wind Vector Direction	Deg	Degrees
Wind Direction Standard Deviation	Deg	Degrees
Reference Evapotranspiration	MM	Millimeters
Heat Units	HU	Heat Units in Centigrade

ENGLISH	ABBR.	UNITS
Air Temperature	DegF	Degrees Fahrenheit
Relative Humidity	%	Percent
Vapor Pressure Deficit	KPas	Kilopascals
Solar Radiation	--	Langleys
Precipitation	In	Inches
Soil Temperature	DegF	Degrees Fahrenheit
Wind Speed	MPH	Miles per Hour
Wind Vector Magnitude	MPH	Miles per Hour
Wind Vector Direction	Deg	Degrees
Wind Direction Standard Deviation	Deg	Degrees
Reference Evapotranspiration	In	Inches
Heat Units	HU	Heat Units in Fahrenheit

Regional Technical Seminar

West Regional Technical Seminar
Phoenix AZ
Tuesday January 31, 2006

Industry Practice on Transformer Loading

H. Jin Sim
919-580-3234
jin.sim@waukeshaelectric.spx.com
Waukesha Electric Systems
Goldsboro, NC office

energysolutions
...to power your future

WAUKESHA ELECTRIC SYSTEMS

Agenda

- Industry Guides
- Limiting Parameters for Overloading
- Theoretical Life
- Functional Life
- User's Practice – Worldwide Survey

Let's make this interactive!

Please stop me and ask questions during the presentation if you have them.

energysolutions
...to power your future

WAUKESHA ELECTRIC SYSTEMS

Industry Practice on Transformer Loading

- **Industry Guides**

old

C57.91-1981
Distribution Tr.

C57.92-1981
Power Tr.

C57.115-1991
Power Tr.>100MVA

⇒ ANSI/IEEE C57.91-1995 Guide for Loading Transformers *

New

*** This guide is currently being revised by the IEEE Transformers Committee**

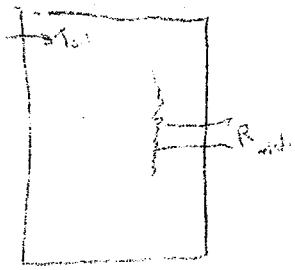
IEC Publication 354 (1991) Loading Guide for oil-immersed power transformers (This is being revised by IEC TC14 and will be re-numbered as IEC 60076-7)

energysolutions
... to power your future

WAUKESHA ELECTRIC SYSTEMS

Industry Practice on Transformer Loading

- **Industry Guides**
  - Main differences between IEEE and IEC standards and guides are limits and calculation methods for Hot-spot temperature
  - IEC limits are lower (160 °C) than the IEEE limit of 180 °C
  - IEC calculation utilize the H factor of 1.1(for Distribution Tr.) to 1.3 (for Power Tr.)
  - New IEC revision will state this H factor ranges 1.0-2.1
    - With default value of 1.1 for Distribution Tr. And 1.5 for ON or OF cooling and 1.2 for OD cooling Power Tr.
  - IEEE requires more accurate calculation and verification (C57.12.00)



waukesha limits 140°C

energysolutions
... to power your future

WAUKESHA ELECTRIC SYSTEMS

Industry Practice on Transformer Loading

- **Limiting Parameters for Overloading**
  - Under old guides:
    - **Top oil temperature ≤ 110 °C**
    - **Winding Hot-spot temperature ≤ 180 °C**
    - **Maximum short-time loading ≤ 2 times Maximum Nameplate rating**
  - Under 1995 guide; (*for distribution transformers*)
    - **Top oil temperature ≤ 120 °C**
    - **Winding Hot-spot temperature ≤ 200 °C**
    - **Short-time loading (1/2 hours or less) ≤ 3 times Maximum Nameplate rating**
  - Under 1995 guide; (*for power transformers*)
    - **Top oil temperature ≤ 110 °C**
    - **Winding Hot-spot temperature ≤ 180 °C**
    - **Maximum loading ≤ 2 times Maximum Nameplate rating**

energysolutions
... to power your future

WAUKESHA ELECTRIC SYSTEMS

Industry Practice on Transformer Loading

Under IEC 354-1991:

Types of Loading	Distribution Transformers	Medium Power Transformers	Large Power Transformers
Normal cyclic loading			
Current (p.u.)	1.5	1.5	1.5
Hot-spot temperature and metallic parts in contact with insulating material (°C)	140	140	140
Top-oil temperature (°C)	105	105	105
Long-time emergency cyclic loading			
Current (p.u.)	1.8	1.5	1.3
Hot-spot temperature and metallic parts in contact with insulating material (°C)	150	140	130
Top-oil temperature (°C)	115	115	115
Short-time emergency cyclic loading			
Current (p.u.)	2.0	1.8	1.5
Hot-spot temperature and metallic parts in contact with insulating material (°C)	N/A	160	160
Top-oil temperature (°C)	N/A	115	115

energysolutions
... to power your future

WAUKESHA ELECTRIC SYSTEMS

Industry Practice on Transformer Loading

- **Theoretical Life**

$$Life = \exp\left(\frac{15000}{HST + 273} - 27.604\right)$$

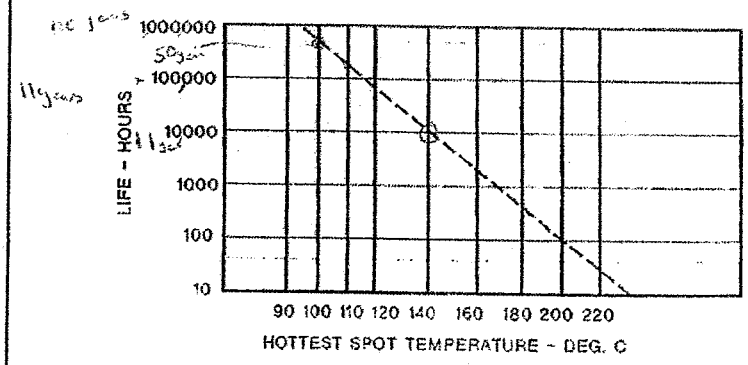
Where, Life = Life in hours at temperature HST
HST = Hot Spot Temperature in °C

energysolutions
... to power your future

WAUKESHA ELECTRIC SYSTEMS

Industry Practice on Transformer Loading

- **Theoretical Life**



energysolutions
... to power your future

WAUKESHA ELECTRIC SYSTEMS

Industry Practice on Transformer Loading

- **Theoretical Life**

Basis	Normal insulation life	
	Hours	Years
50% retained tensile strength of insulation (former IEEE Std C57.92-1981 criterion)	65,000	7.42
25% retained tensile strength of insulation	135,000	15.41
200 retained degree of polymerization in insulation	150,000	17.12
Interpretation of distribution transformer functional life test data (former IEEE Std C57.91-1981 criterion)	180,000	20.55

"Normal insulation life" of a well-dried, oxygen-free 65 °C average winding temperature rise insulation system at the reference temperature of 110 °C.

energysolutions
to power your future

WAUKESHA ELECTRIC SYSTEMS

Industry Practice on Transformer Loading

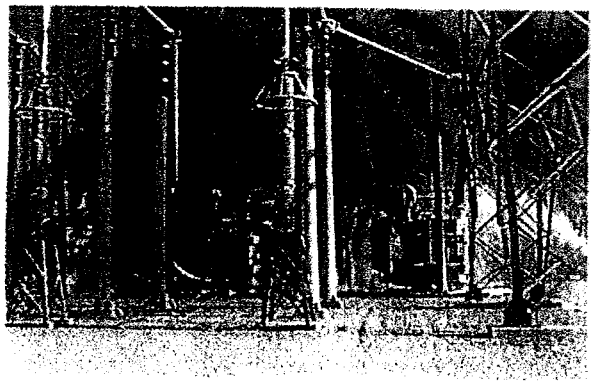
- **Theoretical Life**
  - Aging of insulation materials is caused by
    - Moisture
    - Oxygen
    - Temperature
    - Time
  - Proper application of oil preservation systems and maintenance can minimize the moisture and oxygen content
  - Proper loading can minimize the hot-spot temperature

energysolutions
to power your future

WAUKESHA ELECTRIC SYSTEMS

Industry Practice on Transformer Loading

Functional Life



MPEG Video

energysolutions
... to power your future

WAUKESHA ELECTRIC SYSTEMS

Industry Practice on Transformer Loading

- **Functional Life**
  - Defined as conditions which the transformer does not function as intended
  - Overloading can cause "Bubbles" in the oil to cause dielectric failures (Hot-spot Temp.)
  - Overloading can cause tank pressure build-up to cause gasket leaks and PRD operation (Average Oil Temp.)
  - Other loading related issues: Current carrying components' ratings, CT saturation, Lead heating, leakage flux overheating, etc.

energysolutions
... to power your future

WAUKESHA ELECTRIC SYSTEMS

Industry Practice on Transformer Loading

- **Functional Life (Bubble)**
  - Sources of Bubbles
    - Gasses Dissolved in Oil
    - Gasses Generated from Decomposition of insulation
    - Water Vapor from Paper Insulation in Windings
  - Sudden release of gas/vapor as bubbles is possible under overloading

energysolutions
...to power your future

WAUKESHA ELECTRIC SYSTEMS

Industry Practice on Transformer Loading

- **Functional Life (Bubbles)**
  - Next series of slides were presented to IEEE T&D Conference in Atlanta in 2001 by T.V. Oommen, Permission to use them granted by the author
  - Based on Two EPRI Reports
    - EL-6761, March 1990
    - EL-7291, March 1992

energysolutions
...to power your future

WAUKESHA ELECTRIC SYSTEMS

SSVEC

V-7 Milsoft Analysis

V7 Analysis
July 2009
David J. Bryan, P.E.

Objective

A request was made to study a 336 ACSR, 25 KV distribution line from Huachuca West substation to the proposed Sonoita substation. The new line would be an express feeder, meaning there would be no local loads or taps connected to the line. The question is: how much additional load could this solution support?

The line would be constructed as a second circuit on the existing line. It should be noted that whether the proposed express feeder is part of a double circuit or built adjacent to the existing line does not effect a power flow analysis.

Details of Analysis

For the analysis, a new Milsoft model was created with detailed individual customers and line segments. Development of the model used the following specifications and parameters: the model used a July 2007 line facility export from SSVEC's GIS, and the typical construction unit was changed from a standard RUS C1 construction to SSVEC's standard overhead neutral unit, which is a common unit used in rural line design.

The model used consumer loads and feeder peak data from February 2008;the load mix was 37.5% constant power, 37.5% constant impedance, and 25% constant amps. This approximates standards from industry articles and manuals.

Load allocation was performed with a peak load of 7132 kW (February 6, 2008), an increase of 18.5% over previous analysis peak of 6021 kW in July 2007. The load factors were decreased significantly from 50-60% to 18 -- 25% to match typical consumer load factors at this time of year. As a point of reference, the load factor is a ratio of energy used versus peak demand. At 100% load factor, the peak demand is on 100% of the time; 50% load factor, peak is on 50% of the time.

The parameters identified for this model development produce much more accurate and detailed analysis compared to prior models. While this does not make a significant difference in the results previously reported, it does provide the best analysis that can be done at this time.

The base case with the existing configuration model with no improvements was analyzed for voltage and capacity issues, and the results shown in Figure 1. The model identified several line segment locations with unacceptable voltages (below 118V) and protective devices overloaded beyond their rated ampacity. This matched previous analysis done in November 2007..

A 477 ACSR express feeder, approximately 23 miles long, was modeled from the Huachuca West substation to the Sonoita substation site (Figure 2). SSVEC conductor size standards do not include 336ACSR; the next standard size was used for this model. The use of 477ACSR instead of 336ACSR provides an additional 26% ampacity [530amps to 670amps] with a 42% reduction in conductor resistance. For a 23 mile long distribution line, this is a significant reduction in

voltage drop, as shown in Figure 3 as compared to Figure 2. The rest of analysis and report is based on the use of 477ACSR wire.

At the Sonoita substation site, the existing incoming distribution line was opened to the east of the T-junction, immediately west of the existing Sonoita regulators. With this configuration, the Huachuca West substation serves the load from Mustang Corner to the Highway 83 and Papago Springs Road intersection.

With no improvements nor changing of any existing line regulators, the model indicated low voltages on the Elgin single phase tap and three phase line to Patagonia. Typical benefits of this significant amount of improvements are that all low-voltage and capacity issues are instantly corrected, which did not occur..

Loads in the Patagonia area were re-phased to balance the three phases' loading. The amperage went from 53-33-38 to 41-33-49 amps. All line regulators were removed and reinstalled individually using multiple load flow runs. Capacitors were also tried to correct low voltage issues, but did not work as a likely result of high line charging capacitance. The end result was that:

1) the three line regulators from Huachuca West substation to the new Sonoita substation were removed;
2) the existing Elgin regulator was moved upstream and a second regulator installed;
3) A new regulator bank at the end of the 477 ACSR express feeder was installed.

The net result was that two three phase regulator banks were removed and one additional single phase regulator was installed. The load flow results at the end of this step are shown in Figure 4.

It should be noted the load flow showed low voltage on the 477 ACSR express feeder prior to the line regulator. However since there are no customers on this express feeder, this low-voltage is acceptable.

Using successive load flow analyses, the residential and commercial loads were increased in the model to indicate growth. Irrigation and spot load (greater than 100 kW) were not increased. The majority of the load growth was on that portion of line between Sonoita and Patagonia; significant growth from Mustang corner to the new Sonoita substation site; and minor growth on the single phase tap to Elgin. A summary of the growth is shown below.

Location	kW Increase	% Increase
Mustang corner to new Sonoita substation site	38.9	2.4%
South and West of Sonoita	151	10.6%
Single phase to Elgin	66.2	8.2%
Total Substation including other areas besides 3 above	362	4.8%

The load flow results of the feeder with the improvements and the load growth are shown in Figure 5.

Losses

There are significant losses on the existing configuration of the V7 feeder – just over 24% (1734kW) during peak loading conditions. The proposed 477 ACSR express feeder model drops the losses to over 12% during peak loading conditions. These percentages are based on the Milsoft load flow analysis, which does not include losses due to line regulators.

Capacity

The analysis did not include correcting devices whose capacity was overloaded. The overloaded devices include line reclosers, substation transformer, and substation regulators. Line reclosers would be changed out as part of any large-scale facilities upgrade in an area. The current Huachuca substation transformer's maximum rating is 7000 kW, and the transformer is serving over 7000kW. The current substation's regulators are rated at 200 amps at the neutral setting, and the regulators are carrying over 190 amps.

Summary

Adding an express feeder line that is 23 miles long, 477ACSR, overhead 3phase, rebuilding the substation, and including some other minor improvements allows an additional 362kW to be served. For planning, SSVEC assumes the average household has 7kW of peak load. This equates to approximately 52 additional homes can be served.

Respectively submitted August 7, 2009

David J. Bryan, P.E.
Engineer
SSVEC

David Bryan

Digitally signed by David Bryan
DN: cn=David Bryan, c=US, o=SSVEC, ou=Engineering, email=dbryan@ssvec.com
Date: 2009.08.07 15:15:26 -07'00'

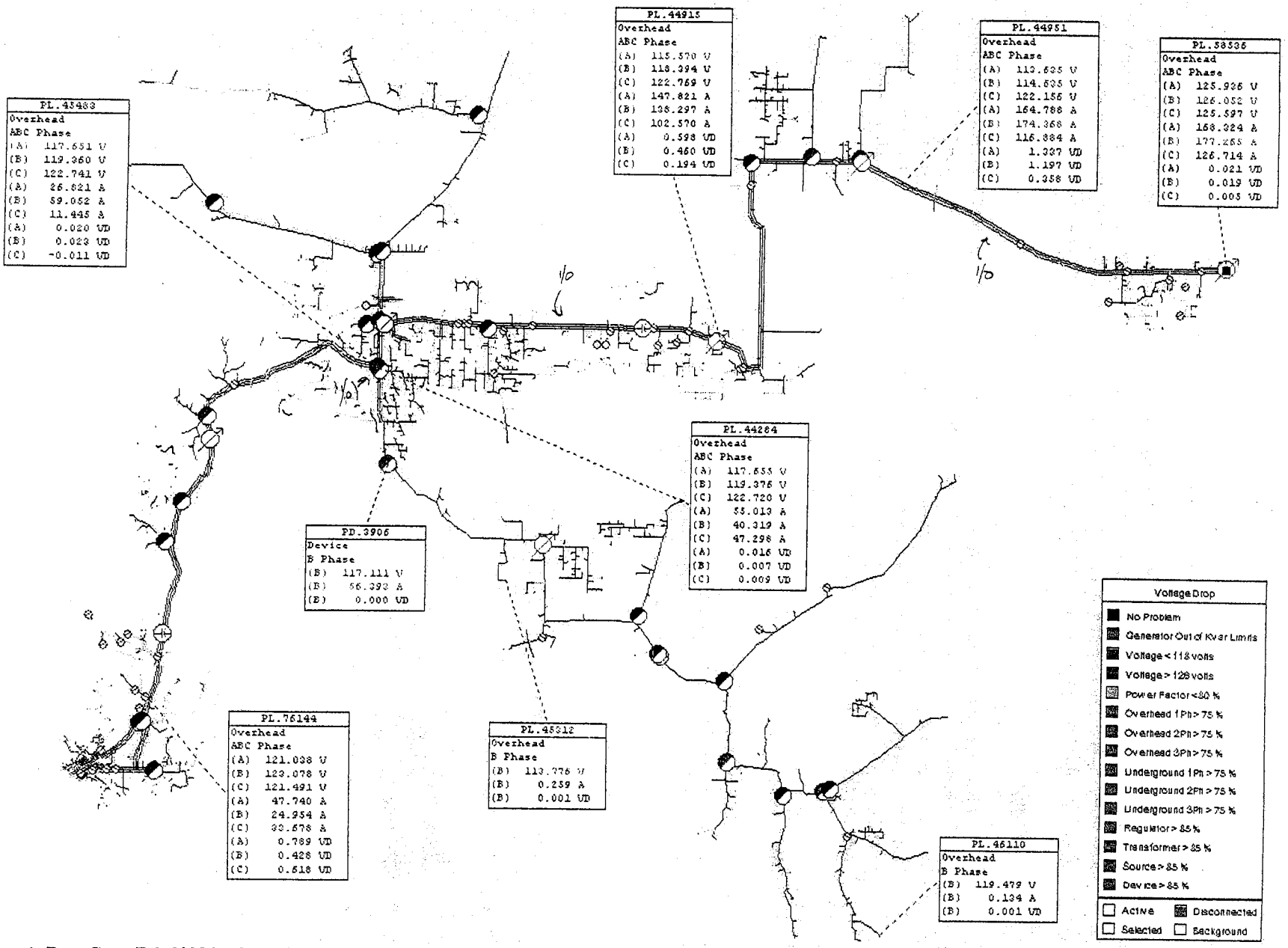


Figure 1: Base Case, Feb 2008 loads, no improvements

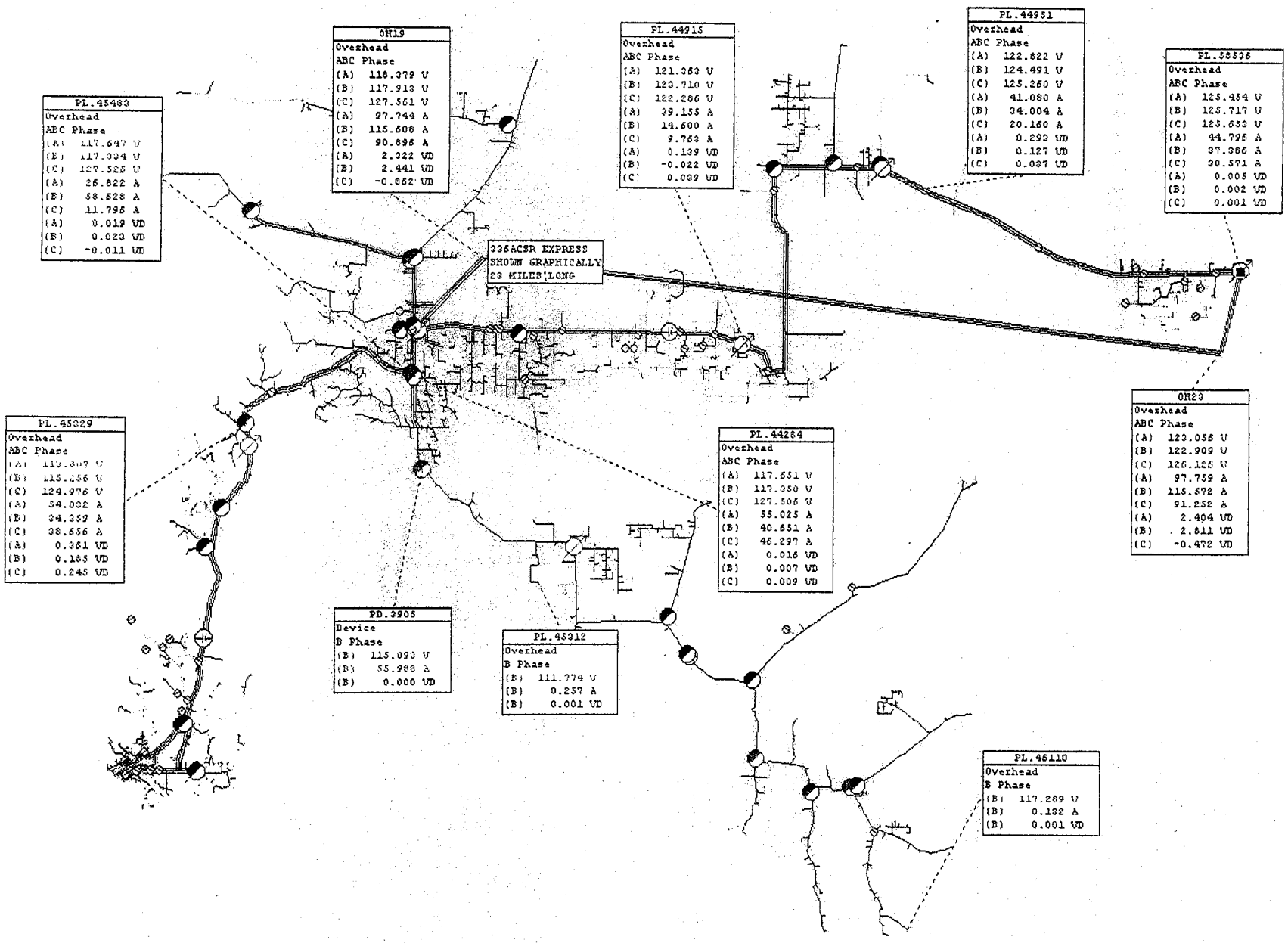


Figure 2: Added 336ACSR line [shown physically incorrect], no other changes, no growth

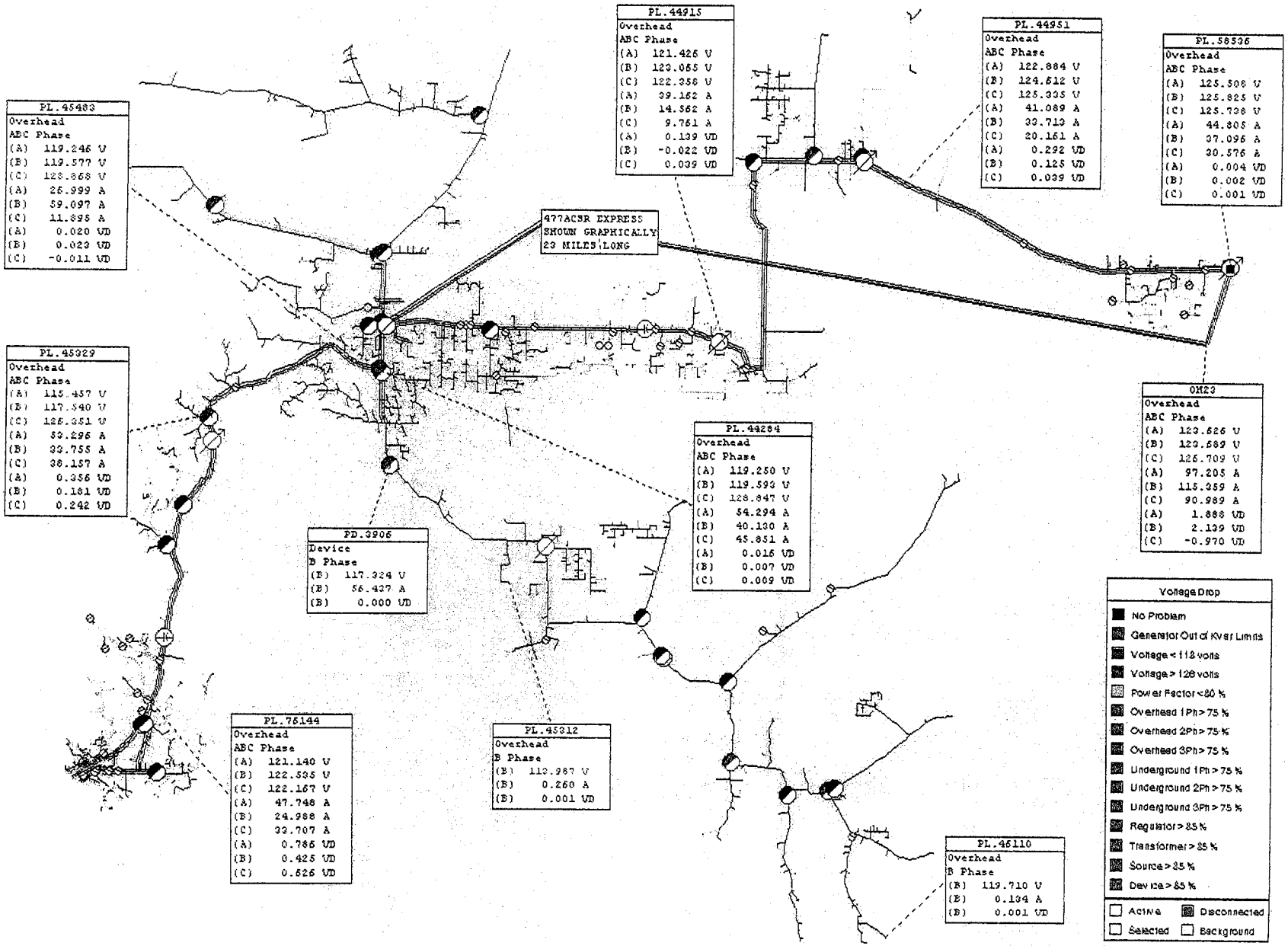


Figure 3: Added 477ACSR line [shown physically incorrect], no other changes, no growth

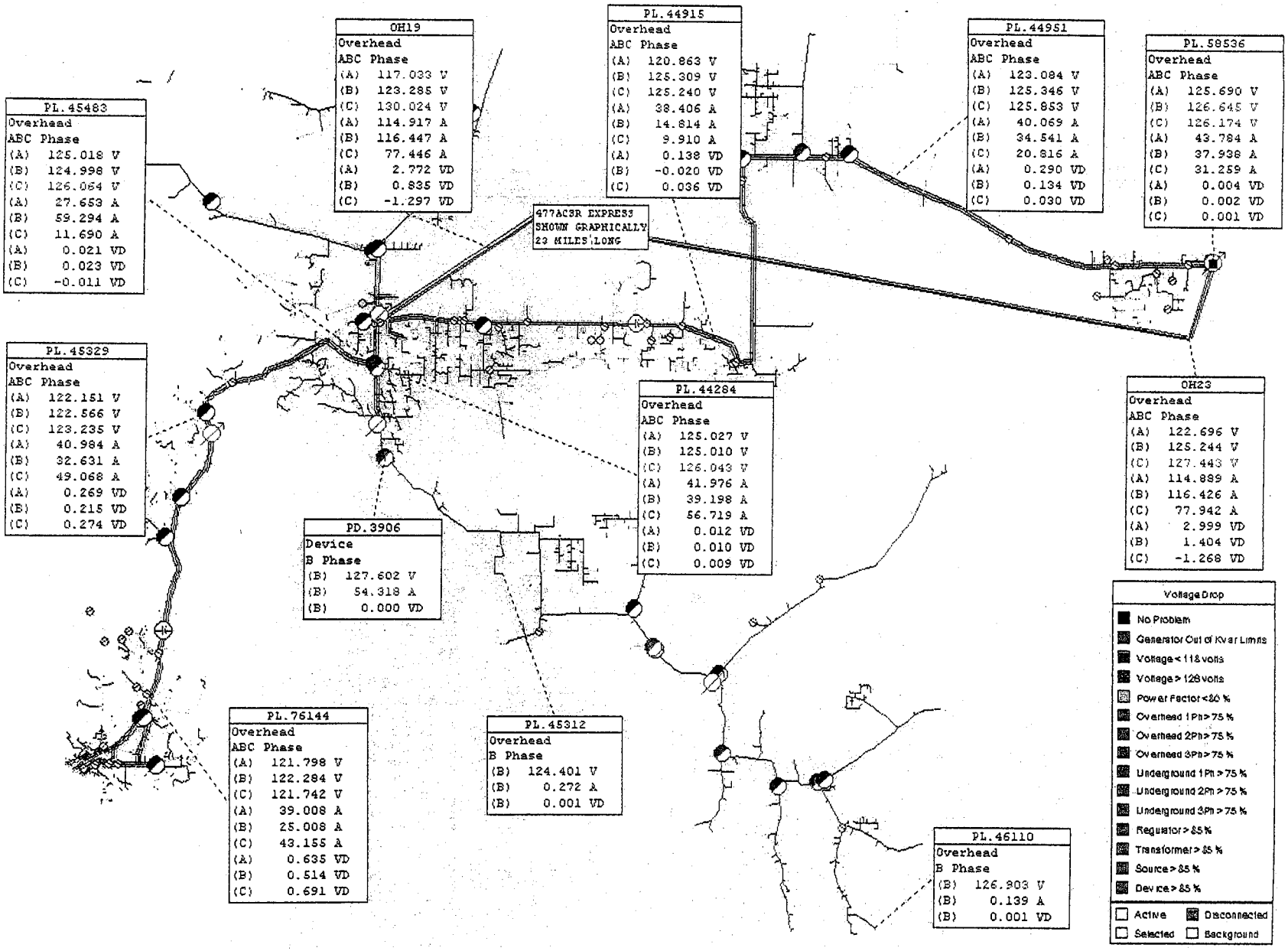


Figure 4: Added 477ACSR line [shown physically incorrect], added/removed regulators, no growth

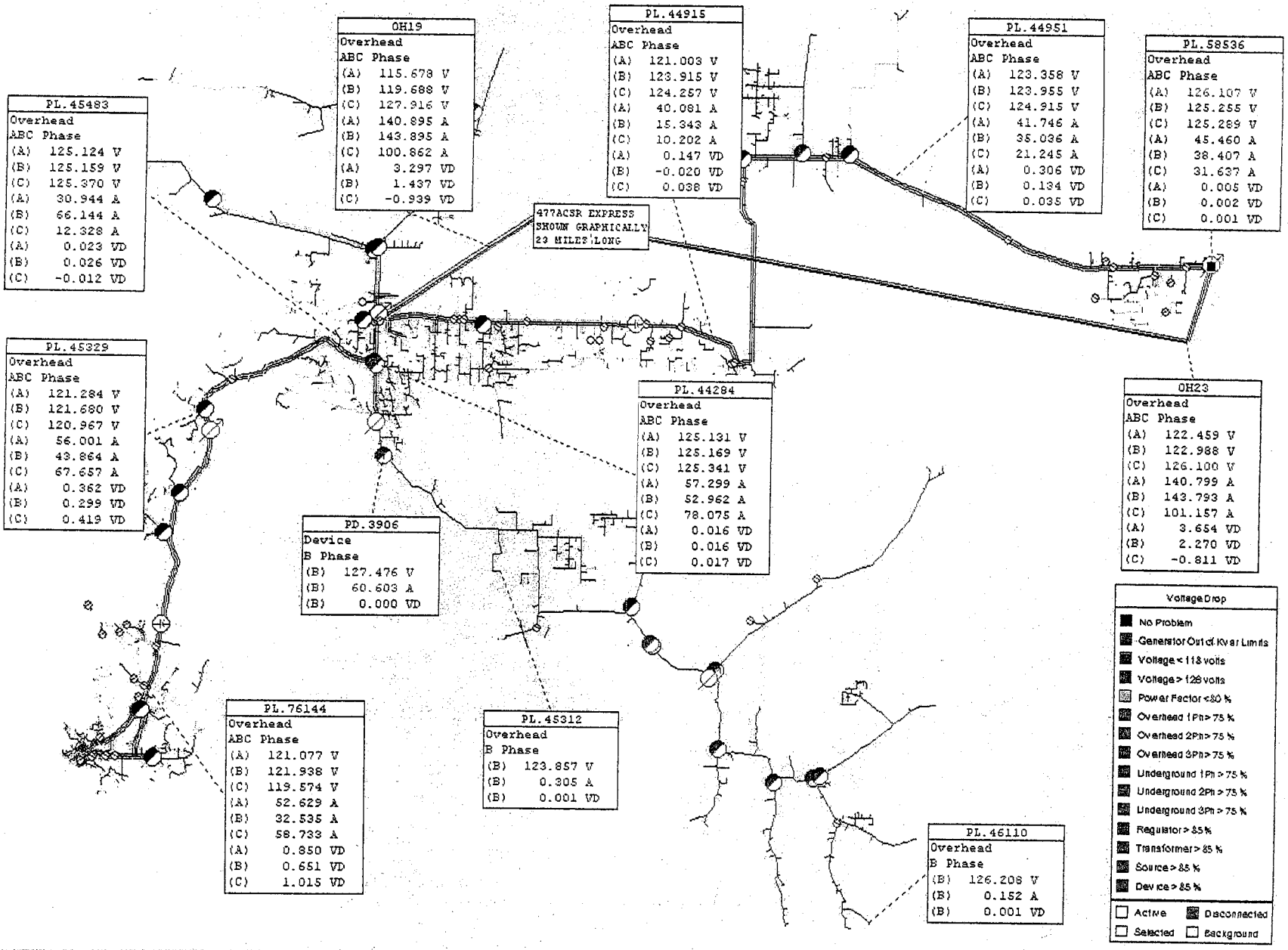


Figure 7 Added 477ACSR line [shown physically incorrect], added/removed regulators, maximum growth

SSVEC

Cost Estimates

Sulphur Springs Valley Electric Cooperative, Inc.

A Touchstone Energy® Cooperative

Sonoita Reliability Project
SSVEC Rate Case E-01575A-08-0328
May 11, 2009

OPTIONS CONSIDERED AND COST ESTIMATES

SSVEC considered many options before making the final decision on where to build and what kind of system to build to ensure quality and reliable service to all of our members in the Sonoita/Elgin/Patagonia area.

- **Option 1: As Currently Planned**

  The route that SSVEC has chosen is the most cost-efficient route, affects the fewest members, and uses existing easements. The cost to build this route and substation is approximately $13.5 million. This route has been on record for more than a quarter of a century and is an established utility corridor. Other alternatives would cost approximately 1.8 to 4.1 times more than the $13.5 projected cost of this option.

- **Option 2: Following V7 Feeder – Energized (Hot)**

  This option upgrades the existing feeder line along Highway 82 and Elgin Road. Rebuilding the line energized would be slow, expensive, and dangerous to our linemen. In addition, it would require the acquisition of rights-of-way from more than 80 landowners, as the existing right-of-way does not include sub-transmission land rights. Furthermore, the majority of this route has been designated a part of the 2000 Las Cienegas Conversation Area and would require special permitting from the Bureau of Land Management. The cost of this option would be approximately $24.6 million.

- **Option 2A: Following V7 Feeder – De-Energized (Cold)**

  This option upgrades the existing feeder line along Highway 82 and Elgin Road. This option reflects the de-energized cost by building an adjacent line. Rebuilding this line by building an adjacent line to the current line, while safer for our linemen, will still require the rights-of-way mentioned in Option 2 above. The cost of this option is approximately $19.6 million.

- **Option 3: 69kV URD (Buried)**

  This option would follow the Option 1 "As Currently Planned" route - but with an underground (URD) 69 kV sub-transmission line. Although this option seems to be a simple solution (especially since many residential members have opted to install underground distribution lines), installing an underground sub-transmission line is a very complex task and significant issues are involved and is quite expensive. Those issues are:

  1. The insulated cables used in underground sub-transmission lines require one or two large trenches which lead to greater environmental disturbances. Also, concrete vaults or large manhole covers are required every 900 to 2,000 feet depending on terrain.

2. Underground electric conductors produce heat, and, for efficient operation, this heat must me carried away from the conductors (air performs this function for overhead lines). This requires special concrete caps around the soils and special thermal backfill material to move the heat away from the line.
3. The right-of-way must be kept clear of any vegetation due to the possible interference by root systems.
4. Studies have indicated the lifespan of underground conductors is half that of overhead, thus increasing costs over time.
5. Any failures in underground transmission lines are extremely costly, disruptive, and time expensive to repair. Underground outages can last for weeks and even months.

The estimated cost of underground 69kV sub-transmission line is estimated to cost approximately $55 million, plus the shorter life span and increased cost over time to repair.

- **Option 4: To Buchanan on Babocomari**

This option would follow the Option 1 "As Currently Planned" route but would end the sub-transmission line at the Buchanan Substation site and build a new substation in the Sonoita Hills Subdivision. After input from the community, it was determined that moving this substation to an industrial/business location would impact less people. If SSVEC were to build on this site, it would require building not only a substation, but also one triple-circuit and one single-circuit large conductor feeder through the Sonoita Hills Subdivision. This option would cost approximately $13.3 million but was not chosen because for $200,000 more, we decided to move the substation and the lines to an industrial/business location.

- **Option 5: TEP Interconnect - Interconnect to the TEP 46kV Sub-Transmission Line.***

This TEP line was built in the 1940's. Several significant issues were identified with this alternative:

1. This power line serves Fort Huachuca and does not have enough capacity available for a substation to carry the additional load of the Sonoita/Elgin/Patagonia area.
2. TEP is bound through their Certificate of Convenience and Necessity by a special bonding arrangement which strictly limits their ability to serve outside two counties. TEP's management in 1993 and in 2007 indicated that a joint project may violate their bonding agreement.
3. Additional rights-of-way adjacent to the TEP line would be required, which would be expensive.
4. SSVEC's short-cost analysis also indicates that this option would be much more expensive than the chosen route .

** Option 5 is not a viable option, therefore, it was not fully estimated.*

Cost Summary for Sonoita Reliability Project Options					
Cost Category	Option #1 As Currently Planned	Option #2 Following V7 Feeder (Hot)	Option #2A Following V7 Feeder (Cold)	Option #3 69kV URD	Option #4 To Buchanan on Babocomari
Labor	$2,111,677	$4,678,210	$2,768,232	$14,651,321	$2,152,797
Materials	$4,315,260	$6,428,950	$6,123,620	$32,230,965	$5,048,297
Equipment & Rentals	$747,222	$1,951,193	$1,324,910	$1,852,193	$647,668
Transportation & Travel Costs	$504,914	$1,339,492	$937,946	$1,246,492	$467,038
Substation	$3,525,000	$3,875,000	$3,675,000	$3,875,000	$3,525,000
ROW & Fees	$686,435	$3,309,464	$3,138,653	$754,592	$86,539
Misc & Overhead	$1,622,657	$3,029,107	$1,709,135	$861,584	$1,389,225
Total	**$13,513,165**	**$24,611,416**	**$19,677,496**	**$55,472,147**	**$13,316,564**

10037537.1

Deborah White

From: Carroll, Bradley [bcarroll@swlaw.com]
Sent: Monday, May 11, 2009 10:53 AM
To: Creden W. Huber; Kirby Chapman; Jack Blair; Deborah White; Ron Orozco; Anselmo Torres
Cc: Christopher Hitchcock
Subject: 69 kV line Summary of Costs for Options - Late filed Hearing Exhibit
Attachments: 69kV Line 69 KV Option Late Filed Exhibit_10037537_1.DOC

Attached for your information and records is the final summary breakdown of costs for the various options considered for the Sonoita Reliability Project that ties into the the customer mailing that was already introduced as an exhibit at the hearing. This document will be filed as a late filed hearing exhibit later today, along with the two other late filed exhibits ordered by the ALJ. Thank you all for your assistance with this.

Bradley S. Carroll
Snell & Wilmer L.L.P.
602.382.6578 (direct)
bcarroll@swlaw.com

Job Cost Estimate for Sonoita Reliability Project

Estimates built on date: 3/31/2009 (inflation-sensitive date) 3 2009

WO #	WO Name	Start Date	Completion Date	# of Months from Estimate to Completion	740c	Engineering Hours	Construction Man Hours	Total Hours	Direct Material Charge	Materials from Inventory	Material and Construction Labor Guess with overhead factored in	Substation Cost	ROW Costs	Permits & Fees	Consultant - E&G	10% Contingency	# of Days for Travel/Per Diem per Employee	# of Employees on Travel/Per Diem
CONSTRUCTION COSTS																		
1	As Currently Planned	09/30/09	12/31/10	21	800.001	300	22,000	22,300	$ 2,485,607	$ 500,000		$ 3,000,000	$ 382,200	$ 202,000	$ 200,000	$ 300,000	175	15
2	Following V7 Feeder Cold	03/15/10	06/15/11	27	800.001	450	14,400	14,850	$ 3,829,946	$ 500,000		$ 3,000,000	$ 2,272,270	$ 289,896	$ 400,000	$ 300,000	275	15
3	Following V7 Feeder Hot	03/15/10	02/15/12	35	800.001	450	49,200	49,650	$ 3,829,946	$ 500,000		$ 3,000,000	$ 2,272,270	$ 289,896	$ 400,000	$ 300,000	410	15
4	To Buchannan on Babocomari	09/30/09	12/10/10	21	800.001	320	18,090	18,410	$ 2,161,473	$ 500,000		$ 3,000,000	$ 59,150	$ 14,500	$ 225,000	$ 300,000	151	15
5	69kV URD All	03/15/10	02/15/12	35	800.001	600		600			$ 35,079,571	$ 3,000,000	$ 382,200	$ 202,000	$ 600,000	$ 500,000	410	15
6	Buchannan Getaways	09/30/09	12/10/10	21	800.001	250	2,582	2,832	$ 200,000	$ 769,967					$ -	$ 100,000	22	15
7	Sonoita Sub Getaways	09/30/09	12/31/10	21	800.001	250	864	1,114	$ 200,000	$ 157,836					$ -	$ 100,000	7	15
8	New V7 Express Cold - 477	03/15/10	02/15/11	23	800.001	282	7,601	7,883		$ 1,163,662		$ 3,700,000	$ 2,272,270	$ 289,896		$ 330,000	951	1
9	Rebuild V7 Hot - 477	03/15/10	07/15/11	28	800.001	282	11,401	11,683		$ 1,163,662		$ 3,700,000	$ 2,272,270	$ 289,896		$ 400,000	1,426	1
10	Rebuild V7 Double Circuit	05/15/10	07/15/11	28	800.001	400	11,045	11,445		$ 1,552,313		$ 3,700,000	$ 2,272,270	$ 289,896		$ 460,000	1,361	1
11	NAME 11		01/09/13	46	800.001			-										
12	NAME 12		01/10/13	46	800.001			-										
13	NAME 13		01/11/13	46	800.001			-										
14	NAME 14		01/12/13	46	800.001			-										
15	NAME 15		01/13/13	46	800.001			-										
16	NAME 16		01/14/13	46				-										
17	NAME 17		01/15/13	46				-										
18	NAME 18		01/16/13	46				-										
	Construction Totals					3,584	137,183	140,767	$ 12,707,172	$ 6,827,441			$ 12,184,900	$ 1,867,980	$ 1,825,000	$ 3,110,000	5,208	108
RETIREMENT COSTS																		
1	As Currently Planned	09/30/09	12/31/10	21		40	600	640							$ 5,000		5	15
2	Following V7 Feeder Cold	03/15/10	06/15/11	27		100	7,200	7,300							$ 50,000		60	15
3	Following V7 Feeder Hot	03/15/10	02/15/12	35		100	4,800	4,900							$ 50,000		40	15
4	To Buchannan on Babocomari	09/30/09	12/10/10	21				-										
5	69kV URD All	03/15/10	02/15/12	35				-										
6	Buchannan Getaways	09/30/09	12/10/10	21		80	1,257	1,337									10	15
7	Sonoita Sub Getaways	09/30/09	12/31/10	21		40	182	222									2	15
8	New V7 Express Cold - 477	03/15/10	02/15/11	23														
9	Rebuild V7 Hot - 477	03/15/10	07/15/11	28		94	2,850	2,944									357	1
10	Rebuild V7 Double Circuit	05/15/10	07/15/11	28		94	2,850	2,944									357	1
11	NAME 11	01/00/00	01/09/13	46				-										
12	NAME 12	01/00/00	01/10/13	46				-										
13	NAME 13	01/00/00	01/11/13	46				-										
14	NAME 14	01/00/00	01/12/13	46				-										
15	NAME 15	01/00/00	01/13/13	46				-										
16	NAME 16	01/00/00	01/14/13	46				-										
17	NAME 17	01/00/00	01/15/13	46				-										
18	NAME 18	01/00/00	01/16/13	46				-										
	Retirement Totals					548	19,738	20,286	$ -	$ -			$ -	$ -	$ 105,000	$ -	831	77
	Totals					4,132.00	156,921.40	161,053	$ 12,707,172	$ 6,827,441			$ 12,184,900	$ 1,867,980	$ 1,930,000	$ 3,110,000	6,039	185

8 New V7 Express Cold - 477	Build new 477 ACSR Circuit in new 50' wide easement. Leave old line as is. Includes perfecting ROW and permits totalling $2.5M.
9 Rebuild V7 Hot - 477	Build new 477 ACSR Circuit in old alignment. Retire old line. Perfect easement to 50' wide.
10 Rebuild V7 Double Circuit	Build new 477 & 1/0 ACSR Double Circuit in new alignment. Retire old line. Need new 50' wide easement. Can abandon old easement.

All of the above include $2.7 million for new Sonoita sub (Original cost was $3 million reduced to $2.7 million to remove transformer cost) & 1million for transformer and substation upgrade at Huachuca Sub..

Job Cost Estimate for Sonoita Reliability Project

Estimates built on date: 3/31/2009 (inflation-sensiti

WO #	WO Name	Start Date	Completion Date	# of Days of SSVEC Equipment	# of SSVEC Equipment Used	# of Days of Outside Rental Equipment	# of Outside Rental Equipment Used	Contractor Foundations	Contractor SWPP	Contractor Dirt Work Already Completed	Permits & Fees	Fence Rental	Utility Rental	Office Space Rental	Other	Engineering Labor	Construction Labor	Total Direct Labor	All Engineering Consultants
CONSTRUCTION COSTS																			
1	As Currently Planned	09/30/09	12/31/10	175	12	180	4	$ 306,002		$ 85,000		$ 4,500	$ 4,500	$ 4,500		$ 14,561	$ 764,944	$ 779,505	$ 200,000
2	Following V7 Feeder Cold	03/15/10	06/15/11	275	12	275	4	$ 278,184		$ 85,000		$ 6,000	$ 6,000	$ 6,000		$ 21,842	$ 500,691	$ 522,532	$ 400,000
3	Following V7 Feeder Hot	03/15/10	02/15/12	410	12	410	4	$ 278,184		$ 85,000		$ 11,000	$ 11,000	$ 11,000		$ 21,842	$ 1,710,693	$ 1,732,535	$ 400,000
4	To Buchannan on Babocomari	09/30/09	12/10/10	151	12	151	4	$ 250,366		$ 85,000		$ 3,775	$ 3,775	$ 3,775		$ 15,532	$ 628,993	$ 644,525	$ 225,000
5	69kV URD All	03/15/10	02/15/12	410	12	410	4			$ 85,000		$ 11,000	$ 11,000	$ 11,000		$ 29,122	$ -	$ 29,122	$ 600,000
6	Buchannan Getaways	09/30/09	12/10/10	22	4			$ 153,001				$ 500	$ 500	$ 500		$ 12,134	$ 89,777	$ 101,911	$ -
7	Sonoita Sub Getaways	09/30/09	12/31/10	7	4			$ 27,818				$ 200	$ 200	$ 200		$ 12,134	$ 30,041	$ 42,176	$ -
8	New V7 Express Cold - 477	03/15/10	02/15/11	951	1							$ 8,000	$ 8,000	$ 8,000		$ 13,687	$ 264,288	$ 277,976	$ -
9	Rebuild V7 Hot - 477	03/15/10	07/15/11	1,426	1							$ 12,000	$ 12,000	$ 12,000		$ 13,687	$ 396,415	$ 410,102	$ -
10	Rebuild V7 Double Circuit	05/15/10	07/15/11	1,381	1							$ 11,500	$ 11,500	$ 11,500		$ 19,415	$ 384,037	$ 403,452	$ -
11	NAME 11		01/09/13													$ -	$ -	$ -	$ -
12	NAME 12		01/10/13													$ -	$ -	$ -	$ -
13	NAME 13		01/11/13													$ -	$ -	$ -	$ -
14	NAME 14		01/12/13													$ -	$ -	$ -	$ -
15	NAME 15		01/13/13													$ -	$ -	$ -	$ -
16	NAME 16		01/14/13													$ -	$ -	$ -	$ -
17	NAME 17		01/15/13													$ -	$ -	$ -	$ -
18	NAME 18		01/16/13													$ -	$ -	$ -	$ -
	Construction Totals			5,208	71	1,426	20	$ 1,293,555	$ -	$ 425,000	$ -	$ 68,475	$ 68,475	$ 68,475	$ -	$ 173,957	$ 4,769,879	$ 4,943,836	$ 1,825,000
RETIREMENT COSTS																			
1	As Currently Planned	09/30/09	12/31/10	5	12	5	4					$ 125	$ 125	$ 125		$ 1,941	$ 20,862	$ 22,804	$ 5,000
2	Following V7 Feeder Cold	03/15/10	06/15/11	60	12							$ 1,500	$ 1,500	$ 1,500		$ 4,854	$ 250,345	$ 255,199	$ 50,000
3	Following V7 Feeder Hot	03/15/10	02/15/12	40	12							$ 1,000	$ 1,000	$ 1,000		$ 4,854	$ 166,897	$ 171,751	$ 50,000
4	To Buchannan on Babocomari	09/30/09	12/10/10													$ -	$ -	$ -	$ -
5	69kV URD All	03/15/10	02/15/12													$ -	$ -	$ -	$ -
6	Buchannan Getaways	09/30/09	12/10/10	10	4							$ 250	$ 250	$ 250		$ 3,883	$ 43,694	$ 47,577	$ -
7	Sonoita Sub Getaways	09/30/09	12/31/10	2	4							$ 100	$ 100	$ 100		$ 1,941	$ 6,319	$ 8,261	$ -
8	New V7 Express Cold - 477	03/15/10	02/15/11													$ -	$ -	$ -	$ -
9	Rebuild V7 Hot - 477	03/15/10	07/15/11	357	1											$ 4,562	$ 99,095	$ 103,658	$ -
10	Rebuild V7 Double Circuit	05/15/10	07/15/11	357	1											$ 4,562	$ 99,095	$ 103,658	$ -
11	NAME 11	01/00/00	01/09/13													$ -	$ -	$ -	$ -
12	NAME 12	01/00/00	01/10/13													$ -	$ -	$ -	$ -
13	NAME 13	01/00/00	01/11/13													$ -	$ -	$ -	$ -
14	NAME 14	01/00/00	01/12/13													$ -	$ -	$ -	$ -
15	NAME 15	01/00/00	01/13/13													$ -	$ -	$ -	$ -
16	NAME 16	01/00/00	01/14/13													$ -	$ -	$ -	$ -
17	NAME 17	01/00/00	01/15/13													$ -	$ -	$ -	$ -
18	NAME 18	01/00/00	01/16/13													$ -	$ -	$ -	$ -
	Retirement Totals			831	46	5	4	$ -	$ -	$ -	$ -	$ 2,975	$ 2,975	$ 2,975	$ -	$ 26,598	$ 686,308	$ 712,906	$ 105,000
	Totals			6,039	117	1,431	24	$ 1,293,555	$ -	$ 425,000	$ -	$ 71,450	$ 71,450	$ 71,450	$ -	$ 200,555	$ 5,456,187	$ 5,656,742	$ 1,930,000

8 New V7 Express Cold - 477	Build new 477 ACSR Circuit in ne
9 Rebuild V7 Hot - 477	Build new 477 ACSR Circuit in ol
10 Rebuild V7 Double Circuit	Build new 477 & 1/0 ACSR Doubl

All of the above include $2.7 million for new Sonoita sub (Original

Job Cost Estimate for Sonoita Reliability Project

Estimates built on date: 3/31/2009 (inflation-sensiti

WO #	WO Name	Start Date	Completion Date	All Construction Contractors	Travel/Per Diem Cost/Day	Cost of SSVEC Equipment	Cost of Outside Rental Equipment	Indirect Labor	Payroll Taxes	Misc Overhead	Stores	Transporation	Total	Total Adjusted for Inflation	Project Budget
CONSTRUCTION COSTS															
1	As Currently Planned	09/30/09	12/31/10	$ 391,002	$ 196,875	$ 420,000	$ 180,000	$ 194,876	$ 62,360	$ 724,940	$ 250,000	$ 210,000	$ 10,493,066	12,329,353	
2	Following V7 Feeder Cold	03/15/10	06/15/11	$ 363,184	$ 309,375	$ 660,000	$ 275,000	$ 130,633	$ 41,803	$ 485,955	$ 250,000	$ 330,000	$ 13,978,594	17,123,778	
3	Following V7 Feeder Hot	03/15/10	02/15/12	$ 363,184	$ 461,250	$ 984,000	$ 410,000	$ 433,134	$ 138,603	$ 1,611,258	$ 250,000	$ 492,000	$ 17,501,075	22,605,556	
4	To Buchannan on Babocomari	09/30/09	12/10/10	$ 335,366	$ 169,875	$ 362,400	$ 151,000	$ 161,131	$ 51,562	$ 599,408	$ 250,000	$ 181,200	$ 9,177,914	10,784,049	
5	69kV URD All	03/15/10	02/15/12	$ 85,000	$ 461,250	$ 984,000	$ 410,000	$ 7,281	$ 2,330	$ 27,084	$ -	$ 492,000	$ 42,294,837	54,630,831	
6	Buchannan Getaways	09/30/09	12/10/10	$ 153,001	$ 24,206	$ 17,213	$ -	$ 25,478	$ 8,153	$ 94,777	$ 394,983	$ 8,607	$ 1,919,796	2,255,761	
7	Sonoita Sub Getaways	09/30/09	12/31/10	$ 27,818	$ 8,100	$ 5,760	$ -	$ 10,544	$ 3,374	$ 39,223	$ 78,918	$ 2,880	$ 677,230	795,745	
8	New V7 Express Cold - 477	03/15/10	02/15/11	$ -	$ 71,325	$ 190,200	$ -	$ 69,494	$ 22,238	$ 258,517	$ 581,831	$ 95,100	$ 9,346,509	11,137,923	
9	Rebuild V7 Hot - 477	03/15/10	07/15/11	$ -	$ 106,950	$ 285,200	$ -	$ 102,526	$ 32,808	$ 381,395	$ 581,831	$ 142,600	$ 9,905,241	12,216,463	
10	Rebuild V7 Double Circuit	05/15/10	07/15/11	$ -	$ 103,575	$ 276,200	$ -	$ 100,863	$ 32,276	$ 375,210	$ 776,157	$ 138,100	$ 10,534,811	12,992,934	
11	NAME 11		01/09/13	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-	
12	NAME 12		01/10/13	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-	
13	NAME 13		01/11/13	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-	
14	NAME 14		01/12/13	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-	
15	NAME 15		01/13/13	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-	
16	NAME 16		01/14/13	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-	
17	NAME 17		01/15/13	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-	
18	NAME 18		01/16/13	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-	
	Construction Totals			$ 1,718,555	$ 1,912,781	$ 4,184,973	$ 1,426,000	$ 1,235,959	$ 395,507	$ 4,597,767	$ 3,413,720	$ 2,092,487	$ 125,829,075	$ 156,872,394	
RETIREMENT COSTS															
1	As Currently Planned	09/30/09	12/31/10	$ -	$ 5,625	$ 12,000	$ 5,000	$ 5,701	$ 1,824	$ 21,207	$ -	$ 6,000	$ 85,536	85,536	13,233,126
2	Following V7 Feeder Cold	03/15/10	06/15/11	$ -	$ 67,500	$ 144,000	$ -	$ 63,800	$ 20,416	$ 237,335	$ -	$ 72,000	$ 914,750	914,750	18,856,764
3	Following V7 Feeder Hot	03/15/10	02/15/12	$ -	$ 45,000	$ 96,000	$ -	$ 42,938	$ 13,740	$ 159,728	$ -	$ 48,000	$ 630,156	630,156	24,053,949
4	To Buchannan on Babocomari	09/30/09	12/10/10	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-	13,172,431
5	69kV URD All	03/15/10	02/15/12	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-	55,449,068
6	Buchannan Getaways	09/30/09	12/10/10	$ -	$ 11,781	$ 8,378	$ -	$ 11,894	$ 3,806	$ 44,247	$ -	$ 4,189	$ 132,621	132,621	2,388,382
7	Sonoita Sub Getaways	09/30/09	12/31/10	$ -	$ 1,704	$ 1,212	$ -	$ 2,065	$ 661	$ 7,663	$ -	$ 606	$ 22,491	22,491	818,236
8	New V7 Express Cold - 477	03/15/10	02/15/11	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-	11,137,923
9	Rebuild V7 Hot - 477	03/15/10	07/15/11	$ -	$ 26,775	$ 71,400	$ -	$ 25,914	$ 8,293	$ 96,402	$ -	$ 35,700	$ 368,141	368,141	12,584,604
10	Rebuild V7 Double Circuit	05/15/10	07/15/11	$ -	$ 26,775	$ 71,400	$ -	$ 25,914	$ 8,293	$ 96,402	$ -	$ 35,700	$ 366,141	366,141	13,361,075
11	NAME 11	01/00/00	01/09/13	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-	-
12	NAME 12	01/00/00	01/10/13	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-	-
13	NAME 13	01/00/00	01/11/13	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		-
14	NAME 14	01/00/00	01/12/13	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		-
15	NAME 15	01/00/00	01/13/13	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		-
16	NAME 16	01/00/00	01/14/13	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		-
17	NAME 17	01/00/00	01/15/13	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		-
18	NAME 18	01/00/00	01/16/13	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		-
	Retirement Totals			$ -	$ 185,160	$ 404,389	$ 5,000	$ 178,227	$ 57,033	$ 663,003	$ -	$ 202,195	$ 2,521,837	$ 2,521,837	
	Totals			$ 1,718,555	$ 2,097,941	$ 4,589,363	$ 1,431,000	$ 1,414,186	$ 452,539	$ 5,260,770	$ 3,413,720	$ 2,294,681	$ 128,350,912	$ 159,394,231	

8 New V7 Express Cold - 477	Build new 477 ACSR Circuit in ne
9 Rebuild V7 Hot - 477	Build new 477 ACSR Circuit in ol
10 Rebuild V7 Double Circuit	Build new 477 & 1/0 ACSR Doubl

All of the above include $2.7 million for new Sonoita sub (Original

PRELIMINARY OPTIONS & COST ESTIMATES FEBRUARY 23, 1993

CONSTRUCTION OPTIONS	TOTAL 1ST YEAR	ANNUAL PRESENT VALUE	TOTAL PRESENT VALUE	TERM
Upgrade existing distribution feeder line only.	$2,854,000	$ 458,094	$ 6,107,173	U/A
Add a second distribution line along the Babocomari land grant boundary.	$3,045,000	$ 600,000	$ 7,993,000	S-T
Upgrade existing distribution line; wheel power from TEP's line; & add a distribution tie to Citizen's Electric's line near Patagonia.	$7,669,000	$1,323,000	$17,643,000	S-T
Add a 69 kV line along the existing distribution line in Rain Valley and extend directly west along highway 82 through Sonoita.	$5,830,000	$ 729,000	$ 9,718,000	L-T
Same as above, but divert the line through Elgin.	$7,537,000	$ 952,000	$12,697,000	L-T
Extend a 69 kV line along the Babocomari and follow the best available route to a point west of Sonoita, where a distribution substation would be installed.	$4,709,000	$ 575,000	$ 7,665,000	L-T
Same as above, but stop east of Sonoita; significant additional distribution lines would be required.	$5,782,000	$ 692,000	$ 9,229,000	I-T
Same as basic proposal, but build Joint Use line with TEP across the Land Grant.	$5,981,000	$ 736,000	$9,810,000	L-T
Extend 115 kV along the Land Grant to a new substation east of Sonoita. Several additional distribution lines would be necessary.	$7,453,000	$ 846,000	$11,275,000	I-T

U/A = UNACCEPTABLE
S-T = SHORT-TERM
I-T = INTERMEDIATE TERM
L-T = LONG-TERM
RADIAL = USUALLY UNDERGROUND IS LOOPED FOR RELIABILITY; THIS WAS N ESTIMATED HERE

PRELIMINARY OPTIONS & COST ESTIMATES FEBRUARY 23, 1993 Con'd

CONSTRUCTION OPTIONS	TOTAL 1ST YEAR	ANNUAL PRESENT VALUE	TOTAL PRESENT VALUE	TERM
Extend 69 kV underground along the Land Grant @ $1,000,000/mile to a new substation east of Sonoita.	$27,496,000	$3,454,000	$46,053,000	RADIAL
		(13 CENTS KWH - 25 YRS.)		
New substation, battery bank, and distribution ties; low capacity initial installation only. (EAST SITE)	$8,638,000	$1,440,000	$19,191,000	I-T

U/A	=	UNACCEPTABLE
S-T	=	SHORT-TERM
I-T	=	INTERMEDIATE TERM
L-T	=	LONG-TERM
RADIAL	=	USUALLY UNDERGROUND IS LOOPED FOR RELIABILITY; THIS WAS NOT ESTIMATED HERE

SSVEC

TEP

TEP SUBSTATION - BACKUP SERVICE ONLY

TEP has stated that the 46kV line's current capacity is intended as backup for Fort Huachuca. The 46 kV line's capacity is the same as the peak load at the Fort's substation. There is no excess capacity on the 46 kV line during peak conditions. This means that SSVEC would only be able to serve load from this line when Fort Huachuca is not is not needing service from this line or their load is not at peak. If it is decided to install a connection to the 46kV line then there could be times when the Fort needs the capacity of the line and SSVEC customers would be without power. The Fort may only need the capacity for short periods but there are times due to major catastrophes on the 138kV line that the 46kV would be utilized by the Fort for months at a time.
If TEP is doing maintance on their 138 kV line they may also be using the 46 kV line for long periods and this would limit SSVEC's access to the line. TEP would most likely deenergize the 138 kV line while they do maintenance and transfer the Fort's load to the 46 kV line. It would not be prudent to connect to the line if it is not upgraded to required capacity and allows uninterrupted service.

It has been stated that if two subs were connected to the 46kV line that there would be two sources or basically a looped system to serve SSVEC's customers. This is not so unless some changes are made to TEP's Fort Substation. The 46kV line is currently setup as a radial source into the Fort's substation and is unable to be looped into the 138kV line. Both are designed to be radial into the sub and neither is setup to back feed the other. Therefore unless a change is made that allows the 138kV to back feed onto the 46kV line then the 46kV line is a radial transmission source and the two subs would not make since if the line is out of service then both subs are also out of services. If the 46kV was able to be fed from either end then the two subs would electrically make since a problem on the transmission line could be isolated so that at most only one sub would be out of services. The cost associated with two subs would double the costs discussed below. It would be up to TEP to determine a cost to allow the 138kV line to back feed onto the 46kV line.

If the 46kV line were upgraded then perhaps SSVEC would have full service capability from this line. There are some complications to upgrading the line. Certificate of Convenience and Necessity Border Agreements and ACC approval procedures would need to be followed to allow this to happen. The cost to upgrade the line would also be a major factor since it would need to be upgraded from its origin to the proposed substation site that is to serve SSVEC. This will have a cost of approximately $350,000 to $450,000 per mile not including any ROW or legal expenses. Also unknown is the capacity at the source substation for the 46kV line. If there is no excess capacity at the source substation then an upgrade would be required and this could cost millions of dollars.

The V7-46kV Site substation would require a minimum site of 350' X 350' or approximately 3 acres not including any set back requirements the County may impose. SSVEC has recently analyzed the land requirement for a transmission switching station adjacent to a distribution substation and it was determined that this was the appropriate sized site.

When choosing the location of this Substation the ability to interconnect with the transmission system and the distribution system is a major concern. Typically substations are located at points where transmission lines cross distribution lines and are close to the load center for the load to be served. The 3SEG has proposed three locations for 46kV/25kV substation interconnections. I will address in the following paragraphs the location where the 46kV crosses SSVEC's V7 Feeder only (V7-46kV Site). The other two sites would require upgrading single phase lines to three phase at a per mile cost of $87,000 but the V7-47kV site would not require any upgrade of single phase to three phase. Another benefit of the V7-46kV Site is that this would allow two feeders to be established to split loads and improve reliability. If the V7 feeder is split into two feeders at this site then fewer customers would be affected by an interruption of service along the existing V7 Feeder. For the other two locations to have

two feeders to help split V7 would require in addition to the single phase to three phase conversion a new line to be constructed at a cost of $100,000 per mile from the substation to V7 Feeder.

TEP has stated that a three breaker ring bus would be required for SSVEC to tap their 46kV line. The cost for this would be approximately 1 to 1.5 million dollars. They also stated that without a line upgrade the capacity of this line is committed to serving Fort Huachuca. Due to this restriction there would need to be a communication link between the V7-46kV Site and Fort Huachuca's Substation and additional switching devices at Fort Huachuca's substation. The operation and ownership of the communication link and devices at Fort Huachuca Substation would remain with TEP and they would need to develop those costs.

This substation would require a transformer to step the voltage from 46kV to 25kV. The smallest transformer that could be justified using SSVEC standards would be a 10 MVA transformer to serve the existing 7 MVA of load and allowing for future load growth. SSVEC last week received bids on a 10 MVA transformer and the minimum bid was $230,000. Three voltage regulators would also be required for the substation to insure proper voltage is delivered to the customers and these would cost approximately $120,000 installed. Also required would be two 25kV Automatic circuit reclosures, one for each feeder, at a cost of $50,000 each installed or $100,000 total. The structural steel, insulators, switches, bus materials, and miscellaneous hardware needed to connect all the devices together will cost approximately $350,000. A control house will also need to be included to house all of the control, metering, and communication equipment. The cost for this is approximately $300,000. The cost for labor for construction of the substation not included above is $400,000 to $600,000. The cost for land at this site is approximately $60,000 per acre or a total cost of $170,000. Therefore as stated above the cost for the distribution sub will be 1.6 to 1.9 million dollars and the transmission sub will cost 1 to 1.5 million dollars.

The total cost for the V7-46kV Site will be 2.6 to 3.4 million dollars. This cost does not include any legal expenses, transmission upgrades discussed above, wheeling costs, any costs associated with Certificate of Convenience and Necessity Border Agreements, or ACC approval procedures

SSVEC / TEP BACK-UP SUBSTATION

Interconnect location substation site	$ 170,000
46:25kV transformers	230,000
Set of 3-Voltage regulators	120,000
2- Distribution Automatic Circuit Reclosures, SCADA controlled	100,000
Substation structure	350,000
Control house	300,000
Construction	500,000
Transmission Sub including 3 Breaker Ring Bus	1,500,000
SSVEC Cost (does NOT include costs for TEP facility upgrades)	**$ 3,270,000**
DOES NOT INCLUDE ANY LEGAL EXPENSES OR ANY COSTS ASSOCIATED WITH CCN BORDER AGREEMENTS, ACC APPROVAL PROCEDURES, WHEELING COSTS, ETC	

Tucson Electric Power Company

Mailing Address: P.O. Box 711, Tucson, AZ 85702
Located at: 4350 E. Irvington Road, Tucson, AZ 85714

June 6, 2003

Bruce Evans
Southwest Transmission Cooperative, Inc.
Post Office Box 2195
Benson, Arizona 85602

RE: Proposed tap of TEP's 46kV line near Sonoita, Arizona

Dear Bruce:

This letter is in response to your request for possible transmission service in the Sonoita area. You propose that Sulphur Springs Valley Electric Cooperative tap our South to Fort Huachuca 46kV line 4-5 miles east of Sonoita.

Based on a preliminary review the proposed tap could only be constructed with the understanding that TEP have the ability to discontinue service to Sulphur Springs in the event of an outage on TEP's 138kV line to Fort Huachuca resulting in transferring the Fort service over to the 46kV line in question. Currently this 46kV line serves as back up to the load at Fort Huachuca and TEP's obligation to its customers at the Fort must not be jeopardized. The capacity of this 46kV line is just sufficient to meet the peak Fort load.

For your information there were three outages of the 138kV line to Ft. Huachuca in 2002: one in May (16 hours due to brush fire), one in June (22 hours due to brush fire) and one in December (4 hours due to raccoon). In April and May of this year, TEP cleared heavy vegetation away from the 138kV structures of this line to reduce the likelihood of outages due to brush fires.

The interconnection point is outside TEP's two-county retail service territory. In order to complete this interconnection outside that service territory, AEPCO will have to request an Order for Interconnection from FERC. Our bond counsel indicates that this is a routine procedure that is not uncommon and TEP is willing to provide to AEPCO a typical filing reflecting what such a request would look like.

The following is a recap of the information provided by TEP's distribution planning department.

- The 46kV line to Fort Huachuca is the back-up to the normal feed, which is a 138kV line.
- When the 138kV line is out, the load automatically transfers to the 46kV line.
- If the transfer occurs on peak in the summer the voltage is right at the lower limit of allowable.
- I modeled an additional 4.5 MW of load for a Sonoita tap near Greaterville. With this added load, the voltage dropped to the equivalent of 110 volts, which is not acceptable.
- The limit of the line capacity, as the system is currently configured, is somewhere between 17.5 MW and 22 MW.

Thank you for your inquiry. We look forward to working with you and Sulphur Springs Valley on this project.

Sincerely,
Mark Albertson

-----Original Message-----
From: Bruce Evans [mailto:bevans@aepnet.com]
Sent: Monday, June 09, 2003 10:14 AM
To: Torey Bell
Cc: Karen Cathers; Larry D. Huff; Raymond Som; Anselmo Torres
Subject: Sonoita Project

Torey,

I am forwarding to you a letter from TEP to Southwest Transmission regarding the potential for tapping TEP's 46 kV line to serve the proposed Sonoita substation.

The letter notes that there are limitations to the use of the line, under an outage of the 138 kV line that feeds Ft. Huachuca, from both a capacity and voltage standpoint. SSVEC will need to decide if they can live with this possibility. The letter also references a request for an order for interconnection from FERC, as a means of satisfying TEP's Bond Counsel on the two-county bond issue. I have asked Mark Albertson, the author of the letter, for information on a typical filing of this nature, as referenced in the letter.

Once I get this additional information from TEP, I will contact you again.

Thanks,

Bruce

SSVEC

UNS

UNS BACKUP/LOAD SERVING TIE

The first issue that will need to be addressed is how much capacity is available from UNS and how much would be reciprocated by SSVEC. All equipment will be sized according to this required capacity. Load islands will also need to be determined based on available capacity (how many miles can be served when load islands are created).

To serve the load islands in a looped configuration would be very costly and more than likely the costs would not offset the benefits. Load control devices would be required to control load flowing from one system to the other to limit overload of equipment installed. These devices would cost millions of dollars and would not be practical for the small capacities that either system will have available since this area is at the end of the line for both UNS and SSVEC.

As the line operating voltage differs between UNS (13.8kV) and SSVEC (25kV), the tie point will require a set of step down transformers and voltage regulators sized to the limits of capacity available from UNS's line in Flux Canyon or SSVEC's V-7 Feeder, which ever is largest. Three SCADA controlled Automatic Circuit Reclosers (ACR's) will also be required at the tie point, and at each end of the two load islands. This would allow for automated control for islanding and connection for the loads to be served.

Some work must be done to determine if the UNS's and SSVEC's system can be connected at the proposed tie point. Due to the phase angle difference it could be very expensive to tie these two systems if the phase shift can not be corrected by the connections of the step-down transformers. Step-down transformers can be connected Y-Y which provides no phase shift if none is needed or they can be connected Y-Delta if a 30^0 phase shift is needed. Most likely a Y-Y or Y-Delta connection is all that is needed, but analysis and testing will be required to determine if this is possible. If these two can not resolve the phase shift then it will require equipment that is too costly to justify for this connection. The cost would not offset the benefit.

Regulators cost approximately $20,000 to $30,000 each installed, depending on size. This tie point will require three (one for each phase). Due to small amount of power available at this location the cost for a small three phase regulator installation will be approximately $60,000. The cost of the three phase step-down transformer installation will be approximately $70,000. The cost of a three phase ACR installation will be $50,000 for each location and three installations will be required as discussed above. The total equipment cost for this tie point will be approximately $280,000.

UNS electric and SSVEC's system currently have a gap of approximately 1 mile were no lines exist. The cost to connect the two systems with a three phase line would be approximately $100,000. UNS system is currently two phase and this would require an additional phase to be added to their line to be able to properly connect into SSVEC's three phase system. Without knowing the condition and length of the two phase line it is impossible to estimate what the two phase to three phase upgrade would cost.

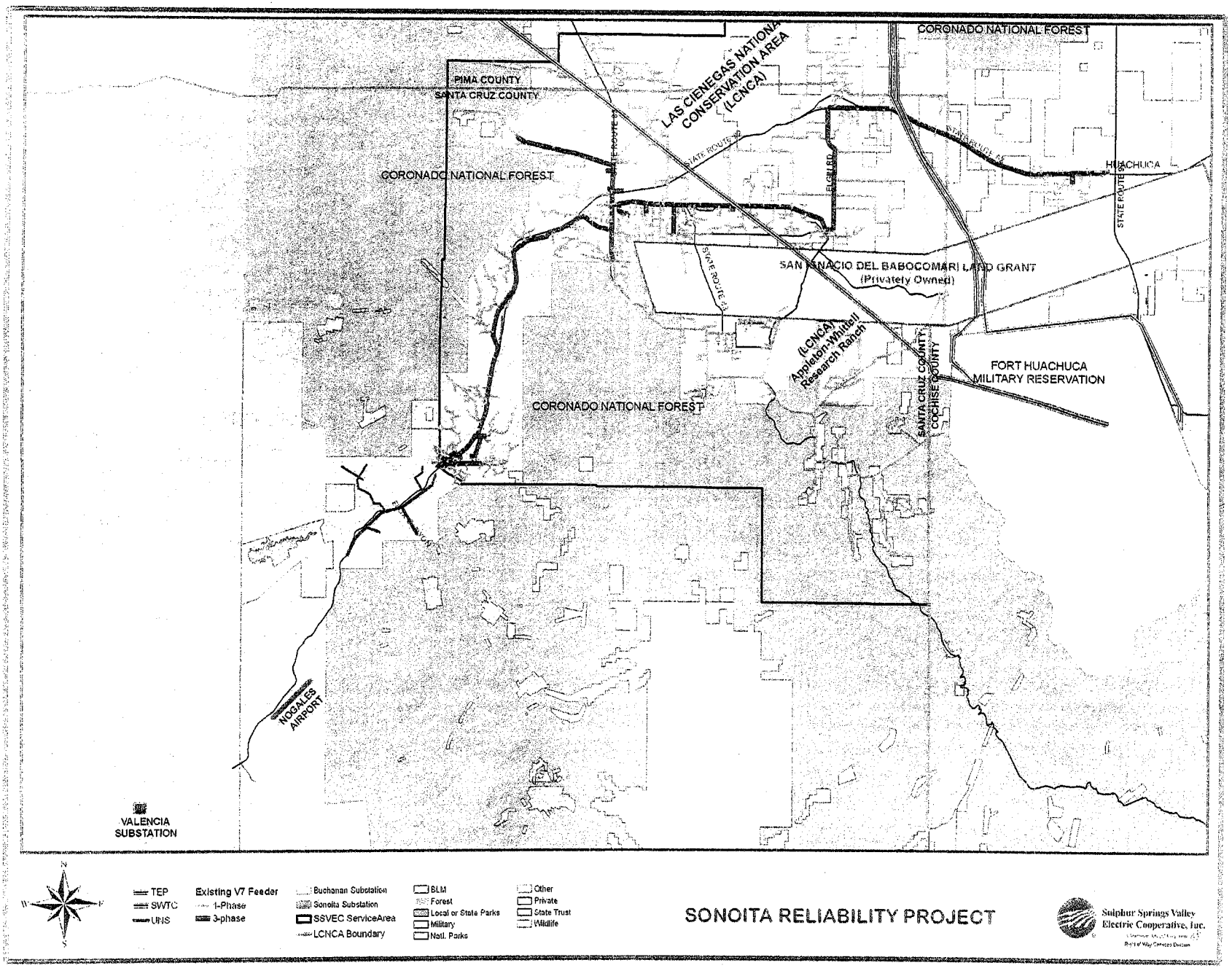
ROW costs for the 1-mile of private easement for the line extension, 6 acres total, would be approximately $40,000 plus any additional fees/requirements for permitting from ADOT along the Scenic Highway 82 Corridor.

Not included in the above costs are any required system upgrades that maybe required such as substation upgrades or line upgrades not discussed. To estimate these costs would require considerable analysis to determine what is required. Also not included is the cost of the engineering studies and testing that would be required. There would also be a requirement for communications between the three ACR installations discussed above. The cost for installation of the communication link has not been determined but it would be significant.

Futhermore, not included in the total cost of this project are legal fees associated with the Certificate of Convenience and Necessity Border Agreements and ACC approval procedures.

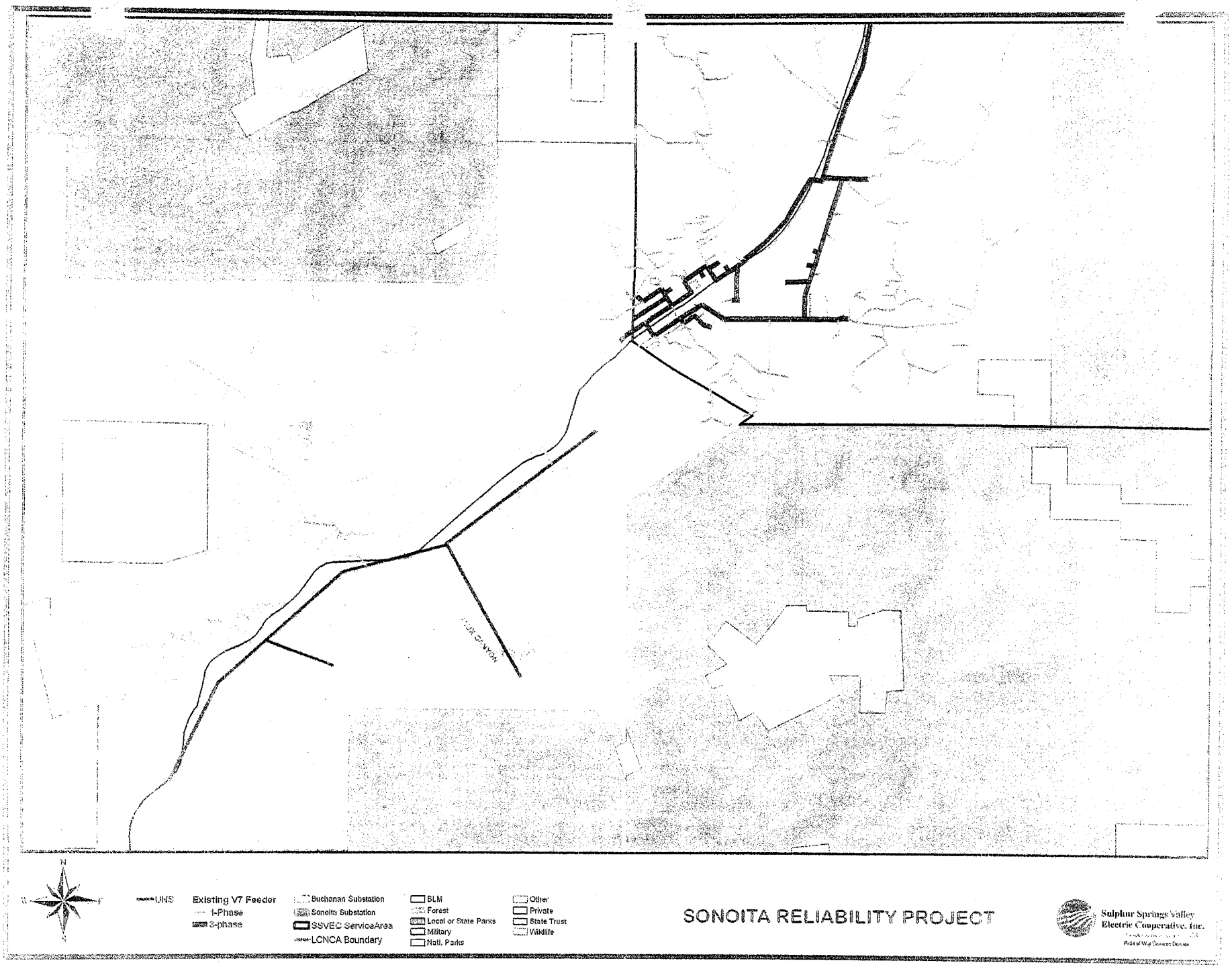
SSVEC / UNS DISTRIBUTION CONNECTION

New 3-Phase line to be constructed from SSVEC to UNS at Flux Canyon – 1 mile	$ 100,000
Step-down transformers (specialized phase shift corrections) required	70,000
Set of 3-Voltage regulators	60,000
3- Automatic Circuit Reclosures, SCADA controlled	150,000
1 mile ROW for 3-Phase line on private property – Transformer Site	40,000
SSVEC Cost (does NOT include costs for UNS facility upgrades)	$ **420,000**
DOES NOT INCLUDE ANY LEGAL EXPENSES OR ANY COSTS ASSOCIATED WITH CCN BORDER AGREEMENTS, ACC APPROVAL PROCEDURES, ETC	



SONOITA RELIABILITY PROJECT

Sulphur Springs Valley Electric Cooperative, Inc.


N
UNS
Existing V7 Feeder
1-Phase
3-phase
Buchanan Substation
Sonoita Substation
SSVEC ServiceArea
LCNCA Boundary
BLM
Forest
Local or State Parks
Military
Natl. Parks
Other
Private
State Trust
Wildlife
SONOITA RELIABILITY PROJECT
Sulphur Springs Valley
Electric Cooperative, Inc.

2008 V-7 AND OTHER FEEDERS (CONNECTIVITY) OUTAGE DATA

Feeder Line	Hours Off	Number of Customers	Customer Hours OFF	Hours OFF/custo mer
V-7 Sonoita/Patagonia	179.98	3057	3839.91	0.06
R-3 Ramsey	64.16	1006	2988.66	0.06
K-2 Chri	239.75	1828	4299.75	0.13
O-5 Mescal	392.22	2639	4657.97	0.15
J-3 Kansas Settlement	197.05	1202	3409.05	0.16

1. Three feeder lines have higher outages than V-7, with twice the outage hours per customer.
2. Only 1 V-7 outage was due to "overload" impacting 1 customer.

Analysis prepared by Jeanne Horsmann and Gail Getzwiller, Sonoita.
Ref: SSVEC 2008 Feeder Outage Data (without November)

In 2008, there were 80 outages for total of 180 hours on the V-7 feeder. Note November data was not provided; however, 12 months of data are shown as January 2008 and 2009 were provided.

- 50 Outages (63%) impacted 1 meter (Causes: 18 unknown, 11 birds, 11 lightning, 3 animals, 3 wind, 3 other, 1 overload)
- 7 Outages (9%) impacted 2 meters (Causes: 3 lightning, 2 birds, 2 unknown, 1 Other)
- 5 Outages(6%) impacted 3 meters (Causes: 2 lighting, 1 birds, 1 tree, 1 unknown)

ONLY 3 Outages (4%) impacted a significant number of people on the main line with causes as indicated:

- 1 impacted 1,700 meters– cause "Other"
- 1 impacted 580 meters – cause wind
- 1 impacted 450 meters – cause wind

Others, 1 impacted 60 meters (cause "accident"), 1 impacted 45 meters (wind), 1 impacted 40 meters (lightning), 1 impacted 20 meters (birds), 1 impacted 12 meters (underground fault)

The causes for V-7 outages in 2008 were as follows:

Cause	No. of Outages	Hours
Overload	1	2.0
Tree	1	2.0
Underground Fault	2	10.0
Accidents	3	10.5
Animals	3	25.0
Other	5	6.5
Wind	7	21.0
Birds	15	22.3
Lightning	21	39.9
Unknown	25	42.8

SSVEC

Reliability

LIST OF TABLES / FIGURES

TABLE 1 2008 FEEDER OUTAGE DATA
TABLE 2 1999 - 2008 OUTAGE DATA
TABLE 3 1995 - 1999 OUTAGE DATA
TABLE 4 1992 - 1996 OUTAGE DATA
TABLE 5 1986 - 1990 OUTAGE DATA
TABLE 6 RELIABILITY DEFINITIONS

2010-2012 CONSTRUCTION WORK PLAN EXHIBIT
- TABLE 9 92-2008 RELIABILITY RANKING TABLE
- TABLE 10 2005 - 2008 RELIABILITY RANKING TABLE
- TABLE 11 TABLE OF FEEDER/SUBSTATION CUSTOMER COUNTS
- MAPS

CHART 1-2 1999 - 2008 TOTAL ANNUAL OUTAGE DURATION AND MILES SERVED
CHART 3 1999 - 2008 TOTAL CUSTOMERS AFFECTED ANNUALLY BY OUTAGES
CHART 4 1999 - 2008 TOTAL NUMBER OF OUTAGES ANNUALLY
CHART 5 1999 - 2008 AVERAGE NUMBER OF OUTAGES PER CUSTOMER
CHART 6 1999 - 2008 AVERAGE CONSUMER-HOURS OUTAGE TIME
CHART 7 1999 - 2008 AVERAGE CONSUMER-HOURS OUTAGE TIME PER CUSTOMER
CHART 8-9 1999 - 2008 CONTRIBUTION TO TOTAL HOURS OFF: HOURS
1999 - 2008 CONTRIBUTION TO TOTAL HOURS OFF: CONSUMER-HOURS
CHART 10 1999 - 2008 INTERRUPTIONS REASONS (FACILITY DAMAGE)
CHART 11 1999 - 2008 INTERRUPTIONS CAUSES (HAZARDS)
CHART 12 NRECA MOMENTARY CHART
CHART 13 NRECA "ITIC" CHART

V7 AND GENERAL FEEDER RELIABILITY ANALYSIS

INTRODUCTION - HISTORY

ıe history of service to this area has previously been presented. Here is just a quick summary:

With the expansion of Ft. Huachuca, during World War II, plans were made for extension of primary electric lines from Fry, near Sierra Vista and from an area which became know as "Huachuca Junction" north of Ft Huachuca at State Highway 82. By the 1950's this extension actually happened from the more northern of the two routes. At Huachuca Junction, Huachuca Substation was constructed and single-phase primary service was extended through "Rain Valley" to Elgin and Sonoita. From Sonoita service was routed to the Canelo and "West Gate" areas. Patagonia at this time was served by Patagonia Water and Light Company.

It must be remembered that these were very sparsely populated areas that were not desired by any of the larger investor owned power companies; they couldn't make any money in these rural areas. With the Rural Electrification Act in the 1930's, cooperatives were encouraged and assisted to serve rural areas. SSVEC sprang from this effort in 1939.

By the early 1960's Patagonia Water and Light Company was having trouble meeting demands for power. SSVEC eventually was granted this addition to their Certificate of Convenience and Necessity by the Arizona Corporation Commission, and three-phase power was extended all the way from Huachuca substation, nearly 40 miles of line conversion and extension. The Patagonia addition added an acceptable load burden to the lightly loaded Santa Cruz County electric facilities owned by SSVEC. Reliability was not excellent, but it was acceptable by the standards of the day.

In the 1970's reliability analysis indicated that reliability was about average, but with growth it was identified as future problem area and monitoring was increased. At one time this area was growing in load as fast as 16% per year. As long-range planning was being conducted in the early 1980's future major extensions were identified and property rights began to be acquired for substations and easements. The Sonoita-bound easement was acquired through the Bobocomari Land Grant. Although growth continued, sometimes slower and sometimes faster, the first immediate problem was actually to maintain voltages within industry standard parameters. At the time the technology only allowed about 3 regulating units to be in series; 1 at the substation and 2 line-mounted units. The Rural Electrification Administration (REA - now Rural Utilities Service - RUS) only allowed planning to include 1 line-mounted unit. SSVEC had to resort to much more drastic measures to continue acceptable service performance.

PRESENT SITUATION

As problems arose over the years, SSVEC stayed substantially aware of both the reliability situation and the available technology and has been able to resolve immediate problems up to now. Industry standard voltage levels and reliability levels have been maintained. However, electric loads continue to increase and service standards have been raised, so problems have arisen in three categories: **1)** Power Quality involving voltage parameters: Steady state voltage must remain within industry-defined and regulated boundaries; voltages need to be stable without excessive highs (swells or spikes) or lows (sags or dips or flicker); the steady 60 HZ AC voltage sine wave must remain of proper shape; neither frequency nor waveform shape can be allowed to be out of defined boundaries. Unfortunately, our measurements now indicate the waveform is being distorted and system harmonics (accidental tuning) is resulting in high voltage in the center of the feeder. The series of voltage regulators works quite well in steady conditions, but sudden load changes are resulting in very severe voltage swings, both high and low temporary voltages. **2)** Reliability: Both industry and regulatory standards have been developed for service interruption management and measurement, and the delay in V7 solutions is now causing these limits to be approached and sometimes violated. **3)** Basic line capacity: Although this can be defined very precisely for certain facilities and conditions, those conditions are neither steady nor certain. A load imbalance of about 15 - 20 % on B-phase is very difficult and expensive to eliminate. Also, a 15 - 20 %

margin must be maintained for severe weather and to handle transient loads. As a result of these two factors alone, only 65 - 70 percent of the theoretical conductor capacity can be reliably carried (also sectionalizing devices recommend no more than 70 - 80% of maximum load be carried steady-state for these same reasons). ıce this is a winter peaking feeder (so far), 250 amps per phase is a reasonable maximum load (less in summer). This would normally indicate that real concerns are raise as load approaches 175 amps per phase. The SSVEC loads on this feeder have already exceeded 190 amps on the peak phase. Only one parameter is an inadequate measure; the full practical operations capacity of this line is rapidly being approached.

As SSVEC began to seriously consider longer-term solutions in the Santa Cruz County area, impediments also arose. **1)** SSVEC has sought to avoid unnecessary costs relative to revenue. Even now, this is not a profit center, especially if multiple millions of dollars are used to upgrade service quality and capacity. It is vital to identify the optimum long-term solutions to these problems, while maintaining a reasonable facility investment per dollar of revenue. **2)** Alarms were sounded about 1990 relating to "Electro-magnetic forces" (EMF). Folks became concerned, even though rural loads are low, and the proposed 69 kV extension would lower these substantially. SSVEC had to hold meetings to answer these questions. **3)** In the late 1990's the land owners near the power line easement began to raise concerns; the easement was challenged and much time has been spent trying to fairly deal with these concerns while trying to serve this area. The proposed solutions have been delayed by all these factors nearly 10 years.

DATA PREPARATION / PRESENTATION

Various presentations of the feeder data have previously been submitted. Because of our own extensive data and analysis of this feeder's problems over 3 decades and the many customer complaints both SSVEC and the Arizona Corporation Commission have received, ***disagreement along these issues was not anticipated.*** SSVEC neither prepared nor presented extensive support data for what, to SSVEC analysts, seem obvious; V7 feeder periences poor reliability and power quality. *A compounding factor* in this was the upgrading of SSVEC software and data systems throughout the late 1990's and early in this present decade. The changes being made in these systems resulted in general accounting customer data uncorrelated to engineering/facility data. Accurate accounting of meters served by each feeder was not prepared for several years. This was to avoid maintaining two or more sets of data throughout the accounting and mapping system upgrades. At all times accurate counts were maintained of total customers and meters and of all feeder loading data and interruption statistics. It was only the count of meters served by each feeder that was not maintained for several years. Key historical REA/RUS and more recent IEEE/NRECA interruption indices use these customer counts per feeder. SSVEC was temporarily not in a position to maintain this data by feeder. In response to these past SSVEC submittals, a customer group submitted **Table 1** data for 2008 along with their reasoning why this feeder is not having difficulties. When data began once again to be available, it was not always on the same counting basis as previous software systems. In responding to inquiries for more information for 2008, confusion was introduced by focusing on only one year of data. Weather and other hazards are too variable to focus on any one year. SSVEC has always reviewed 5 - 10 years of data in drawing conclusions and in making facility recommendations.

Charts 1 and 2 were presented originally . They clearly indicate that "total of outage durations" for feeder V7 has been very high relative to other feeders. Part of the reason is evident in **Chart 2**, the comparison of total miles of primary voltage line served by each of SSVEC's feeders. However, more data was needed to display the whole longer-term picture.

STANDARDS

ᴰEA/RUS traditionally evaluated interruption history and maintained standards based on ***"Consumer-Hours .r Consumer"*** [The sum (for all system or feeder outages) of the product of customers affected times the hours duration of interruptions and this sum divided by the number of customers served by the system (or feeder).] SSVEC record systems and all history were set up to maintain this REA/RUS mandated standard. For decades

the minimum system standard was set by REA at 5 Consumer-Hours per Customer annually. During long-term planning, it was required by REA that a lower goal be set. SSVEC initiated a "2 Consumer-Hours per Customer" annual outage goal in 1984, because the system average was then varying but near 3 hours. Larger ilities, mostly urban achieve generally significantly higher standards. In recent year RUS has been encouraging the 2-Hour standard.

As there has been consolidation and competition in the industry, more indices and standards have appeared. The National Rural Electric Cooperative Association (NRECA) has now published quite a list of standards **(See Table 6)** developed by various groups and for various purposed around the country. Frankly, these various indices were typically developed when they placed a given utility in better light than some other standard. Because of SSVEC's major software upgrades, data for a period of about 5 years was maintained with inadequate customer counts by feeder; so it has been unfeasible to calculate many of the newer standards using "Customers per Feeder". With this recent work presented here, many of these indices have now been calculated. The REA/RUS standard was developed to allow the agency's regulators to fairly evaluate rural cooperative performance on maintenance and outage prevention. Densely populated utilities score better with one measure, while sparsely populated systems look better using different measures. Mostly agricultural systems favor one standard over measures used by mostly residential systems. SSVEC always used the RUS measure, because that was how SSVEC was primarily regulated.

RECENT ANALYSIS

In the past few weeks and months it has become clear that there is no consensus on the feeder reliability data. Since there are firm standards on these issues, an effort has been made by SSVEC analysts to pull the best customer data from older records, so standard data and feeder comparisons can better be made. The efforts and systems available were somewhat imperfect, but the accuracy achieved will not affect comparisons of data between various feeders, even if there is a modest error bound in the precise results of the indices. **Tables 2a-**, 1999 - 2008 SSVEC feeder outage data are presented here. This can be readily compared with older feeder and substation interruption data in **Tables 3-5**.

Table 2a includes all feeders; **Table 2b** includes only the feeders approaching 750 consumers or more (the SSVEC average). These are comparable with V7. A few additional problematic feeders serving less than 750 customers, but which have other poor indicators, have been included to reveal the entire situation. **Table 2c** includes those same feeders, but only where the "Consumer-Hours per Consumer" indicator is greater than or equal to 1 hour per year. This leaves a collection of 10 of SSVEC's feeders most comparable with feeder V7; SSVEC analysts feel this latter table **(Table 2c)** provides the best outage data comparison. Of 12 parameters and indices, feeder J3 is maximum in 4, K2 is maximum in 3, and V7 is maximum in 5, which include:

- ✓ Sum of the durations of all the feeder's interruptions; V7 totals about twice as many as any other feeder; **Chart 1** still is correct.
- ✓ The maximum number of customers with service actually interrupted during the year, **Chart 3**. For comparison, R3 feeder with similar average customers served as V7 experiences less than one half the number of customers interrupted annually.
- ✓ V7 experiences more than twice as many interruptions annually as any other feeder; see **Chart 4**. Although many of these are individual services, feeder issues (voltage spikes and dips) are likely contributing to some of these individual interruptions. **Chart 5**, which displays "SAIFI" the "Number of Outages per Customer" also indicates that V7 is *second highest* of feeders in this group.
- ✓ V7 data **(see Chart 6)** totals more than twice as many total Consumer-Hours interruption time than any other SSVEC feeder. Most of these hours is from feeder interruption rather than individual outages **(see Charts 3 and 4).**
- ✓ V7 has the highest indicator (2.83) of Consumer-Hours per Consumer per year **(Chart 7),** more than 3 times the system average (0.93). This is the indicator which has traditionally been **most used by REA/RUS** in evaluating performance.

Charts 8 and 9 were originally presented. These respectively indicate the contributions toward total annual hours of outage time and toward Consumer-Hours outage measures. These are useful in seeking explanations for the performance record and various solutions which might reduce problems. Similarly **Chart 10** provides ..ight into what facilities are damaged or which type of device is opening to cause the outages. **Chart 11** helps to visualize the specific hazard behind the interruptions. **Chart 12** presents a performance guide from NRECA, using the Computer Business Equipment Manufacturers Association (CBEMA) curves which indicate voltage performance which is normal (center), low (bottom), or high (top). **Chart 13** Information Technology Industry Council (ITIC) data is presented is a similar, but unsmoothed, set of "curves".

In the end with all present and previous presentations SSVEC is not intending or needing to argue which feeder has the truly worst performance record; each has its own issues, but SSVEC's analysts are stressing primarily that feeder V7 is very near the limits of what can be accomplished without a major facility upgrade in this area. Some other feeders do perform worse in some years and by some of the measures. Each feeder has a different history, environment, and customer/load mix. Here is a little illustration of how the problems evident in the data have been dealt with in the past few years for other feeder areas:

- Feeder O5 (originally O1 and presented for ten years in the new tables as "O15") recently was recently upgraded for several miles and new Cottonwood Substation was constructed. The long-range plan indicates that a 69 kV extension and an additional "Empirita" substation will also eventually be required. [Note: Feeder O8 was originally designated as O2; in the data tables the entire series is labeled "O28".]
- Feeder J3 was recently upgraded for several miles and the long-range plan has indicated that a 69 kV extension and an additional "Playa" substation will also eventually be required.
- Feeder K2 is itself a solution. In 2001 Chiricahua Substation was added as feeders K1 and K2 were formed from a portion of feeder J7. This latter feeder was once the SSVEC feeder with the most extreme problems. In the mid-1990's feeder N1 was extended to the extremity of feeder J7 to provide a loop and backup to the Rucker Canyon area.
- Feeder R3 is experiencing growth pains and will soon be split as various feeders from a new Hereford Substation west of Palominas, AZ.
- Feeder H4 was recently divided; a voltage conversion was performed and a portion of the feeder was transferred to Feeder J5. A new Sunsites Substation will be required within a few years.

Other poorly performing feeders evident in this recently available 10-year history have already been improved. SSVEC is seeking to ensure that our customers in Santa Cruz County are also provided with the highest quality service we can feasibly provide.

In reviewing the interruption data, these outage indicators are not actually describing the most critical problem with this feeder: For example, feeders which have been more problematic have "end of line voltmeters" (EOLVM) installed. Looking at two similar feeders which have these meters similarly placed:

- J3's EOLVM, over the past 5 years has experienced 15 high voltage spikes and 305 voltage dips that the meter registered.
- V7's EOLVM, for the same period, has counted 271 voltage spikes and 638 voltage dips. Unfortunately, the voltmeters nearer the mid-point of the V7 feeder (east and north of Sonoita) are registering much higher indications of voltage swells and spikes. J3 has no mid-point meters for comparison. The series of 5 voltage regulators, combined with frequent sudden load changes, help produce these spikes. Also near the feeder mid-point, voltage harmonic distortions have been measured exceeding prescribed limits (the underground lines in the vicinity have significant capacitive reactance, somewhat matching the large inductive reactance of the line back to the substation; this likely is producing the resonance).

..urther, the numerous individual customer line-faults and interruptions produce sags and spikes that affect the entire feeder. The fault drags down the voltage momentarily, and subsequently there is an inductive voltage

spike when the fault clears. These performance issues affect the customers with visible light "flicker" and with trouble in resetting clock displays repeatedly on various devices.

the past few years, measurements have also indicated that excessive voltage harmonic content in the Sonoita area exceeds standard for good performance of computers and electronic devices. This issue must be addressed, because modern devices, including alternative energy inverters, will not remain stable with these conditions.

It is felt that these various power quality issues alone justify solutions that will bring service quality back to normal ranges as soon as feasible. This is likely the highest priority issue of feeder V7 to be solved. Priorities must be set. Which are of immediate concern? Which are of concern now, but might be considered serious nuisances, rather than really serious problems by the customers? Which will become serious threats to receiving normal electric service in the near-term? These priorities should be viewed approximately as:

- ✓ Power Quality / Stability Issues: A better "stiffer" grid connection and dividing the 1 feeder into several feeders.
- ✓ Pending Capacity Issues: Sources of energy are much discussed today. SSVEC has been ready to support any reasonable solution. More difficult and much more expensive is meeting customer demand at times of peak loading. This is currently much higher about sunrise on winter mornings and after dark on winter evenings. Summer peaks are now less problematic, but will also eventually become an issue. For non-traditional sources unavailable at peak, power storage becomes a necessity for these technologies, unless additional grid connections can be made. Additionally, a key issue in defining capacity is practical sectionalizing device coordination/selectivity. Normally these devices are loaded no more than 80%, for several devices this is precisely where V7 loads level are. More problematical is that phase trip setting have already been set higher than conductor melting points (SSVEC is forced to rely on "ground trips" and manual load management to avoid a literal conductor meltdown in the next few seasons -- when ever the next great winter storm arrives.)
- ✓ Transient Service Interruptions: A better "stiffer" grid connection and dividing the 1 feeder into several feeders, in addition to continued attention to individual line components.
- ✓ The general high incidence of power interruptions. Once separate feeders are formed, good sectionalizing plans and good attention to line components can significantly improve the outage record for this area.

2010 - 2012 CONSTRUCTION WORK PLAN ANALYSIS

An independent analysis was completed in early 2009 in preparation for the 2010 - 2012 Construction Work Plan. Here, some highlights are presented:

- **Table 9** presented a listing of substation reliability for 1992 - 2008: Feeder V7 was worst of all for 2 of the 4 indicators.
- **Table 10** presented a sort of outage data for transmission lines, substations, and for distribution feeders. Feeder V7 was indicated to have the worst distribution record of all for both parameters.
- **Table 11** presented an example of how the customers per substation and feeder have traditionally been distributed. However, this data was omitted or faulty for about 5 years, so is not reliably available. (For the most recent analysis, presented above for the first time, all available customer data was normalized with every tool immediately available. Then this data was averaged for the entire 10-year period of analysis. This was an effort to minimize the effect of missing or approximated data. While specific indicator calculations may have a limit in accuracy, using the same basis for all feeders should allow a fair comparison of the feeder's outage performance.)

RELIABILITY COMPONENTS

UTAGES

Some factors determining how many service interruptions will be experienced include:

- The number of customers, transformers, and service drops that are exposed to the various hazards. Also 3-phase customers frequently have 3 transformers with exposure instead of 1 transformer per single-phase customer. This is one primary reason J3 and K2 have as many interruptions as they do. V7, however, has very few 3-phase customers.
- Customer mix: Can customers notice problems (irrigation pumps versus residences)? Are customers home to notice the interruptions? Can customers easily report problems? Irrigation customers have different needs than residential customers also.
- The number of miles of primary line exposed to vibration damage, wind, lightning, trees, accidents, deterioration, snow, ice, etc. V7 has more primary miles of line connected than any other SSVEC feeder. This represents a great deal of weather exposure; V7 has the most exposure to snow/ice of any feeder.
- How well does the feeder configuration (straight radial, most line on side branch lines, customers nearer the source or closer to the feeder end points) serve the area? Does the line location and configuration allow for easy troubleshooting or is the line remote from roadways in many locations?
- Has optimum line fault protection (automatic sectionalizing) been determined and installed. This is one primary method extensively used to reduce problems for V7 in the past. However, increasing customers eventually overcomes this advantage. As a whole SSVEC interruptions are gradually involving more customers per incident.
- Feeder voltage and structure design effectiveness. V7 consists of many structures with "overhead neutral" design, seeking to shunt lightning strokes to ground; however, this configuration can, in some environments, lead to more interruptions of other types. Higher voltage lines are much better at resisting lightning flashovers, with 350kV basic insulation level (BIL) as opposed to 95 kV or 110 kV for distribution lines. This is one major advantage of 69 kV lines over distribution lines.
- Feeder age and condition; maintenance programs, etc.

'OMENTARY INTERRUPTIONS

ı or V7 momentary interruptions are a much greater problem than for most other feeders. Even if exposures don't result in power outages, line faults do produce sags and spikes. Lightning produces powerful spikes; faults can drop the line voltage momentarily to very low values. Especially motor starting loads cause voltage dips; this is not as large a problem for V7 as in some other places, because there are fewer large motors, but longer lines magnify this problem. Any load or fault interruption is followed with a voltage spike as the line inductance (electrical inertia) acts to maintain current flow.

- V7 is a very long feeder with about 350 connected primary miles. This all leads to lots of exposure to voltage dips, which act a momentary service interruptions. Lightning, bird-related faults, conductor "slap" (conductor movement in the wind) is more frequent. Snow or ice can cause upper conductors to sag into lower ones or sudden "unloading" causes lower conductors to flip upward into higher conductors. A much larger incidence of line faults is the result of all these factors, for this feeder. There are many protective sectionalizing devices (breakers) along the feeder; these open and close automatically as problems are sensed and eliminated. Breaker interruptions result in momentary power interruptions every time.
- This feeder is very long; customers are very remote from the substation. This translates into many miles of line with electric resistance and reactance. A surge of current through these lines creates substantial momentary voltage drops. The same fault or starting load results in greater voltage dips on long feeders. What is a minor nuisance on some feeders, frequently acts like a full momentary service interruption on longer lines.

This line has many more temporary current surges than most feeders, as described, because of the excessive exposure. Then the line is longer (and the conductor is quite small). This means greater impedance to power flows and greater voltage transients.

TYPICAL SOLUTIONS

- The most typical solution is to "divide and conquer": In some areas additional feeders can be extended. This is not a good solution when the length of the extension is more than about 5-10 miles or many miles of line remain served by individual sources. Construct new sub-transmission lines if needed and new load centers (substations) are sometimes essential. Split more extensive feeders into shorter optimized feeders.
- Multiple sources will not prevent interruptions, but the most serious interruptions can frequently be shortened by transferring affected customers temporarily to an alternate source. Multiple circuits on the same physical structures can help with some problems if the shared length is not too long, but these are not independent sources. Each circuit can affect the others and structural damage affects all attached circuits. Also, these facilities are expensive to construct.
- Upgrade existing lines (structures, conductors, voltage, etc) where feasible. This works best where the line configuration is not a long radial configuration, but where most primary line exists in significant multiple lateral branches; the source may be shared, but each lateral functions almost as an independent mini-feeder otherwise. Even newly upgraded lines are subject to damage or interference from various hazards. Excessive feeder length always leads to poorer feeder performance. In any event, feeders exceeding 50 miles of total primary or with a long radial source will deteriorate in quality of service delivered.

POWER QUALITY CAUSES

Primary feeders with long, small, conductors have high electrical resistance and inductance (magnetic properties). As loads increase voltage is reduced at points progressing away from the substation. At a certain load and distance stead-state voltage regulation becomes necessary. This is very true of V7 feeder.

Multiple Voltage Regulators in Series: As loads further increase, additional voltage regulators become necessary. For feeder V7 a total of 5 voltage regulators are in series to reach customers in Patagonia and Canelo. Steady state voltages are well maintained as long as controls don't malfunction. With voltage regulators, timers are necessary to avoid continual tap changing which would soon wear out the internal mechanisms. The substation must be set fastest, while the most remote regulators are set slowest. So, 20 seconds, 40 seconds, 60 seconds, 80 seconds, and 100 seconds, for example. Source issues are handled fairly rapidly, while voltage fluctuation affecting only the far ends are handled much more slowly. Rapid voltage dips caused by momentary surges or faults are not dealt with at all. If a disturbance caused the loss of significant load, high voltage will occur all along the feeder until the regulators "time out" and deal with the steady-state voltage. There is a problem with transient voltage regulation on V7.

Extensive feeder miles and customer transformers: Longer, more extensive feeders are affected by widely distributed hazards, such as lightning strikes, wind, trees, deterioration, accidents, birds, animals, etc. Although systems, devices, and procedures attempt to deal with these hazards, lines are affected and faults occur. A feeder with hundreds of miles of line and thousands of transformers experiences more faults than shorter feeders. V7 is the most extensive SSVEC feeder now in operation, and it experiences a large number of faults. These act in conjunction with the high line resistance and inductance to produce voltage fluctuations. Higher voltage (more than 6% above nominal) is referred to as swells or spikes; lower voltage (beginning about a 9% below nominal) would be referred to a sags or dips. Fluctuating power might be referred to as "unstable", or small fluctuations that are repeatedly visible in lights are termed "flicker". All of these occur at a much above average frequency on feeder V7.

Conductor inductance and capacitance are near matches: As it happens the source inductance and the line capacitance on feeder V7 are more or less matched or "tuned" by chance (especially as many miles of underground lines have been added). This results in types of electrical "resonance", "harmonics", voltage distortions, and similar phenomena. The harmonic content has a standard industry set maximum. SSVEC

testing (not yet extensive) indicates that about a 7% harmonic content. This is at or above standards for modern electronics to perform optimally. Additionally, during lighter load periods, voltages in the Sonoita vicinity (near mid-feeder) are rising well above standard steady state limits, because of these feeder characteristics, even ›ugh the voltage regulators next "upstream are appropriately maintaining voltage"; a significant voltage "rise" is occurring at these times.

V7 is seriously experiencing all of the above power quality issues. This type of issue can prevent voltage inverters from functioning.

CONCLUSIONS

- Delays, for economy, expediency, out of customer considerations, and for legal pursuits, have amplified the problems on this feeder. SSVEC initiated actions well ahead of serious developments, but subsequent unanticipated delays are leading to serious feeder performance issues right now. The voltage performance issues (not necessarily steady state voltage levels) ***especially need serious attention now.***
- This feeder V7 has severe issues right now, and gradual load growth will very soon (if not during the next severe winter storm) begin to require power curtailments during peak periods of customer demand.
- Solutions are needed soon to the many momentary interruptions, sags, dips, etc. These are causing our customers real management issues and SSVEC wants to solve these problems.
- If all the other issues can be resolved, and the feeder can be separated into smaller feeders, good sectionalizing design, maintenance, component upgrades, etc, can result in excellent rural electric service to this area.
- Some seem to feel SSVEC does not want non-traditional solutions. Actually, SSVEC desires any cost effective, reliable, and predictable methods to allow us to optimally and satisfactorily serve our customers.

TABLE 1

2008 V-7 AND OTHER FEEDERS (CONNECTIVITY) OUTAGE DATA

Feeder Line	Hours Off	Approx. Customers	Customer Hours Off	Hours Off/Cust. Hrs
V-7 Sonoita/Patagonia	179.98	3057	3839.91	0.06
R-3 Ramsey	64.16	1006	2988.66	0.06
K-2 Chri	239.75	1828	4299.75	0.13
O-5 Mescal	392.22	2639	4657.97	0.15
J-3 Kansas Settlement	197.05	1202	3409.05	0.16

1. Three feeder lines have higher outages than V-7, with twice the outage hours per customer.
2. Only 1 V-7 outage was due to "overload" impacting 1 customer.

Analysis prepared by Jeanne Horsmann and Gail Getzwiller, Sonoita.
Ref: SSVEC 2008 Feeder Outage Data (without November)

In 2008, there were 80 outages for total of 180 hours on the V-7 feeder. Note November data was not provided; however, 12 months of data are shown as January 2008 and 2009 were provided.

- *50 Outages (63%) impacted 1 meter (Causes: 18 unknown, 11 birds, 11 lightning, 3 animals, 3 wind, 3 other, 1 overload)*
- *7 Outages (9%) impacted 2 meters (Causes: 3 lightning, 2 birds, 2 unknown, 1 Other)*
- *5 Outages(6%) impacted 3 meters (Causes: 2 lighting, 1 birds, 1 tree, 1 unknown)*

ONLY 3 Outages (4%) impacted a significant number of people on the main line with causes as indicated:

- *1 impacted 1,700 meters– cause "Other"*
- *1 impacted 580 meters – cause wind*
- *1 impacted 450 meters – cause wind*

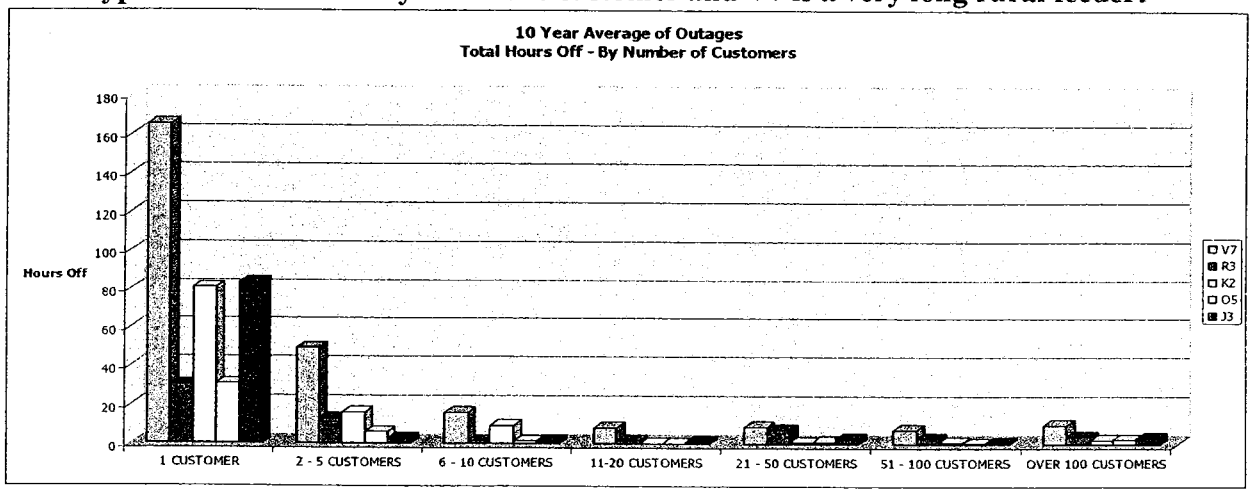
Others, 1 impacted 60 meters (cause "accident"), 1 impacted 45 meters (wind), 1 impacted 40 meters (lightning), 1 impacted 20 meters (birds), 1 impacted 12 meters (underground fault)
The causes for V-7 outages in 2008 were as follows:

Cause	*No. of Outages*	*Hours*
Overload	*1*	*2.0*
Tree	*1*	*2.0*
Underground Fault	*2*	*10.0*
Accidents	*3*	*10.5*
Animals	*3*	*25.0*
Other	*5*	*6.5*
Wind	*7*	*21.0*
Birds	*15*	*22.3*
Lightning	*21*	*39.9*
Unknown	*25*	*42.8*

- The above data is correct for 11-months in 2008. HOWEVER, industry standards followed by SSVEC typically analyze outage data for 5 or 10-year periods in order to identify trends and statistics for problem feeders.
- The Outage Data for a 10-year period indicates the V7 Feeder is has the highest outage rate on the SSVEC System.

FEEDER	AVG Hours Out	AVG No. Customers Effected	AVG Consumer Hours Out
V7	270.7	2735.95	6883.131
R3	63.05	1134.81	2675.756
O5	43.86	2054.60	2004.006
K2	113.63	676.45	1568.918
J3	98.25	759.90	1332.726

- Outage types stated are consistent with system configuration. Majority of outages on typical rural feeder only affect one customer and V7 is a very long rural feeder:



- The area of concern is the actual number of CUSTOMER HOURS affected by the outages. Although there are over 160 HOURS OFF affecting one customer, that is diminutive compared to the number of CONSUMER HOURS affected by the HOURS OFF of >100 Customers:

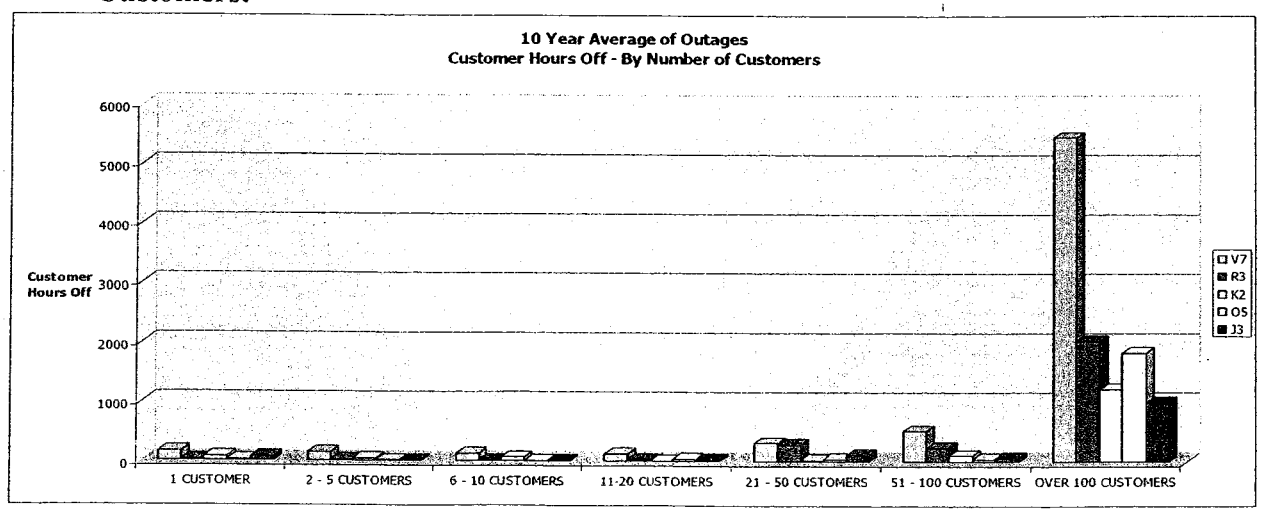


TABLE [redacted] METERS AND INDICATORS [redacted] TA 2

SUB/AREA	FEEDER	AVG CUST	Total Hours Off	HRS OFF/CUST	Total # Cons	AFFECT/CUST	# OUTAGES	# OUTGS/CUST	TOT CONS-HRS	CONS-HR/CUST	SAIDI DUR/CUST TTL HRS PER CUST	CAIDI AVG INCI DUR TTL HRS # OUTAGES	CTAIDI DUR/AF CUST TTL HRS INTR CUST	CAIFI FREQ/AF CUST OUTAGES INTR CUST
		ALL THESE COLUMNS ARE AVERAGES FOR 10 YEARS OF DATA:					AVG	INTR/CUST						
MESCAL	O8	575	62.3	0.108	882	1.533	23	0.040	2222.6	3.86	0.108	2.731	0.071	0.026
MORT	D7	84	9.0	0.108	20	0.238	2	0.027	317.0	3.78	0.108	3.922	0.451	0.115
W HUAC	V7	2149	269.6	0.125	2525	1.175	124	0.058	6077.5	**2.83**	0.125	2.181	0.107	0.049
MORT	D1	65	3.0	0.046	76	1.158	2	0.028	177.2	2.71	0.046	1.655	0.039	0.024
MESCAL	O28*	525	71.0	0.135	622	1.184	30	0.056	1333.5	2.54	0.135	2.408	0.114	0.047
MORT	D5	298	14.1	0.047	161	0.542	8	0.026	729.2	2.45	0.047	1.854	0.087	0.047
KANSAS	J3	548	96.6	0.176	579	1.057	42	0.077	1171.8	2.14	0.176	2.278	0.167	0.073
MESCAL	O1	1382	140.1	0.101	1734	1.255	66	0.048	2750.6	1.99	0.101	2.122	0.081	0.038
E HUAC	W3	1058	23.7	0.022	1294	1.223	16	0.015	2037.7	1.93	0.022	1.489	0.018	0.012
MESCAL	O15*	1624	111.3	0.069	2440	1.503	54	0.033	3081.6	1.90	0.069	2.072	0.046	0.022
MESCAL	O5	1866	82.5	0.044	3145	1.686	41	0.022	3412.7	1.83	0.044	1.992	0.026	0.013
SAN S	A2	183	28.2	0.155	167	0.912	9	0.049	325.4	1.78	0.155	3.172	0.169	0.053
WEBB	M1	228	43.7	0.192	111	0.489	12	0.054	387.0	1.70	0.192	3.578	0.392	0.110
CHIR	K2	840	138.2	0.164	661	0.786	43	0.051	1394.8	1.66	0.164	3.204	0.209	0.065
STEW	E3	698	16.5	0.024	339	0.486	8	0.012	1155.4	1.66	0.024	1.982	0.049	0.024
KANSAS	J7	529	55.0	0.104	421	0.795	25	0.048	808.8	1.53	0.104	2.175	0.131	0.060
STEW	E1	45	3.2	0.071	21	0.471	2	0.042	65.3	1.45	0.071	1.679	0.150	0.090
BOWIE	B5	39	9.1	0.232	14	0.351	3	0.079	55.3	1.41	0.232	2.935	0.659	0.225
COCH	H4	1480	56.2	0.038	1160	0.784	18	0.012	2060.8	1.39	0.038	3.073	0.048	0.016
SAN S	A3	291	16.8	0.058	200	0.685	6	0.020	386.5	1.33	0.058	2.945	0.084	0.029
TOMB	S23	320	22.4	0.070	291	0.907	10	0.032	408.7	1.28	0.070	2.174	0.077	0.035
RAMSEY	R3	2121	62.6	0.030	1121	0.529	40	0.019	2663.0	1.26	0.030	1.549	0.056	0.036
COCH	H3	365	15.9	0.044	138	0.378	7	0.019	386.5	1.06	0.044	2.338	0.115	0.049
MESCAL	O2	475	79.8	0.168	362	0.762	36	0.076	444.5	0.94	0.168	2.205	0.221	0.100
SYS	**AVG**	746	28.7	0.105	402	0.469	13	0.025	675.6	**0.93**	0.105	2.478	0.442	0.080
KEAT	T2	972	21.3	0.022	636	0.654	13	0.014	866.3	0.89	0.022	1.610	0.033	0.021
HAWES	X8	1798	14.1	0.008	844	0.470	6	0.004	1553.6	0.86	0.008	2.230	0.017	0.007
HAWES	X5	965	18.2	0.019	490	0.508	13	0.013	831.4	0.86	0.019	1.456	0.037	0.026
KEAT	T4	797	12.4	0.015	366	0.459	7	0.009	674.1	0.85	0.015	1.816	0.034	0.019
KANSAS	J5	202	16.9	0.084	65	0.323	9	0.043	162.5	0.80	0.084	1.941	0.259	0.133
HUAC	W5	1395	18.4	0.013	907	0.650	12	0.008	1080.6	0.77	0.013	1.573	0.020	0.013
BENSON	P5	843	20.8	0.025	423	0.501	10	0.011	620.1	0.74	0.025	2.162	0.049	0.023
BOWIE	B7	353	8.7	0.025	73	0.205	4	0.010	252.2	0.71	0.025	2.407	0.119	0.050
MCNL	N1	421	76.0	0.180	148	0.350	12	0.028	294.5	0.70	0.180	6.387	0.515	0.081
WEBB	M3	137	13.1	0.096	31	0.229	5	0.034	78.3	0.57	0.096	2.854	0.419	0.147
HAWES	X7	1629	19.6	0.012	662	0.407	11	0.007	904.9	0.56	0.012	1.818	0.030	0.016
STEW	E2	222	7.8	0.035	32	0.145	4	0.018	118.9	0.54	0.035	1.960	0.244	0.125
BOWIE	B3	101	6.0	0.060	15	0.146	2	0.019	51.3	0.51	0.060	3.158	0.408	0.129
WEBB	M5	81	10.8	0.132	30	0.370	2	0.027	41.2	0.51	0.132	4.886	0.357	0.073
ST DAV	Q3	453	7.5	0.017	175	0.386	5	0.010	228.6	0.51	0.017	1.667	0.043	0.026
MCNL	N2	556	44.9	0.081	138	0.248	13	0.024	267.7	0.48	0.081	3.374	0.325	0.096
RAMSEY	R1	906	16.2	0.018	256	0.282	10	0.011	424.6	0.47	0.018	1.588	0.063	0.040
BL VSTA	Y3	935	11.8	0.013	335	0.358	7	0.008	413.4	0.44	0.013	1.614	0.035	0.022
PUEBLO	Z2	261	3.4	0.013	17	0.067	2	0.006	114.1	0.44	0.013	2.292	0.198	0.086
PUEBLO	Z1	626	9.0	0.014	134	0.214	6	0.009	250.8	0.40	0.014	1.566	0.067	0.043
BL VSTA	Y2	666	3.6	0.005	144	0.217	2	0.004	258.5	0.39	0.005	1.518	0.025	0.017
SAN S	A1	29	2.2	0.075	5	0.173	1	0.045	11.0	0.38	0.075	1.673	0.435	0.260
RAMSEY	R4	392	9.0	0.023	160	0.408	7	0.019	143.8	0.37	0.023	1.209	0.056	0.046
ST DAV	Q7	2	6.0	3.600	0	0.180	0	0.180	0.6	0.36	3.600	20.000	20.000	1.000
PUEBLO	Z4	1660	16.0	0.010	413	0.249	10	0.006	554.1	0.33	0.010	1.659	0.039	0.023
S VSTA	U3	497	6.9	0.014	90	0.181	4	0.007	163.8	0.33	0.014	1.915	0.077	0.040
WEBB	M4	558	36.9	0.066	124	0.222	10	0.018	183.2	0.33	0.066	3.583	0.298	0.083
MESCAL	O4	1206	9.8	0.008	496	0.411	5	0.004	388.6	0.32	0.008	1.917	0.020	0.010
BL VSTA	Y1	490	3.3	0.007	127	0.260	2	0.004	156.0	0.32	0.007	1.737	0.026	0.015
CHIR	K1	27	6.1	0.227	4	0.149	3	0.098	8.4	0.31	0.227	2.321	1.523	0.656
BENSON	P7	418	8.4	0.020	78	0.187	5	0.011	129.1	0.31	0.020	1.740	0.107	0.061
HAWES	X1	1313	2.7	0.002	166	0.126	1	0.001	387.1	0.29	0.002	2.418	0.016	0.007
BENSON	P8	662	12.8	0.019	113	0.170	5	0.008	168.1	0.25	0.019	2.410	0.114	0.047
S VSTA	U5	981	5.8	0.006	252	0.256	5	0.005	247.2	0.25	0.006	1.229	0.023	0.019
KEAT	T1	1196	6.2	0.005	216	0.180	4	0.003	293.0	0.24	0.005	1.561	0.029	0.019
WLCX	F8	884	9.8	0.011	300	0.339	6	0.007	212.5	0.24	0.011	1.576	0.033	0.021
WLCX	F7	868	19.0	0.022	233	0.269	10	0.011	196.9	0.23	0.022	1.924	0.082	0.042
RAMSEY	R2	1195	12.0	0.010	249	0.208	10	0.008	265.7	0.22	0.010	1.220	0.048	0.039

ST DAV	IC	306	9.2	0.030	42	0.137	4	J12	66.6	0.22	0.030	2.554	0.219	0.08	
KEAT	T3	1275	7.0	0.005	190	0.149	5	0.004	258.0	0.20	0.005	1.363	0.037	0.027	
WLCX	F4	98	3.5	0.036	17	0.172	2	0.021	18.5	0.19	0.036	1.655	0.207	0.125	
S VSTA	U6	1352	9.1	0.007	157	0.116	6	0.004	248.1	0.18	0.007	1.591	0.058	0.036	
S VSTA	U7	937	6.9	0.007	169	0.180	4	0.004	167.1	0.18	0.007	1.957	0.041	0.021	
MESCAL	O3	478	5.5	0.011	44	0.091	2	0.004	61.6	0.13	0.011	2.868	0.125	0.044	
PUEBLO	Z3	2192	11.2	0.005	241	0.110	9	0.004	254.6	0.12	0.005	1.215	0.047	0.038	
WLCX	F3	901	15.2	0.017	19	0.021	6	0.007	34.6	0.04	0.017	2.568	0.815	0.317	
BL VSTA	Y4	934	8.2	0.009	251	0.269	3	0.004	7.3	0.01	0.009	2.492	0.033	0.013	

TABLE 2b SELECTED FEEDERS # CUSTOMERS

								SAIFI			SAIDI	CAIDI	CTAIDI	CAIFI	
								INTR/CUST			DUR/CUST	AVG INCI DUR	DUR/AF CUST	FREQ/AF CUST	
		ALL THESE COLUMNS ARE AVERAGES FOR 10 YEARS OF DATA:					AVG				TTL HRS	TTL HRS	TTL HRS	OUTAGES	
SUB/AREA	FEEDER	AVG CUST	Total Hours Off	HRS OFF/CUST	Total # Cons	AFFECT/CUST	# OUTAGES	# OUTGS/CUST	TOT CONS-HRS	CONS-HR/CUST	PER CUST	# OUTAGES	INTR CUST	INTR CUST	
W HUAC	V7	2149	269.6	0.125	2525	1.175	124	0.058	6077.5	**2.83**	0.125	2.181	0.107	0.049	
MESCAL	O28*	525	71.0	0.135	622	1.184	30	0.056	1333.5	2.54	0.135	2.408	0.114	0.047	
KANSAS	J3	548	96.6	0.176	579	1.057	42	0.077	1171.8	2.14	0.176	2.278	0.167	0.073	
E HUAC	W3	1058	23.7	0.022	1294	1.223	16	0.015	2037.7	1.93	0.022	1.489	0.018	0.012	
MESCAL	O15*	1624	111.3	0.069	2440	1.503	54	0.033	3081.6	1.90	0.069	2.072	0.046	0.022	
CHIR	K2	840	138.2	0.164	661	0.786	43	0.051	1394.8	1.66	0.164	3.204	0.209	0.065	
STEW	E3	698	16.5	0.024	339	0.486	8	0.012	1155.4	1.66	0.024	1.982	0.049	0.024	
KANSAS	J7	529	55.0	0.104	421	0.795	25	0.048	808.8	1.53	0.104	2.175	0.131	0.060	
COCH	H4	1480	56.2	0.038	1160	0.784	18	0.012	2060.8	1.39	0.038	3.073	0.048	0.016	
RAMSEY	R3	2121	62.6	0.030	1121	0.529	40	0.019	2663.0	1.26	0.030	1.549	0.056	0.036	
HAWES	X8	1798	14.1	0.008	844	0.470	6	0.004	1553.6	0.86	0.008	2.230	0.017	0.007	
HAWES	X5	965	18.2	0.019	490	0.508	13	0.013	831.4	0.86	0.019	1.456	0.037	0.026	
KEAT	T4	797	12.4	0.015	366	0.459	7	0.009	674.1	0.85	0.015	1.816	0.034	0.019	
E HUAC	W5	1395	18.4	0.013	907	0.650	12	0.008	1080.6	0.77	0.013	1.573	0.020	0.013	
BEN	P5	843	20.8	0.025	423	0.501	10	0.011	620.1	0.74	0.025	2.162	0.049	0.023	
HAWES	X7	1629	19.6	0.012	662	0.407	11	0.007	904.9	0.56	0.012	1.818	0.030	0.016	
RAMSEY	R1	906	16.2	0.018	256	0.282	10	0.011	424.6	0.47	0.018	1.588	0.063	0.040	
B VSTA	Y3	935	11.8	0.013	335	0.358	7	0.008	413.4	0.44	0.013	1.614	0.035	0.022	
PUEBLO	Z4	1660	16.0	0.010	413	0.249	10	0.006	554.1	0.33	0.010	1.659	0.039	0.023	
MESCAL	O4	1206	9.8	0.008	496	0.411	5	0.004	388.6	0.32	0.008	1.917	0.020	0.010	
HAWES	X1	1313	2.7	0.002	166	0.126	1	0.001	387.1	0.29	0.002	2.418	0.016	0.007	
S VSTA	U5	981	5.8	0.006	252	0.256	5	0.005	247.2	0.25	0.006	1.229	0.023	0.019	
KEAT	T1	1196	6.2	0.005	216	0.180	4	0.003	293.0	0.24	0.005	1.561	0.029	0.019	
WLCX	F8	884	9.8	0.011	300	0.339	6	0.007	212.5	0.24	0.011	1.576	0.033	0.021	
WLCX	F7	868	19.0	0.022	233	0.269	10	0.011	196.9	0.23	0.022	1.924	0.082	0.042	
RAMSEY	R2	1195	12.0	0.010	249	0.208	10	0.008	265.7	0.22	0.010	1.220	0.048	0.039	
KEAT	T3	1275	7.0	0.005	190	0.149	5	0.004	258.0	0.20	0.005	1.363	0.037	0.027	
S VSTA	U6	1352	9.1	0.007	157	0.116	6	0.004	248.1	0.18	0.007	1.591	0.058	0.036	
S VSTA	U7	937	6.9	0.007	169	0.180	4	0.004	167.1	0.18	0.007	1.957	0.041	0.021	
PUEBLO	Z3	2192	11.2	0.005	241	0.110	9	0.004	254.6	0.12	0.005	1.215	0.047	0.038	
WLCX	F3	901	15.2	0.017	19	0.021	6	0.007	34.6	0.04	0.017	2.568	0.815	0.317	
B VSTA	Y4	934	8.2	0.009	251	0.269	3	0.004	7.3	0.01	0.009	2.492	0.033	0.013	

[redacted]

								SAIFI			SAIDI	CAIDI	CTAIDI	CAIFI	
								INTR/CUST			DUR/CUST	AVG INCI DUR	DUR/AF CUST	FREQ/AF CUST	
		ALL THESE COLUMNS ARE AVERAGES FOR 10 YEARS OF DATA:					AVG				TTL HRS	TTL HRS	TTL HRS	OUTAGES	
SUB/AREA	FEEDER	AVG CUST	Total Hours Off	HRS OFF/CUST	Total # Cons	AFFECT/CUST	# OUTAGES	# OUTGS/CUST	TOT CONS-HRS	CONS-HR/CUST	PER CUST	# OUTAGES	INTR CUST	INTR CUST	
W HUAC	V7	**2149**	**269.6**	0.125	**2525**	1.175	**124**	0.058	**6077.5**	**2.83**	0.125	2.181	0.107	0.049	0
MESCAL	O28*	525	71.0	0.135	622	1.184	30	0.056	1333.5	2.54	0.135	2.408	0.114	0.047	4
KANSAS	J3	548	96.6	**0.176**	579	1.057	42	**0.077**	1171.8	2.14	**0.176**	2.278	0.167	**0.073**	0
E HUAC	W3	1058	23.7	0.022	1294	1.223	16	0.015	2037.7	1.93	0.022	1.489	0.018	0.012	2
MESCAL	O15*	1624	111.3	0.069	2440	**1.503**	54	0.033	3081.6	1.90	0.069	2.072	0.046	0.022	1
CHIR	K2	840	138.2	0.164	661	0.786	43	0.051	1394.8	1.66	0.164	**3.204**	**0.209**	0.065	0
STEW	E3	698	16.5	0.024	339	0.486	8	0.012	1155.4	1.66	0.024	1.982	0.049	0.024	5
KANSAS	J7	529	55.0	0.104	421	0.795	25	0.048	808.8	1.53	0.104	2.175	0.131	0.060	0
COCH	H4	1480	56.2	0.038	1160	0.784	18	0.012	2060.8	1.39	0.038	3.073	0.048	0.016	
RAMSEY	R3	2121	62.6	0.030	1121	0.529	40	0.019	2663.0	1.26	0.030	1.549	0.056	0.036	
	GRP AVG	**1157**	**90**	**0.089**	**1116**	**0.952**	**40**	**0.038**	**2178.5**	**1.88**	**0.089**	**2.241**	**0.094**	**0.041**	
	MAX	**2149**	**269.6**	**0.176**	**2525**	**1.503**	**124**	**0.077**	**6077.5**	**2.83**	**0.176**	**3.204**	**0.209**	**0.073**	**0**

TABLE 3

TOTAL NUMBER OF CONSUMER OUTAGE HOURS PER CONSUMER 1995 - 1999

SUBSTATION	1995	1996	1997	1998	1999	Sub/Fdr Average	% Comparison to System
SYSTEM TOTAL	1.110	1.690	1.613	1.659	2.706	1.756	
SAN SIMON TOTALS	0.642	1.559	1.291	0.090	0.969	0.910	52%
A1	0.000	0.000	2.353	0.143	0.057	0.511	
A3	1.350	2.212	1.901	0.069	0.162	1.139	
A5	0.351	0.868	0.247	0.068	0.022	0.311	
Outages of Entire Sub A	0.000	0.000	0.000	0.000	0.810	0.162	
BOWIE TOTALS	0.438	0.327	0.215	0.346	1.708	0.607	35%
B3	0.862	1.316	0.174	0.440	0.887	0.736	
B5	2.481	0.167	0.264	1.757	0.042	0.942	
B7	0.140	0.100	0.217	0.167	0.970	0.319	
Outages of Entire Sub B	0.000	0.000	0.000	0.000	0.827	0.165	
MORTENSON TOTALS	0.324	2.995	3.931	0.676	3.961	2.377	135%
D1	0.034	0.103	0.321	5.862	0.069	1.278	
D5	0.486	0.249	0.058	0.052	3.880	0.945	
D7	0.020	0.081	0.083	0.250	2.234	0.534	
Outages of Entire Sub D	0.000	2.802	3.830	0.000	0.808	1.488	
STEWART TOTALS	0.330	1.180	0.547	0.099	4.506	1.333	76%
E1	0.190	0.185	0.014	0.097	0.000	0.097	
E2	1.184	0.500	1.986	0.197	0.062	0.786	
E3	0.079	0.053	0.105	0.067	5.107	1.082	
Outages of Entire Sub E	0.000	1.016	0.000	0.000	0.822	0.368	
WILLCOX TOTALS	0.165	0.552	0.041	0.135	0.956	0.370	21%
F3	0.072	0.033	0.046	0.031	0.011	0.039	
F4	0.892	0.000	0.035	0.301	0.011	0.248	
F7	0.045	0.145	0.059	0.374	0.147	0.154	
F8	0.214	0.003	0.012	0.046	0.262	0.107	
Outages of Entire Sub F	0.000	0.503	0.000	0.000	0.816	0.264	
COCHISE TOTALS	0.463	0.516	0.413	0.625	0.595	0.522	30%
H3	0.167	0.067	0.273	2.186	1.403	0.819	
H4	0.536	0.630	0.450	0.221	0.067	0.381	
Outages of Entire Sub H	0.000	0.000	0.000	0.000	0.256	0.051	
KANSAS TOTALS	0.808	3.279	4.172	0.963	4.665	2.778	158%
J3	1.064	1.696	0.460	2.265	0.742	1.245	
J5	1.905	0.191	0.201	0.090	2.786	1.035	
J7	0.502	1.804	7.095	0.268	5.748	3.083	
Outages of Entire Sub J	0.000	1.642	0.000	0.000	0.925	0.513	
WEBB TOTALS	0.577	1.363	0.143	2.165	1.081	1.066	61%
M1	0.984	0.133	0.029	2.195	0.318	0.732	
M3	0.589	0.394	0.112	0.007	0.259	0.272	
M4	0.162	1.358	0.167	2.777	0.079	0.909	
M5	3.524	0.522	0.365	0.408	0.163	0.996	
Outages of Entire Sub M	0.000	0.422	0.000	0.000	0.925	0.269	
MCNEAL TOTALS	1.033	3.728	1.094	1.284	2.480	1.924	110%
N1	1.394	0.519	1.815	2.921	3.399	2.010	
N2	0.778	3.178	0.558	0.095	0.215	0.965	
Outages of Entire Sub N	0.000	1.646	0.000	0.000	0.927	0.515	
MESCAL TOTALS	2.073	4.127	1.240	0.724	1.268	1.886	107%
O1	2.074	6.311	1.723	0.433	1.803	2.469	
O2	6.536	5.730	1.253	3.291	2.021	3.766	
O3	0.000	1.150	0.000	0.000	0.000	0.230	
O4	0.902	1.297	0.799	0.164	0.010	0.634	
Outages of Entire Sub O	0.000	0.251	0.000	0.000	0.257	0.101	

SUBSTATION	1995	1996	1997	1998	1999	Sub/Fdr Average	Comparison to System
SYSTEM TOTAL	1.145	1.699	1.509	1.675	2.735	1.753	129%
BENSON TOTALS	1.186	1.180	0.582	0.560	1.863	1.074	61%
P5	2.512	0.450	1.091	1.154	1.709	1.383	
P7	0.253	0.111	0.005	0.022	1.064	0.291	
P8	0.030	1.340	0.240	0.111	1.718	0.688	
Outages of Entire Sub P	0.000	0.435	0.000	0.000	0.257	0.138	
ST DAVID TOTALS	1.849	0.945	0.130	1.142	1.889	1.191	68%
Q3	0.332	0.534	0.024	3.467	0.523	0.976	
Q5	0.002	0.015	0.187	0.046	0.035	0.057	
Q7	0.000	0.000	0.000	4.500	4.000	1.700	
Outages of Entire Sub Q	1.740	0.768	0.000	0.000	1.689	0.839	
RAMSEY TOTALS	0.259	0.403	0.542	3.667	4.141	1.802	103%
R1	0.563	0.705	3.105	1.251	1.949	1.514	
R2	0.252	0.094	0.132	3.592	0.104	0.835	
R3	0.164	0.566	0.138	5.046	5.633	2.309	
Outages of Entire Sub R	0.000	0.000	0.000	0.000	1.161	0.232	
TOMBSTONE TOTALS	1.903	3.908	1.584	0.519	1.781	1.939	111%
S3	0.079	4.392	1.205	0.586	0.948	1.442	
S7	0.050	0.056	3.643	0.031	4.594	1.675	
Outages of Entire Sub S	1.827	0.000	0.000	0.000	0.392	0.444	
KEATING TOTALS	2.063	0.533	1.056	0.931	2.865	1.489	85%
T1	1.510	0.154	0.944	1.663	0.222	0.899	
T2	0.476	0.333	0.436	0.875	1.736	0.771	
T3	0.388	0.801	1.550	0.212	0.814	0.753	
T4	0.524	1.174	1.437	0.555	0.451	0.828	
Outages of Entire Sub T	1.270	0.000	0.000	0.000	2.132	0.680	
SIERRA VISTA TOTALS	0.163	0.309	0.210	1.299	0.804	0.557	32%
U3	0.130	0.081	0.000	0.118	0.224	0.111	
U5	0.284	0.564	0.386	0.763	0.153	0.430	
U6	0.082	0.221	0.055	0.063	0.011	0.086	
U7	0.169	0.229	0.384	0.171	0.154	0.221	
Outages of Entire Sub U	0.000	0.000	0.000	0.999	0.697	0.339	
HUACHUCA WEST TOTALS	5.482	4.694	2.406	11.263	9.380	6.645	379%
V7	1.746	1.311	2.406	11.263	8.943	5.134	
Outages of Entire Sub V	3.736	3.383	0.000	0.000	0.437	1.511	
HUACHUCA EAST TOTALS	2.445	3.042	3.204	0.330	0.472	1.899	108%
W3	0.255	5.300	6.739	0.097	0.168	2.512	
W5	0.769	0.232	0.633	0.489	0.093	0.442	
Outages of Entire Sub W	1.883	0.742	0.000	0.000	0.349	0.595	
HAWES TOTALS	0.510	0.685	1.177	0.717	4.583	1.534	88%
X1	0.126	0.003	0.003	0.006	3.223	0.672	
X5	0.434	0.633	2.295	1.243	2.464	1.414	
X7	1.145	2.097	0.713	1.483	1.490	1.386	
X8	0.638	0.790	0.738	0.363	4.256	1.357	
Outages of Entire Sub X	0.000	0.000	0.000	0.000	1.417	0.283	
BELLA VISTA TOTALS	0.786	3.981	0.480	1.201	0.503	1.390	79%
Y1	1.079	0.533	5.533	0.000	1.765	1.782	
Y2	0.220	0.215	0.229	0.164	0.011	0.168	
Y3	1.461	2.889	0.461	2.374	0.145	1.466	
Y4	0.315	1.554	0.855	0.320	0.173	0.643	
Outages of Entire Sub Y	0.000	2.300	0.000	0.000	0.390	0.538	

TABLE 4
TOTAL NUMBER OF CONSUMER OUTAGE HOURS PER CONSUMER 1992 - 1996

SUBSTATION	1992	1993	1994	1995	1996	Sub/Fdr Average	Comparison to System
SYSTEM TOTAL	1.083	1.119	1.540	1.145	1.549	1.287	1.287
SAN SIMON TOTALS	2.738	2.029	1.349	0.644	1.261	1.604	0.016
A1	0.000	0.000	1.077	0.000	0.000	0.215	
A3	1.767	3.282	1.077	1.350	2.212	1.937	
A5	3.348	0.213	1.484	0.351	0.868	1.253	
Outages of Entire Sub A	0.000	0.911	0.000	0.000	0.000	0.182	
BOWIE TOTALS	0.769	0.787	0.434	0.437	0.134	0.512	0.006
B3	4.472	3.414	0.900	0.862	0.355	2.000	
B5	0.000	0.556	0.580	2.481	0.167	0.757	
B7	0.135	0.281	0.325	0.140	0.075	0.191	
Outages of Entire Sub B	0.000	0.000	0.000	0.000	0.000	0.000	
MORTENSON TOTALS	1.611	0.232	2.166	0.325	2.219	1.311	0.009
D1	0.056	0.803	3.892	0.034	0.103	0.978	
D5	2.098	0.083	0.029	0.486	0.249	0.589	
D7	2.324	0.132	0.201	0.020	0.065	0.548	
Outages of Entire Sub D	0.000	0.000	1.405	0.000	2.030	0.687	
STEWART TOTALS	0.073	2.218	0.236	0.330	1.171	0.806	0.015
E1	0.781	1.711	0.091	0.190	0.185	0.592	
E2	0.073	2.030	0.047	1.184	0.496	0.766	
E3	0.045	2.290	0.299	0.079	0.042	0.551	
Outages of Entire Sub E	0.000	0.000	0.000	0.000	1.016	0.203	
WILLCOX TOTALS	0.829	1.016	0.786	0.165	0.551	0.669	0.047
F3	1.962	0.773	1.341	0.072	0.030	0.836	
F4	0.997	3.432	1.329	0.892	0.000	1.330	
F7	0.654	2.046	1.331	0.045	0.145	0.844	
F8	0.010	0.003	0.030	0.214	0.003	0.052	
Outages of Entire Sub F	0.000	0.000	0.000	0.000	0.503	0.101	
COCHISE TOTALS	0.541	0.066	0.188	0.463	0.515	0.355	0.013
H3	0.504	0.208	0.094	0.167	0.067	0.208	
H4	0.550	0.031	0.211	0.536	0.630	0.392	
Outages of Entire Sub H	0.000	0.000	0.000	0.000	0.000	0.000	
KANSAS TOTALS	2.509	1.030	5.571	0.809	3.262	2.636	0.078
J3	0.636	0.680	2.455	1.064	1.685	1.304	
J5	0.435	1.433	0.176	1.905	0.165	0.823	
J7	3.593	1.113	3.538	0.502	1.789	2.107	
Outages of Entire Sub J	0.000	0.000	2.673	0.000	1.640	0.863	
WEBB TOTALS	0.958	1.467	4.646	0.577	0.871	1.704	0.034
M1	1.336	1.026	1.069	0.984	0.133	0.910	
M3	0.553	1.154	0.048	0.589	0.394	0.547	
M4	0.985	0.317	7.025	0.162	0.556	1.809	
M5	0.426	0.063	2.330	3.524	0.522	1.373	
Outages of Entire Sub M	0.000	0.931	0.000	0.000	0.422	0.271	
MCNEAL TOTALS	1.948	0.547	4.479	1.033	3.655	2.332	0.048
N1	4.845	0.165	0.768	1.394	0.506	1.536	
N2	0.043	0.795	2.563	0.778	3.062	1.448	
Outages of Entire Sub N	0.000	0.000	2.640	0.000	1.646	0.857	
MESCAL TOTALS	0.457	2.104	1.475	2.073	4.113	2.045	0.149
O1	0.249	3.121	3.773	2.074	6.287	3.101	
O2	1.181	7.956	0.824	6.536	5.686	4.437	
O3	0.000	0.875	0.000	0.000	1.150	0.405	
O4	0.426	0.123	0.090	0.902	1.297	0.568	
Outages of Entire Sub O	0.000	0.000	0.000	0.000	0.251	0.050	

SUBSTATION	1992	1993	1994	1995	1996	Sub/Fdr Average	Comparison to System
SYSTEM TOTAL	1.083	1.119	1.540	1.145	1.549	1.287	1.287
BENSON TOTALS	1.395	1.010	0.593	1.186	1.176	1.072	0.057
P5	2.547	1.755	0.151	2.512	0.450	1.483	
P7	1.403	0.099	0.712	0.253	0.111	0.516	
P8	0.053	0.477	1.064	0.030	1.330	0.591	
Outages of Entire Sub P	0.000	0.000	0.000	0.000	0.435	0.087	
ST DAVID TOTALS	0.056	0.763	0.191	1.849	0.945	0.761	0.007
Q3	0.000	0.042	0.045	0.332	0.534	0.191	
Q5	0.084	0.047	0.261	0.002	0.015	0.082	
Q7	0.000	0.000	0.000	0.000	0.000	0.000	
Outages of Entire Sub Q	0.000	0.718	0.000	1.740	0.768	0.645	
RAMSEY TOTALS	1.414	1.701	0.988	0.259	0.400	0.952	0.093
R1	1.100	1.842	2.982	0.563	0.705	1.438	
R2	2.603	1.796	0.451	0.252	0.091	1.038	
R3	0.163	1.542	0.754	0.164	0.562	0.637	
Outages of Entire Sub R	0.000	0.000	0.000	0.000	0.000	0.000	
TOMBSTONE TOTALS	0.154	0.073	3.182	1.903	3.900	1.843	0.012
S3	0.151	0.080	3.455	0.079	4.383	1.629	
S7	0.188	0.000	0.000	0.050	0.056	0.059	
Outages of Entire Sub S	0.000	0.000	0.000	1.827	0.000	0.365	
KEATING TOTALS	0.870	0.836	1.177	2.063	0.495	1.088	0.124
T1	1.939	0.271	0.420	1.510	0.152	0.858	
T2	0.064	1.396	1.318	0.476	0.331	0.717	
T3	0.150	1.279	0.398	0.388	0.756	0.594	
T4	0.771	0.636	2.331	0.524	1.041	1.061	
Outages of Entire Sub T	0.000	0.000	0.000	1.270	0.000	0.254	
SIERRA VISTA TOTALS	0.749	0.310	0.613	0.163	0.299	0.427	0.046
U3	0.016	0.019	0.629	0.130	0.014	0.162	
U5	0.102	0.002	0.319	0.284	0.564	0.254	
U6	1.318	0.768	0.843	0.082	0.221	0.647	
U7	1.036	0.012	0.550	0.169	0.221	0.398	
Outages of Entire Sub U	0.000	0.000	0.000	0.000	0.000	0.000	
HUACHUCA WEST TOTALS	3.827	4.042	3.058	5.482	4.642	4.210	0.199
V7	3.827	4.042	1.550	1.746	1.259	2.485	
Outages of Entire Sub V	0.000	0.000	1.508	3.736	3.383	1.725	
HUACHUCA EAST TOTALS	0.364	0.602	0.162	2.445	2.153	1.145	0.062
W3	0.226	0.819	0.245	0.255	3.127	0.934	
W5	0.446	0.470	0.112	0.760	0.227	0.403	
Outages of Entire Sub W	0.000	0.000	0.000	1.883	0.742	0.525	
HAWES TOTALS	0.991	0.740	1.600	0.510	0.675	0.903	0.123
X1	0.033	0.011	0.011	0.126	0.003	0.037	
X5	1.046	0.216	1.435	0.434	0.632	0.753	
X7	0.000	6.817	5.918	1.145	1.969	3.170	
X8	1.223	0.164	0.395	0.638	0.790	0.642	
Outages of Entire Sub X	0.000	0.000	0.457	0.000	0.000	0.000	
BELLA VISTA TOTALS	0.821	0.937	3.294	0.786	3.894	1.946	0.149
Y1	2.193	1.611	0.000	1.079	0.533	1.083	
Y2	0.609	1.128	0.115	0.220	0.001	0.414	
Y3	0.252	0.258	1.500	1.461	2.866	1.267	
Y4	0.501	1.406	0.849	0.315	1.554	0.925	
Outages of Entire Sub Y	0.000	0.000	2.458	0.000	2.300	0.952	

TABLE 5

TABLE 110a
ENTIRE SUBSTATION/FEEDER OUTAGE RECORDS (FIVE YEAR AVERAGES)
Consumer Hours per Consumer 1986--1990

ENTIRE SUB/FEEDE	1986	1987	1988	1989	1990	AVE PER FEEDER
SAN SIMON	0.000	0.000	0.000	0.000	0.000	0.000
A-1	0.105	3.033	0.000	0.000	0.000	0.579
A-3	1.245	0.801	0.600	0.472	1.472	0.915
A-5	0.664	0.320	0.280	1.637	0.078	0.579
BOWIE	0.000	0.000	0.487	0.000	0.000	0.106
B-3	0.000	4.778	0.578	3.676	4.729	2.670
B-5	1.706	3.459	0.021	2.788	0.968	1.625
B-7	0.167	0.201	0.041	0.056	0.213	0.134
MORTENSON	3.143	1.493	0.000	0.000	0.000	0.806
D-1	0.185	0.328	0.000	0.077	0.000	0.105
D-5	0.327	0.276	0.482	0.144	0.078	0.247
D-7	0.258	1.050	0.067	0.286	0.050	0.342
STEWART	0.000	0.000	0.000	0.000	0.000	0.000
E-1	0.000	0.125	0.022	0.250	0.175	0.081
E-2	0.258	0.594	0.725	5.554	0.048	1.319
E-3	0.304	0.125	0.025	0.132	0.900	0.292
WILLCOX	0.000	1.937	0.000	0.000	0.000	0.386
F-3	0.018	0.019	0.477	0.049	0.734	0.247
F-4	1.514	1.608	2.519	0.123	0.401	1.169
F-7	0.619	1.242	0.218	0.106	0.504	0.522
F-8	0.069	0.992	0.021	0.051	0.013	0.209
COCHISE	0.000	0.000	0.000	0.000	0.000	0.000
H-3	5.299	0.302	1.443	3.827	0.210	2.138
H-4	1.345	0.381	2.650	0.308	2.780	1.477
KANSAS	0.000	0.932	0.000	4.041	0.000	0.979
J-3	6.528	2.878	2.905	1.284	1.773	3.143
J-5	1.983	1.036	0.293	1.788	3.807	1.631
J-7	5.425	8.295	1.855	16.694	3.320	7.133
WEBB	0.000	0.965	0.750	0.000	0.000	0.354
M-1	3.615	8.894	5.378	8.407	6.962	6.551
M-3	0.868	0.168	0.068	0.128	0.064	0.256
M-4	0.322	7.752	0.615	0.278	1.207	2.001
M-5	0.092	0.250	1.905	0.133	17.073	3.567
MCNEAL	0.000	0.000	0.000	0.000	0.000	0.000
N-1	3.198	0.249	2.009	6.664	1.521	2.659
N-2	0.166	2.480	1.865	1.582	7.135	2.723
MESCAL	0.000	0.000	0.000	0.000	0.000	0.000
O-1	2.871	0.588	0.956	1.377	1.174	1.339
O-2	18.358	4.474	11.560	4.086	2.221	8.244
O-3	1.000	0.000	1.500	0.000	0.000	0.563
O-4	0.613	0.205	0.027	0.205	0.537	0.327

ENTIRE SUB/FEEDER	1986	1987	1988	1989	1990	AVE PER FEEDER
BENSON	0.000	0.000	0.000	0.000	0.000	0.000
P-5	2.530	1.268	0.159	0.826	2.099	1.265
P-7	1.553	0.330	2.357	0.222	0.065	0.882
P-8	0.751	0.444	1.321	0.083	0.464	0.494
ST. DAVID	0.000	0.000	0.000	3.397	0.000	0.220
Q-3	0.239	0.391	0.920		0.173	0.344
Q-5	4.102	0.042	0.266	3.776	0.049	1.382
AP PWDR Q-7	0.000	0.000	0.000	0.250	2.000	0.450
TOMBSTONE	0.000	1.206	0.000	0.000	0.000	0.237
S-3	3.863	6.171	3.209	5.798	13.525	6.549
S-7	0.053	4.550	2.763	0.000	2.211	1.923
HUACHUCA EA	0.000	0.000	0.000	0.000	0.000	0.000
W-3	0.097	0.232	0.527	0.188	0.575	0.327
W-5	0.018	0.061	0.136	2.128	0.739	0.616
HUACHUCA WEST						
V-7	7.269	9.748	2.603	3.870	9.771	6.618
SIERRA VIST	1.000	0.000	0.000	0.000	0.000	0.211
U-3	1.080	1.755	0.115	2.034	1.706	1.369
U-5	0.444	1.749	0.660	0.013	0.054	0.555
U-6	0.420	0.565	0.601	0.771	2.095	0.927
U-7	0.005	0.123	0.507	0.042	0.034	0.152
BELLA VISTA		0.088	0.000	0.000	0.021	0.021
Y-1					2.443	2.443
Y-2		0.124	0.467	1.264	0.896	0.752
Y-3		0.882	7.554	0.131	0.093	2.361
Y-4		1.858	3.450	2.831	1.010	2.271
KEATING	0.000	0.000	0.000	0.000	0.000	0.000
T-1	0.316	0.095	3.038	4.649	1.080	1.964
T-2	0.177	0.236	0.335	0.793	0.309	0.340
T-3		0.925	0.462	1.702	0.244	1.098
T-4	0.955	1.210	0.123	1.403	0.223	0.847
HAWES	0.000	0.000	0.000	0.000	0.000	0.000
X-1					0.027	0.027
X-5	1.502	2.926	0.432	0.354	0.156	1.064
X-7						
X-8	4.060	0.628	1.537	1.173	0.288	1.686
RAMSEY	0.000	0.000	0.000	0.000	1.170	0.239
R-1	0.761	5.072	0.248	2.162	1.925	1.792
R-2	1.794	4.160	3.022	1.339	1.183	2.223
R-3	1.180	1.428	1.320	0.822	0.712	1.080

TABLE 6

NRECA Reliability Survey

APPENDIX - Definitions

SUSTAINED OUTAGE INDICES

Average Service Availability Index – ASAI is a measure of the average availability of the sub transmission and distribution systems to serve customers. It is the ratio of the total customer minutes that service was available to the total customer minutes demanded in a time period. It is normally expressed as a percentage.

$$\text{ASAI} = \frac{\textit{Customer Hours Service Availability}}{\textit{Customer Hours Service Demand}}$$

System Average Interruption Frequency Index (Sustained Interruptions) – This is defined as the average number of times that a customer is interrupted during a specified time period. It is determined by dividing the total number of customers interrupted in a time period by the average number of customers served. The resulting unit is "interruptions per customer".

$$\text{SAIFI} = \frac{\textit{Total Number of Customer Interruptions}}{\textit{Total Number of Customers Served}}$$

System Average Interruption Duration Index – This is defined as the average interruption duration for customers served during a specified time period. It is determined by summing the customer-minutes off for each interruption during a specified time period and dividing the sum by the average number of customers served during that period. The unit is minutes. This index enables the cooperative to report how many minutes customers would have been out of service if all customers were out at one time.

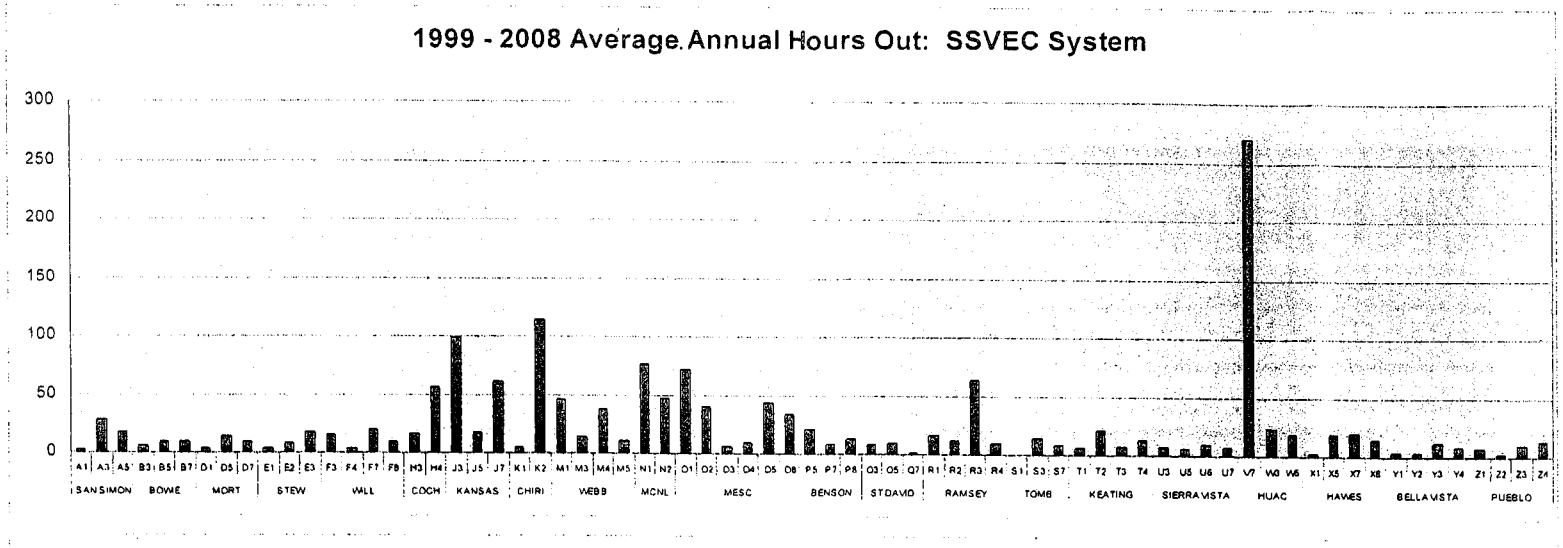
$$\text{SAIDI} = \frac{\sum \textit{Customer Interruption Durations}}{\textit{Total Number of Customers Served}}$$

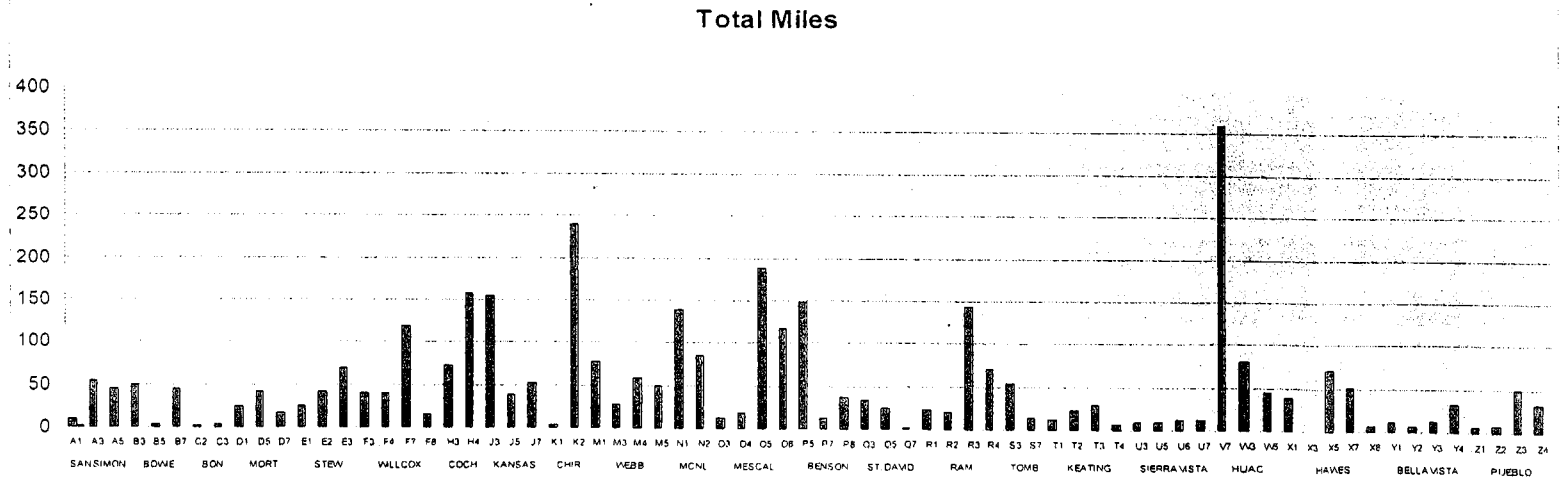
Customer Average Interruption Duration Index – This is defined as the average length of an interruption, weighted by the number of customers affected, for customers interrupted during a specific time period. It is calculated by summing the customer minutes off during each interruption in the time period and dividing this sum by the number of customers experiencing one or more sustained interruptions during the time period. The resulting unit is minutes. The index enables utilities to report the average duration of a customer outage for those customers affected.

$$\text{CAIDI} = \frac{\sum \textit{Customer Interruption Durations}}{\textit{Total Number of Customer Interruptions}}$$

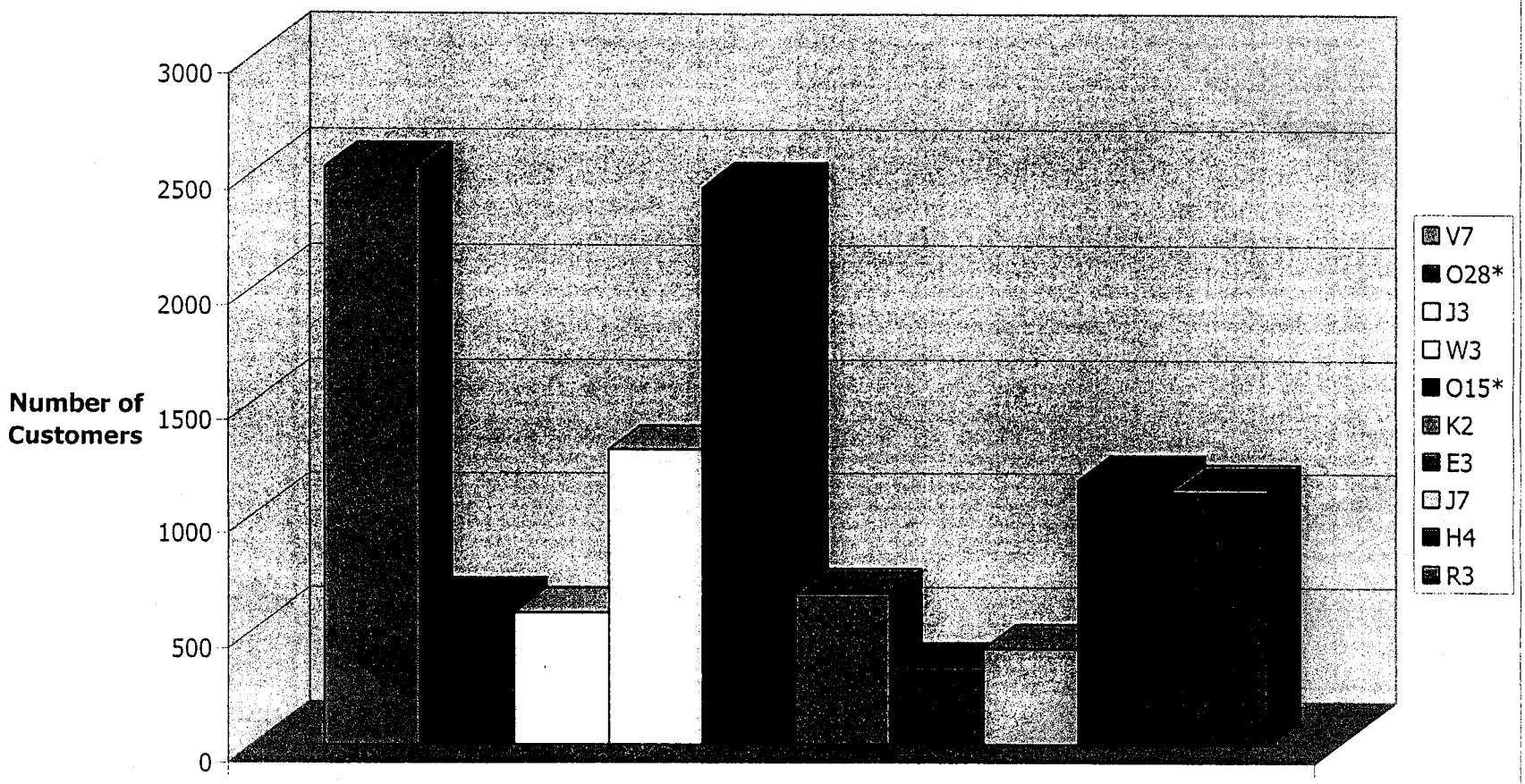
CHART 2

V-7 Feeder Outages and Length in Miles as Compared to all SSVEC feeders

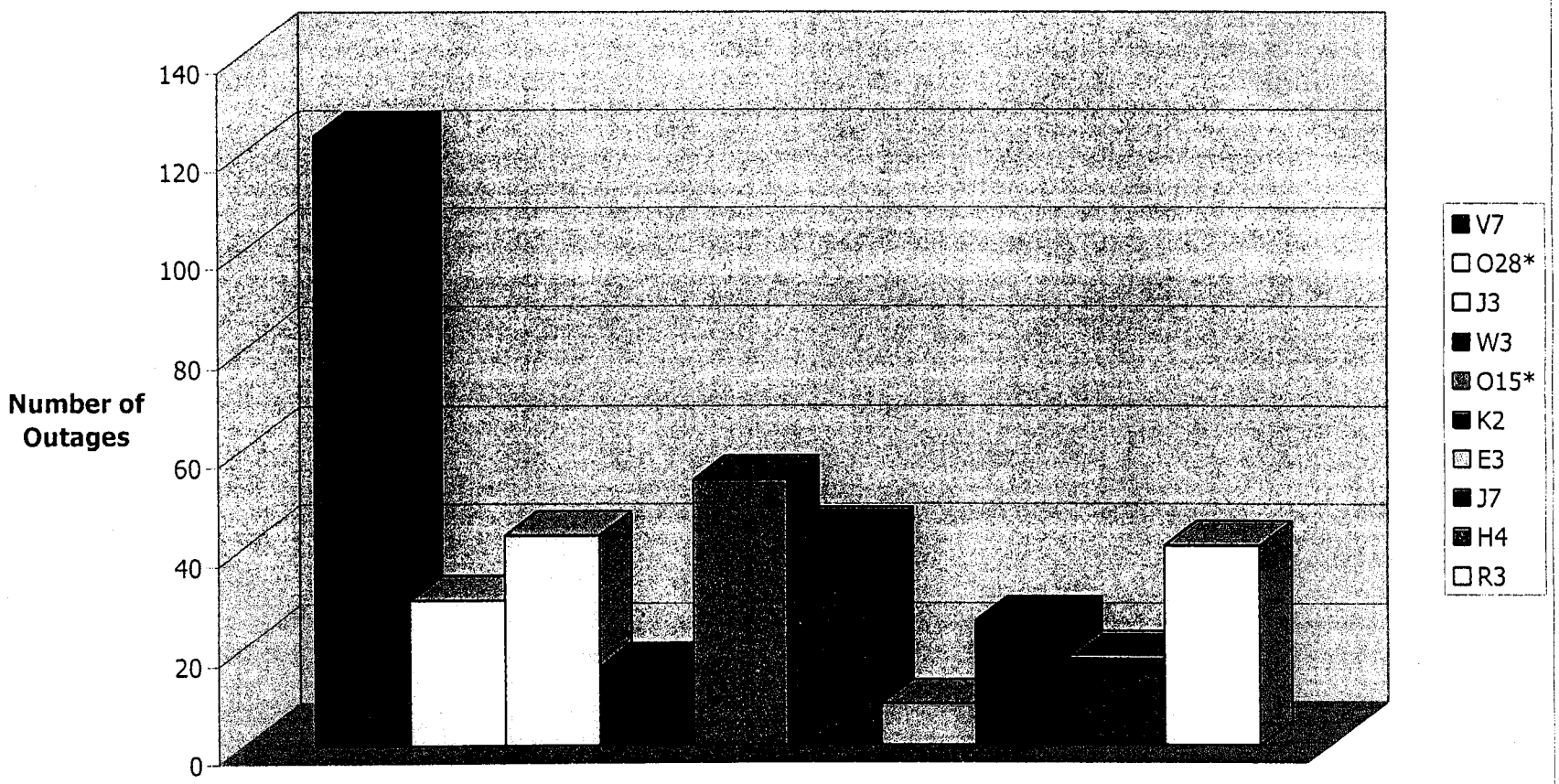




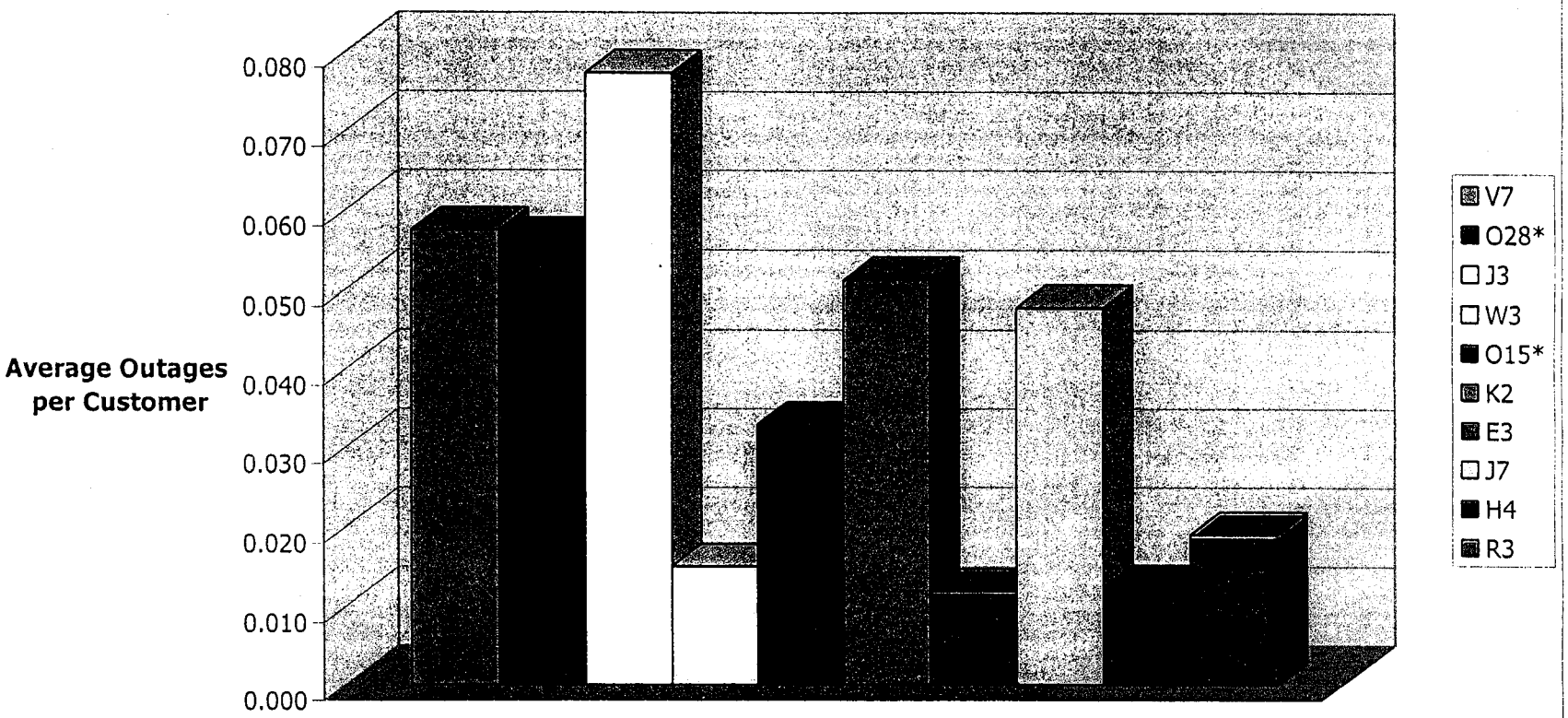
1999 - 2008 Total Customers Affected Annually by Outages
CHART 3



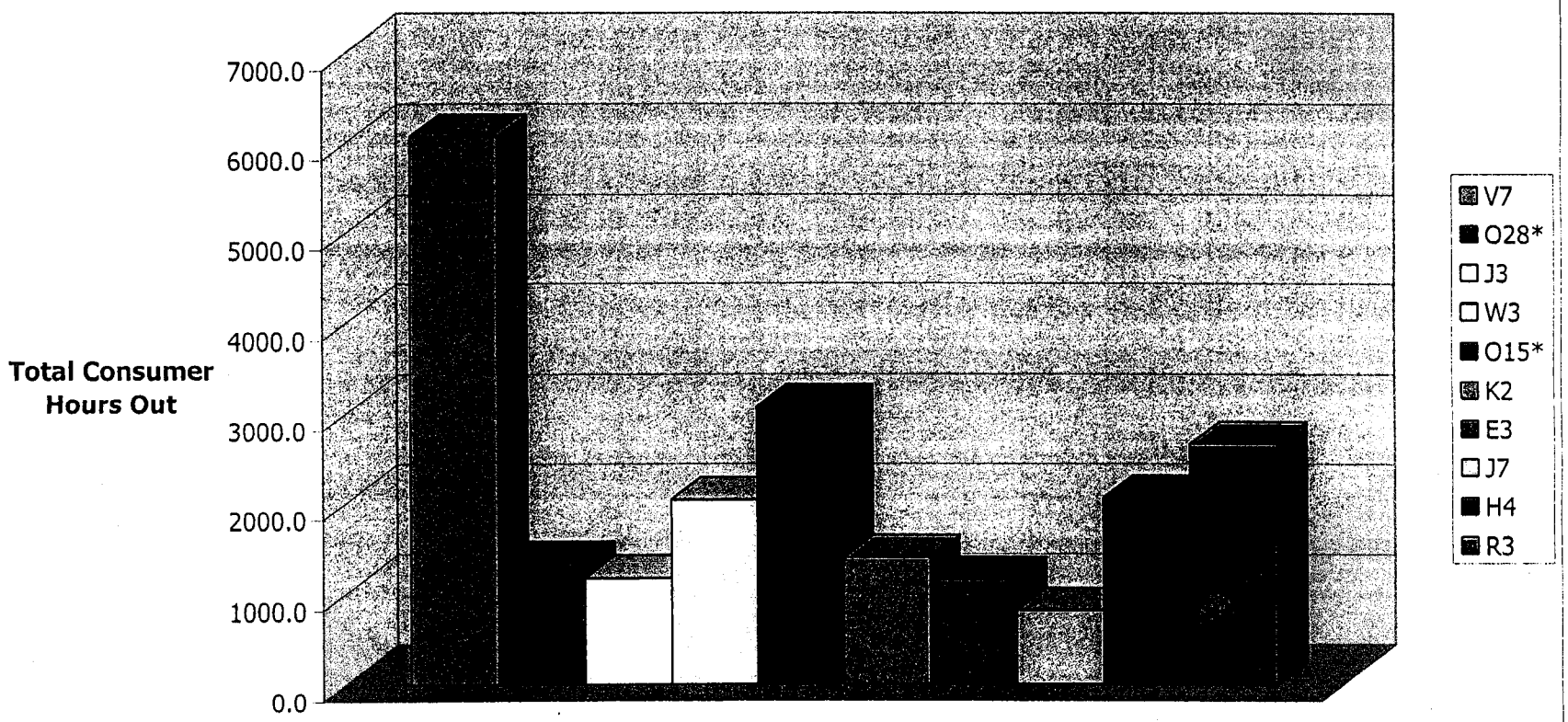
1999 - 2008 Total Number of Outages Annually
CHART 4



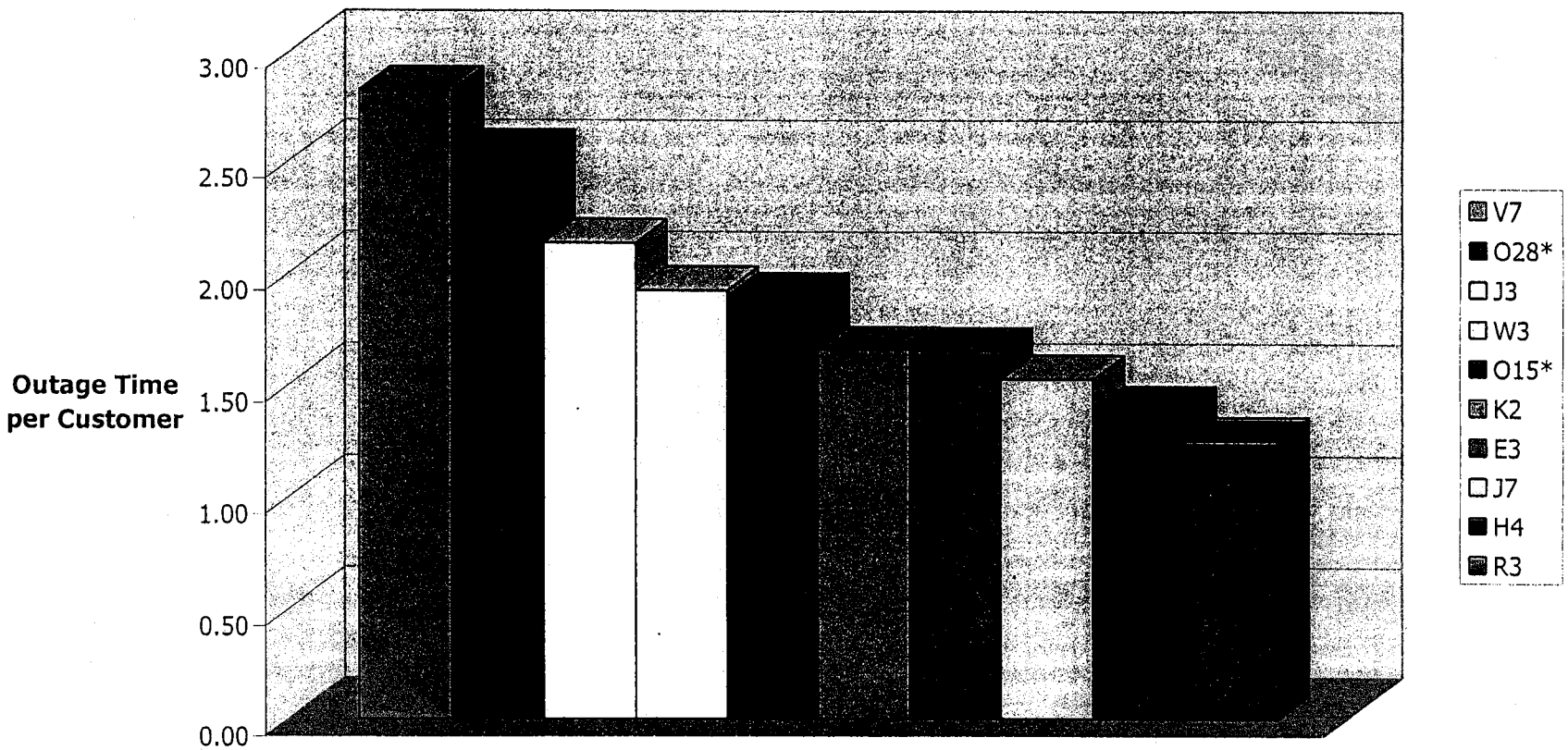
1999 - 2008 Average Number of Outages per Customer
CHART 5



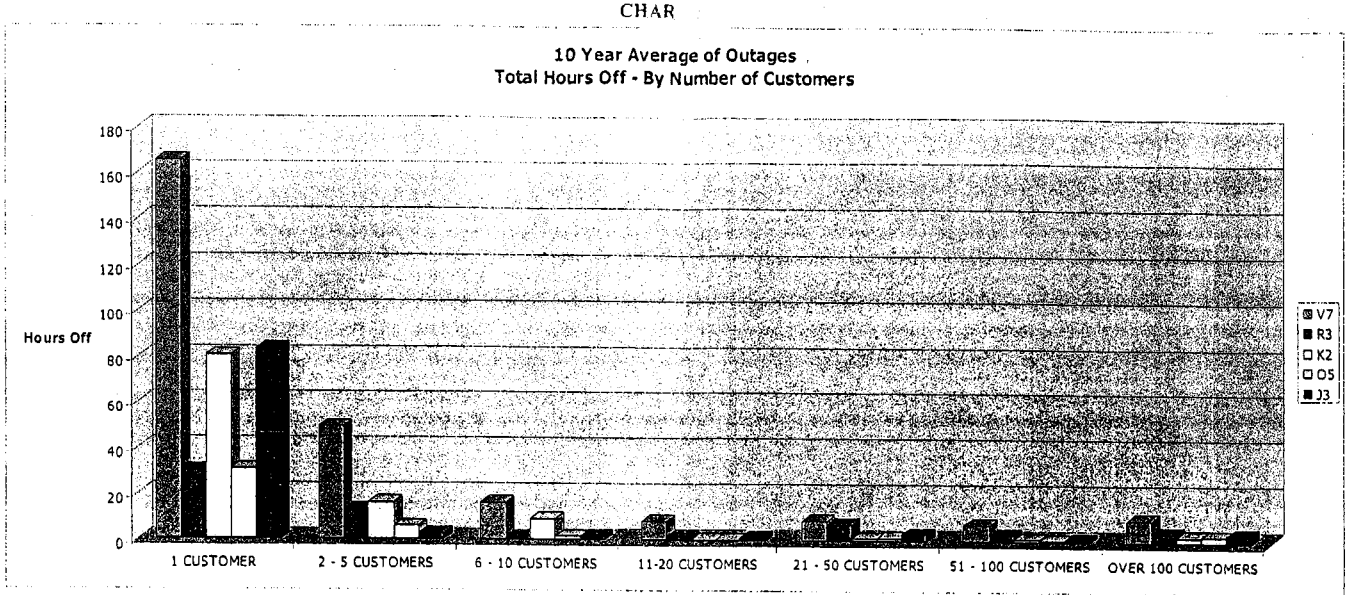
1999 - 2008 Average Consumer-Hours Outage Time
CHART 6

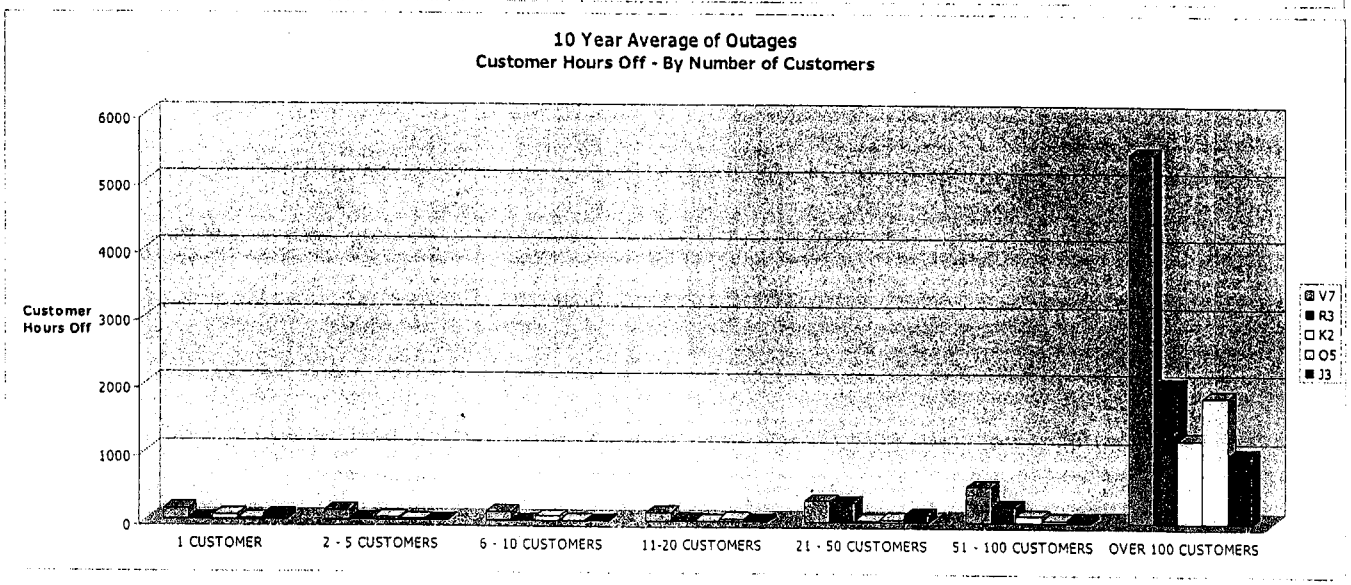


1999 - 2008 Average Consumer-Hours Outage Time per Customer
CHART 7

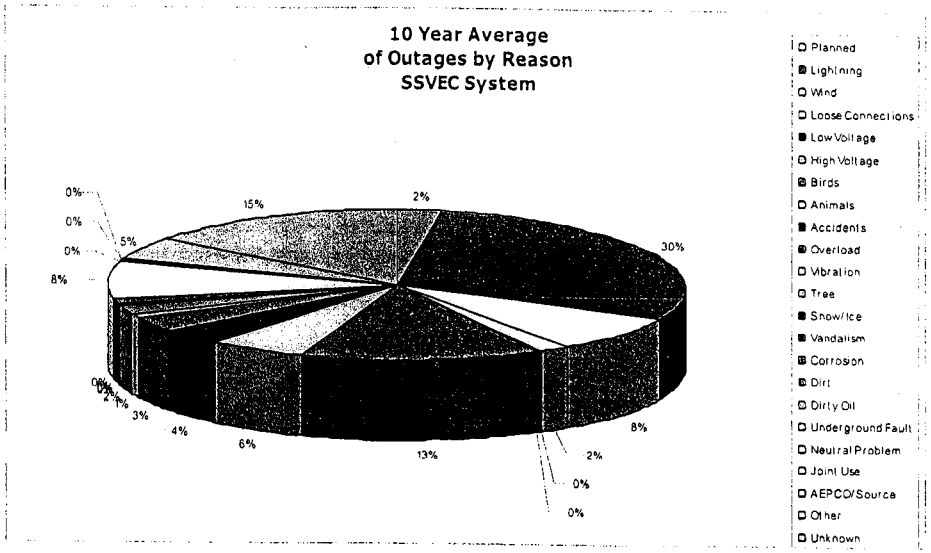


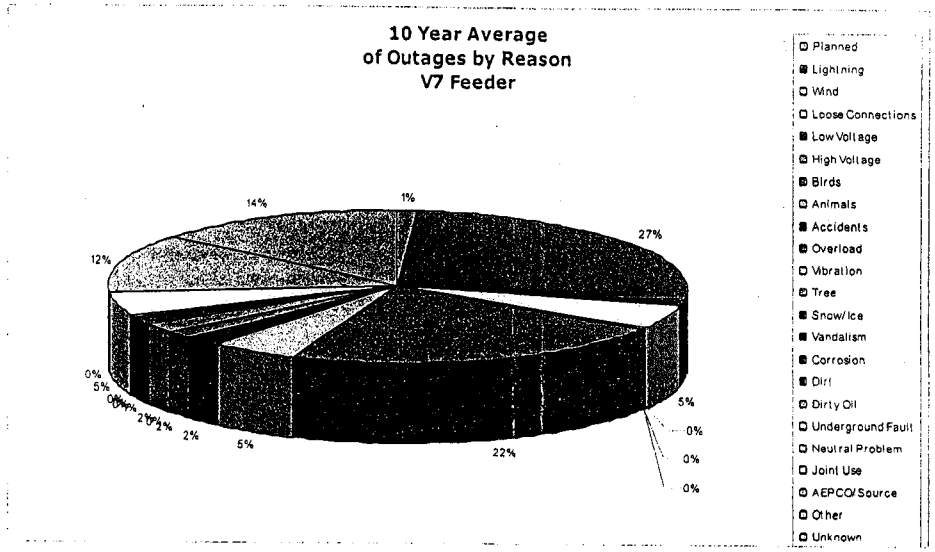
CHAR

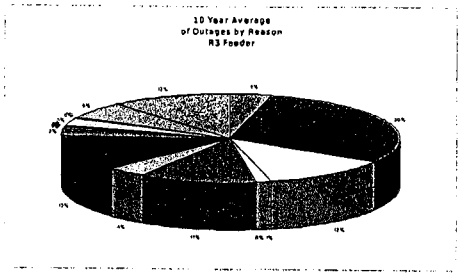

10 Year Average of Outages
Total Hours Off - By Number of Customers
Hours Off
180
160
140
120
100
80
60
40
20
0
1 CUSTOMER
2 - 5 CUSTOMERS
6 - 10 CUSTOMERS
11-20 CUSTOMERS
21 - 50 CUSTOMERS
51 - 100 CUSTOMERS
OVER 100 CUSTOMERS
V7
R3
K2
O5
J3

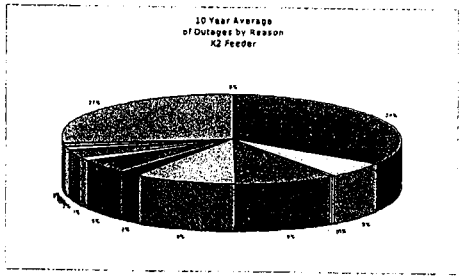

10 Year Average of Outages
Customer Hours Off - By Number of Customers
Customer Hours Off
6000
5000
4000
3000
2000
1000
0
1 CUSTOMER
2 - 5 CUSTOMERS
6 - 10 CUSTOMERS
11-20 CUSTOMERS
21 - 50 CUSTOMERS
51 - 100 CUSTOMERS
OVER 100 CUSTOMERS
V7
R3
K2
O5
J3

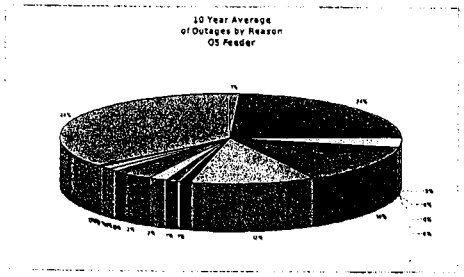
10-YEAR AVERAGE OUTAC NALYSIS BY REASON
SYSTEM – V7 – R3 – K2 – O5 – J3
CHART 10

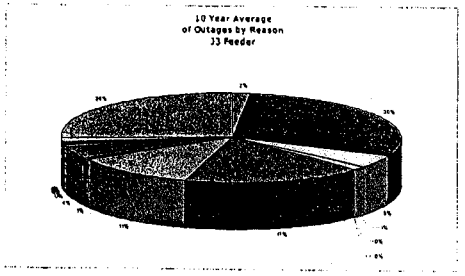




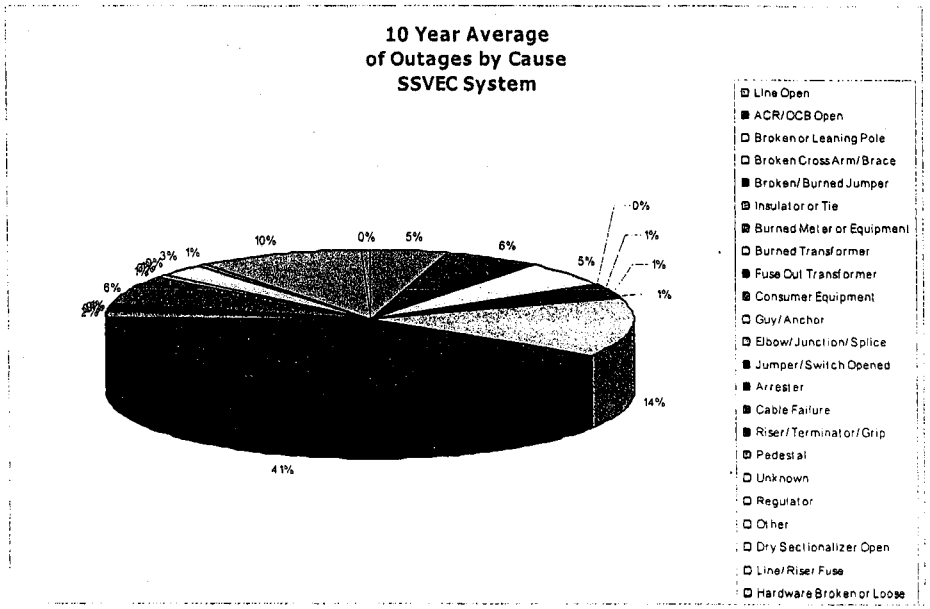


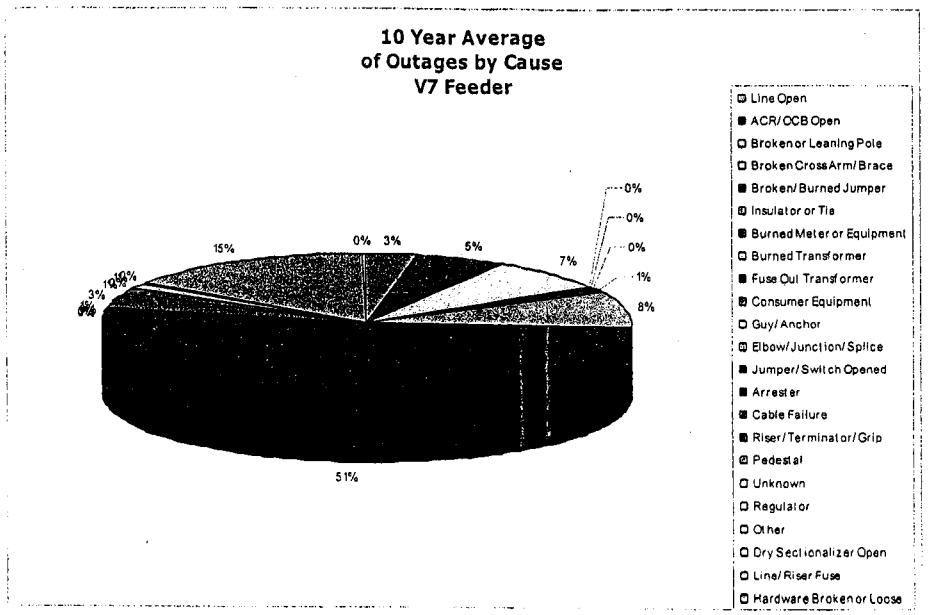


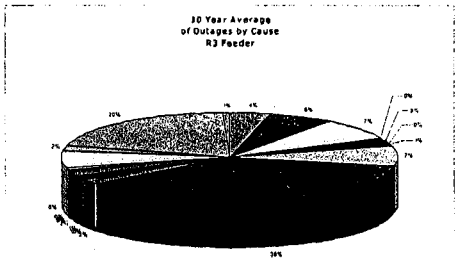


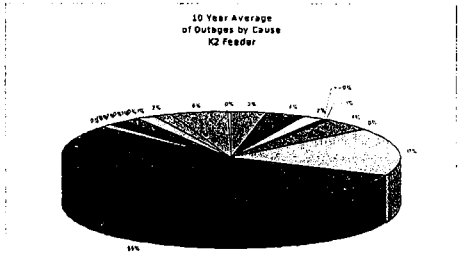


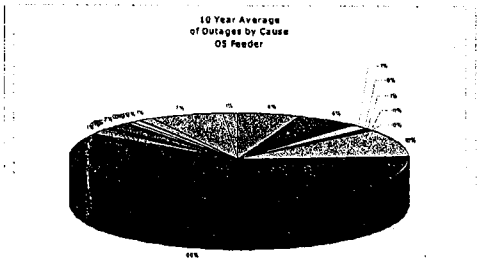
10-YEAR AVERAGE OUTA ANALYSIS BY CAUSE
SYSTEM – V7 – R3 – K2 – O5 – J3
CHART 11

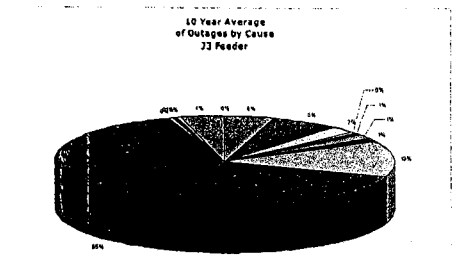










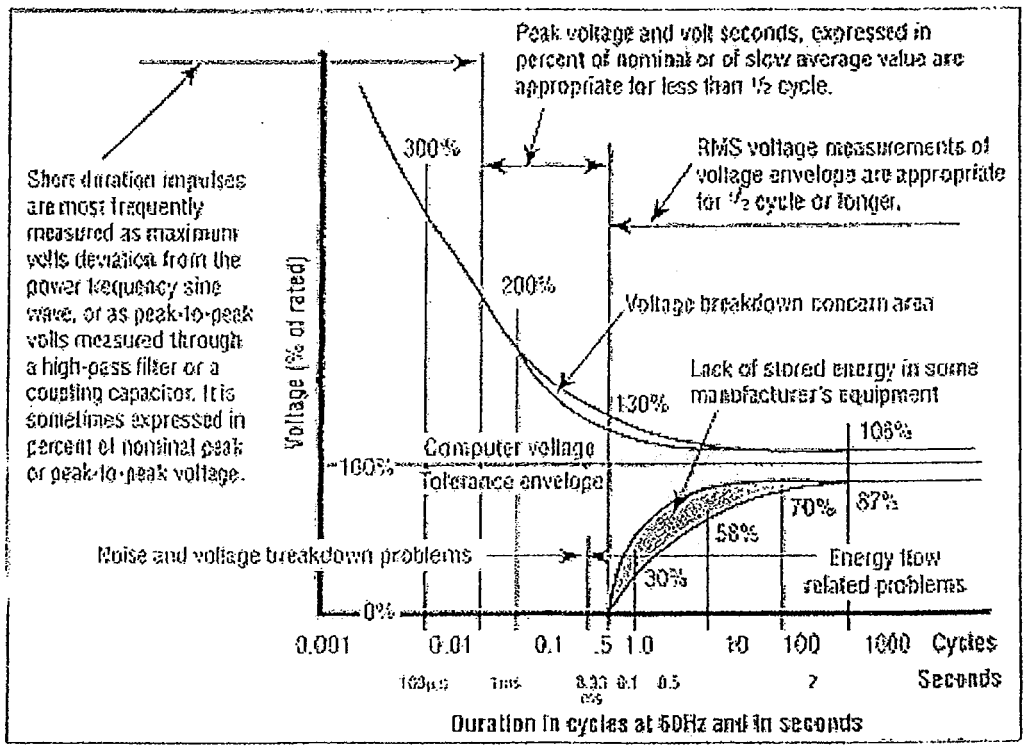


NRECA Reliability Survey

Definitions - continued

MOMENTARY OUTAGE INDICES

CBEMA *Curve.* A set of curves representing the withstand capabilities of computers in terms of the magnitude and duration of the voltage disturbance. Developed by the Computer Business Equipment Manufacturers Association (CBEMA), it has become a de facto standard for measuring the performance of all types of equipment and power systems, and is commonly referred to by this name.



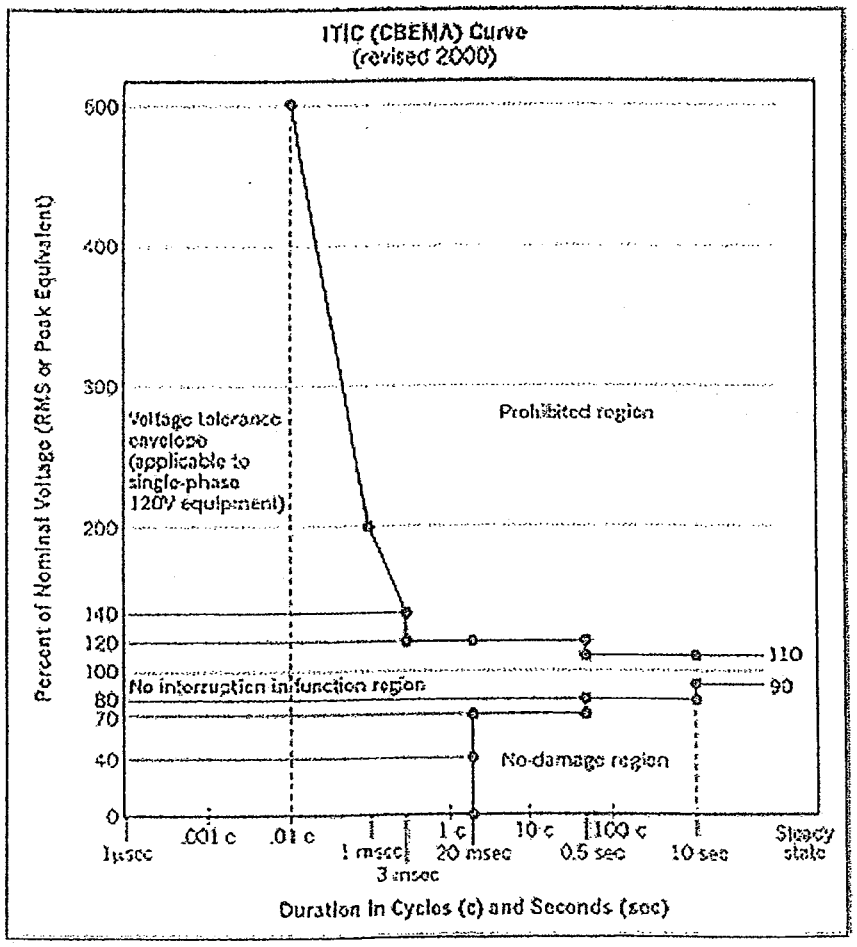
The CBEMA Curve from FIPS No. 94.

NRECA Reliability Survey

Definitions - continued

MOMENTARY OUTAGE INDICES

ITIC *Curve.* The ITIC curve was derived by a working group of CBEMA, which changed its name to the Information Technology Industry Council. This derivation was developed in collaboration with EPRI's Power Electronics Application Center (PEAC). The intent was to develop a curve that more accurately reflects the performance of typical single-phase, 60-Hz computers and their peripherals, and other information technology items like copiers, fax machines, and point-of-sales terminals. While specifically applicable to computer-type equipment (as with the CBEMA curve), the ITIC curve is generally applicable to other equipment containing solid-state devices.



DAVID'S STUDY

From: David Bryan
Sent: Wednesday, February 18, 2009 2:58 PM
To: Torey Bell; Phil Asbury; Ron Orozco; Vic Plumb; Ricardo Garcia; Bobby Bernal; Anselmo Torres
Subject: 2009 Outage Study
Importance: Low

Everyone:

If you have time and want to, please review the attached and provide any comments.

I did some analysis on which feeders/subs were the worst in terms of outages. Also, tried to look at causes of outages for overall design issues. Attached is a summary of the analysis.

Thanks

David

NOT PREPARED FOR THIS PRESENTATION, BUT RATHER FOR 2010-12 CWP ANALYSIS.

2009 Outage Study

DJB Summary:

For the 2010-12 CWP, I wanted to list the 10 worst feeders in terms of outages and have a project to concentrate on them for reliability issues. Each feeder would be reviewed for corrections for unprotected taps, lack of lightening arrestors, and coordination problems.

There was quite abit of data available. Hand-inputted outage data was available from 1992 on; the total count was approximately 12,300 individual outages with over 1,000,000 consumer-hour outages. The data appeared to be valid and consistent.

Other than V7 and O5 consistently coming out as the worst feeders, there wasn't any clear indications of which feeders were worst than the others.

There were clear indications of which substations with all feeders aggregated had the worst outage records. The subs, in priority, were:

Huachuca West
Mescal 25kV
Ramsey
Keating
Hawes
Kansas Settlement

Attached are several summary pages.

For design issues, many of the outages are wind or lightening caused. This speaks to the issues of the need for wood pole replacement and increased use of lightening arrestors on the system.

DJB Recommendation

Three of the substations above will have significant work done in the area with the new Sonoita, Cottonwood, and Hereford substations. I suggest working on their feeders as part of the projects already underway.

Data available

Also available are:

1) Spreadsheet with the data;
2) Printouts from spreadsheet showing work analysis.

TABLE 9

RANKING ONLY

Sub	Number of Outages	~~Total~~ Consumer Hours	~~Avg~~ Consumer Hours	Geometric Mean
O	1	1	1	3
R	2	4	5	6
T	3	3	4	5
X	4	2	2	4
J	5	5	6	8
M	6	11	18	9
F	7	16	11	7
U	8	8	8	10
Y	9	6	3	1
P	10	10	17	14
Z	11	15	7	2
N	12	14	16	16
W	13	7	10	20
E	14	13	14	12
A	15	22	13	11
H	16	9	9	15
D	17	12	12	13
B	18	20	22	19
K	19	18	15	18
S	20	19	19	17
Q	21	21	21	21
V	22	17	20	22

Ranking of Substations on various metrics – ~~low~~ HIGH numbers are the worst. Data is from 1992-2008.

TABLE 10

4 (n)

Using 2005-8 data only, list of worst feeders by number of consumer-hours and by number of outages.

Xmission FEEDER (KARTCHNER)

Sum of CONS HR	Years 2005-8
FEEDER	total
TK03	76,763
V7	30,601
WSUB	25,110
[illegible]	19,316
TA1F	17,206
[illegible]	16,476
TR1F	14,149
W3	12,657
[illegible]	12,148
[illegible]	11,092
[illegible]	10,511
[illegible]	9,365
R3	8,461
W5	7,417
AS[illegible]	6,639
[illegible]	6,580
[illegible]	6,467
TA[illegible]	6,368
[illegible]	6,157
[illegible]	5,914
A8	4,650
TA[illegible]	3,617
[illegible]SUB	3,403
[illegible]	2,866
[illegible]SUB	[illegible]
[illegible]A1F	2,652
[illegible]	[illegible]
[illegible]	2,418
[illegible]	2,176
[illegible]	2,146
[illegible]	2,135
[illegible]	1,898
[illegible]	1,844
[illegible]	1,720
[illegible]	1,765
D1	1,762
[illegible]	1,741
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	1,221
[illegible]	1,196
[illegible]	1,101
[illegible]	1,044
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	911
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Count of CONS HR	Years 2005-8
FEEDER	total
V7	397
[illegible]	297
[illegible]	190
[illegible]	163
[illegible]	161
[illegible]	94
[illegible]	71
[illegible]	64
[illegible]	62
[illegible]	57
[illegible]	55
[illegible]	[illegible]
[illegible]	53
[illegible]	52
[illegible]	51
[illegible]	48
[illegible]	47
[illegible]	43
[illegible]	42
[illegible]	41
[illegible]	[illegible]
[illegible]	35
A5	33
[illegible]	33
[illegible]	32
[illegible]	32
[illegible]	32
[illegible]	30
[illegible]	28
[illegible]	26
[illegible]	24
[illegible]	23
FR	23
[illegible]	22
[illegible]	21
[illegible]	21
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	18
[illegible]	[illegible]
[illegible]	16
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	14
[illegible]	14
[illegible]	13
[illegible]	12
[illegible]	12
[illegible]	11
[illegible]	11
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
TA1F	[illegible]
[illegible]	[illegible]
[illegible]SUB	[illegible]
TK03	[illegible]
[illegible]	[illegible]
ASUB	[illegible]
[illegible]	[illegible]

Data Available

- SCADA 1994 - 2008, manually inputted
- Feeder lengths
- # Customers/feeder (missing)

Use of Criteria

	GOOD	BAD
TOTAL CONS HRS	total $ lost	emphasizes device with most customers
Number of Outages		emphasizes long lines
Geometric, Harmonic Mean		skewed by high or low
Average		skewed by high or low outages
Median	the actual value that is ~~X~~ center of data	ignores skew
Mean with high or low removed	removes data, sometimes good form calculation	average that attempts to remove skew by removing high & low data
# of Outage ÷ feeder length	attempts to compensate for long feeder length	

Overall Feeder

V7, H4 & 3 come up frequently frequently
plans in place that should help

	Mean w/	# of our	# of Outage	total
Z1		1		
Z4	1			
Y4	2			
W5	3			
R2	4			
M5		2		
F4		3		
J3				
J7			1 4	

W3 based on total consumer hours of # of outages
W5 also

J3, J7

J5 also

~~Y4~~ X

MILSOFT
Utility Solutions
1.800.833.9037 www.milsoft.com info@milsoft.com

sort

	Total Consumer Hours	Number of Outages	Geometric Mean	Harmonic Mean	Mean with high & low removed	Avg Cons-Hrs Outage	Median (half-way)	Feeder Length	# of Outages/Feeder Length
Z4	1,732.60	78.00	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	32.28	[illegible]
USUB	8,737.60	4.00	2,269.21	1,254.88	4,261.34	4,261.34	1,764.62		
TA14	49,228.07	3.00	2.47	0.02	[redacted]	[redacted]	0.01		
TJ11	962.50	2.00	0.00	0.01	3,486.71	3,486.71	0.01		
TA10	7,462.05	2.00	0.14	0.01	2,532.97	2,532.97	0.01		
Y4	4,834.00	66.00	[redacted]	[redacted]	2,265.77	2,265.77	[redacted]	32.30	0.03
W5	13,462.05	216.00	0.15	0.01	2,224.56	2,224.56	0.01	35.16	0.20
TL4	1,128.00	4.00	0.09	0.01	1,599.62	1,599.62	0.01		
R2	3,418.16	176.00	5.46	206.83	1,445.42	1,445.42	697.95	19.05	0.11
VSUB	15,029.52	6.00	360.59	27.20	1,296.10	1,296.10	563.50		
NSUB	15,127.00	12.00	379.15	126.33	1,176.72	1,176.72	345.05		
H4	23,985.00	242.00	0.57	0.01	1,073.75	1,073.75	0.01	156.81	0.17
H3	5,163.00	130.00	364.26	158.19	999.38	999.38	299.25	72.20	0.56
J5	2,730.63	143.00	381.47	115.32	943.97	943.97	824.04	28.47	0.27
X7	14,380.97	165.00	367.23	143.23	934.61	934.61	525.25	30.19	0.30
X1	5,047.65	25.00	343.01	30.10	914.86	914.86	372.25	39.23	[redacted]
O4	9,053.50	101.00	58.32	0.12	835.00	835.00	85.68	18.08	0.18
J7	22,665.33	623.00	1.46	0.02	808.97	808.97	0.01	92.51	0.06
TA13	20,791.20	5.00	0.35	0.01	801.59	801.59	0.01		
F8	2,443.84	33.50	0.14	0.01	796.87	796.87	0.01	15.87	0.19
E2	1,924.00	82.50	55.68	10.51	699.36	699.36	30.13	41.45	0.51
HSUB	25,769.75	8.00	386.10	40.97	683.78	683.78	805.13		
T3	4,876.00	83.00	244.62	0.24	658.34	658.34	370.25	29.41	0.35
K1	517.25	22.00	324.45	75.27	658.72	658.72	114.50	3.18	0.14
N2	6,396.46	216.00	1.55	0.02	630.30	630.30	0.01	85.60	0.39
V7	[redacted]	[redacted]	0.21	0.01	626.24	626.24	0.01	[redacted]	0.16
X5	21,056.65	287.00	369.07	0.24	599.58	599.58	362.85	71.68	0.25
Y2	3,413.18	57.00	278.66	73.30	579.06	579.06	308.25	5.17	0.11
TS11	3,527.50	3.00	0.05	0.01	575.06	575.06	0.01		
T1	9,008.00	82.00	325.51	165.55	570.25	570.25	334.50	11.72	0.14
W3	31,168.50	276.00	35.84	10.23	560.93	560.93	112.75	30.44	0.23
O5	20,040.17	912.00	70.70	0.24	550.17	550.17	50.25	[redacted]	0.30
OSUB	1,512.50	5.00	121.97	0.24	514.21	514.21	274.05		
TA19	3,112.70	1.00	0.08	0.01	451.41	451.41	0.01		
X8	12,480.75	155.00	0.05	0.01	413.26	413.26	0.01	6.16	0.05
R1	6,759.50	208.00	59.44	0.21	392.42	392.42	92.75	13.76	0.11
SSUB	1,560.71	4.00	53.66	0.12	375.33	375.33	176.60		
D7	3,353.70	39.00	0.41	0.01	371.06	371.06	0.01	16.05	0.13
QSUB	3,869.74	3.00	298.29	310.49	364.98	364.98	364.75		
O1	13,041.05	568.00	142.59	18.73	362.71	362.71	202.50		
O3	322.00	32.00	26.29	0.12	355.56	355.56	51.58	1.72	0.58
T4	15,900.25	135.00	0.03	0.01	316.93	316.93	0.01	6.08	0.04
D1	2,167.75	56.00	15.29	0.12	309.81	309.81	26.83	45.34	0.72
M3	3,962.55	61.00	91.33	20.31	296.31	296.31	92.25	27.94	0.13
A5	5,206.63	99.00	0.10	0.01	293.73	293.73	0.01	45.10	0.16
A3	1,379.64	134.00	60.04	12.78	283.61	283.61	41.75	34.70	0.41
U7	3,487.68	70.00	0.03	0.01	280.33	280.33	0.01	12.33	0.17
MSUB	1,472.75	3.00	98.59	22.19	266.90	266.90	107.58		

Outages into DavidBryan

4:22 AM, 2/11/2009

This and next 3 pages, using 1992-2008 data, listing top 40 or so feeders in terms of outage metrics, and then sorting by metrics.

102,272 CUST-HRS
2054 OUTAGES

↓ SORT

	Total Consumer Hours	Number of Outages	Geometric Mean	Harmonic Mean	Mean with high & low removed	Avg Cons-Hrs Outage	Median (half-way)	Feeder Length	# of Outages/Feeder Length
V7	[redacted]	[redacted]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[redacted]	[illegible]
J5	14,419.78	732.00	24.05	0.23	113.73	113.78	18.89	184.67	[illegible]
R5	[illegible]	[redacted]	8.74	0.06	62.41	62.41	6.75	[illegible]	[illegible]
J7	70,655.93	908.00	1.46	0.02	808.07	808.07	0.01	[illegible]	[illegible]
O1 *	28,241.25	588.00	132.89	18.73	362.71	362.71	362.38		
O2 *	8,705.00	370.00	0.40	0.02	28.31	28.31	1.00		
K2	15,885.15	356.00	0.35	0.01	264.76	264.76	0.01	238.86	[illegible]
H1	26,966.01	352.00	0.87	0.01	1,073.10	1,073.75	0.01	156.81	0.17
X5	21,906.03	327.00	0.63	0.01	599.58	599.55	362.85	21.00	0.24
W3	31,168.43	276.00	19.01	0.23	594.93	563.03	112.75	68.17	0.04
N2	9,370.46	240.00	1.83	0.02	639.30	690.30	0.01	25.00	[illegible]
N1	8,465.80	206.00	37.07	32.09	264.02	264.02	135.75	135.20	0.61
O5 *	20,650.17	212.00	70.76	0.04	550.17	550.17	90.25	[redacted]	0.34
T2	19,668.75	211.00	116.80	47.85	190.67	190.67	155.50	22.11	0.11
W5	10,340.50	210.00	0.15	0.01	2,224.55	2,224.55	0.01	15.10	0.02
R1	9,756.50	208.00	69.44	0.23	392.42	392.42	92.75	49.76	0.13
Y3	13,697.85	192.00	47.58	5.12	220.41	220.41	75.88	12.71	0.10
M1	4,561.75	178.00	2.77	0.04	37.61	37.61	9.50	77.12	0.03
B2	9,418.16	176.00	598.53	396.95	1,445.42	1,445.42	692.95	10.98	0.11
F7	1,081.94	170.00	12.26	0.28	101.83	101.83	13.50	118.39	0.70
P5	12,341.10	168.00	7.02	0.08	86.65	20.83	16.58	143.41	0.85
M4	7,111.58	166.00	2.05	0.03	30.52	30.52	10.50	53.71	0.32
X7	11,389.97	165.00	10.08	1.13.26	934.81	934.81	35.25	55.19	0.33
E3	16,781.57	161.00	0.01	0.01	139.02	139.02	0.01	49.85	0.31
J5	9,720.64	143.00	261.07	115.32	943.95	945.07	121.64	95.17	0.37
X6	22,430.79	135.00	0.05	0.01	113.26	113.26	0.01	0.16	0.00
F4	15,860.25	135.00	0.05	0.01	310.03	310.03	0.01	0.16	[illegible]
A3	1,574.53	134.00	10.01	12.76	283.61	283.61	11.75	54.35	0.41
H3	9,169.50	130.00	101.16	139.15	169.34	169.32	201.25	27.96	0.00
D5	7,198.35	120.00	0.81	0.02	139.74	139.74	2.50	31.78	0.31
O6 *	15,204.17	120.00	0.03	0.01	168.03	168.03	0.01	117.78	0.98
S3	4,284.75	119.00	1.22	0.03	51.90	51.90	9.75	59.15	0.50
U6	4,204.96	117.00	0.02	0.01	145.33	145.35	47.00	12.61	0.11
P6	4,919.55	115.00	0.07	0.01	223.64	225.64	0.01	[illegible]	[illegible]
F3	1,316.50	104.00	0.55	0.03	18.11	18.11	2.13	[illegible]	[illegible]
O4	8,053.50	101.00	58.30	0.12	455.00	455.00	43.69	13.08	0.13
A5	6,806.67	101.00	0.10	0.01	293.73	293.73	0.01	15.10	0.15
U5	5,061.55	98.00	12.87	0.07	178.58	178.58	71.50	9.45	0.11
T3	4,976.00	93.00	[illegible]	0.21	650.04	648.23	170.25	9.11	0.10
F6	5,418.84	83.00	0.11	0.01	795.37	795.87	0.01	15.87	0.19
T1	[illegible]	82.00	326.51	145.53	570.28	570.28	551.00	11.22	0.13
E2	1,931.00	82.00	55.59	10.51	609.36	609.36	59.15	11.45	0.14
Z1	1,732.00	79.00	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	0.11
Z3	9,287.78	75.00	123.14	15.20	236.63	236.63	267.50	30.19	0.04
R4	1,107.75	73.00	0.16	0.01	196.02	196.02	0.01	20.39	0.03
P7	1,941.25	71.00	12.13	0.06	183.26	183.26	19.50	11.09	0.16
U7	6,497.88	70.00	0.00	0.01	280.33	280.33	0.01	12.22	0.17
Y4	1,848.00	15.00	661.79	695.86	2,245.77	2,235.77	1,281.00	69.50	[illegible]

	Total Consumer Hours	Number of Outages	Geometric Mean	Harmonic Mean	Mean with high & low removed	Avg Cons-Hrs Outage	Median (half-way)	Feeder Length	# of Outages/Feeder Length
V7	[redacted]	[redacted]	0.31	0.01	626.24	626.24	0.01	[redacted]	[illegible]
TA15	89,509.16	23.00	2.12	0.01	171.37	171.37	0.01		
TK03	89,660.91	11.00	0.02	0.01	100.01	100.01	0.01		
TA13	90,791.20	5.00	0.26	0.01	801.59	801.59	0.01		
WSUB	53,589.66	5.00	0.97	0.02	210.33	210.33	1.77		
TB12	36,174.79	4.00	0.02	0.01	29.09	29.09	0.01		
R3	31,450.06	526.00	5.34	0.06	62.41	62.41	4.75	11.09	[illegible]
W3	51,116.06	276.00	93.21	10.23	560.93	560.93	112.75	95.44	[illegible]
O1	53,241.29	568.00	142.52	16.72	362.71	362.71	202.55		
RSUB	75,164.71	8.00	226.10	30.97	683.78	683.78	516.13		
H4	25,985.00	128.00	0.37	0.01	1,073.75	1,073.75	0.01	196.84	0.17
J7	25,156.33	128.00	1.46	0.02	508.97	508.97	0.01	52.31	0.05
X6	22,490.75	105.00	0.05	0.01	413.26	413.26	0.01	6.16	0.06
X5	21,956.55	287.00	369.67	0.24	589.58	589.58	362.85	71.68	0.4[illegible]
O5	20,040.07	212.00	70.70	0.24	550.17	550.17	90.25	[redacted]	0.07
JSUB	19,418.20	13.00	0.28	0.02	22.61	22.81	0.75		
TA14	19,378.67	8.00	2.47	0.02	[redacted]	[redacted]	0.01		
FSUB	19,145.90	5.00	32.47	5.59	215.13	215.13	26.28		
E3	16,754.57	164.00	0.01	0.01	139.02	139.02	0.01	69.65	0.45
J3	16,410.76	152.00	24.05	0.23	113.78	113.78	26.50	154.67	0.21
T4	15,890.15	135.00	0.03	0.01	310.93	310.93	0.01	6.06	0.04
K2	15,389.18	255.00	0.05	0.01	254.26	254.26	0.01	258.97	0.0[illegible]
NSUB	15,127.00	12.00	379.15	128.53	1,176.72	1,176.72	348.06		
VSUB	15,029.53	8.00	500.59	27.20	1,296.10	1,296.10	568.50		
X7	14,589.67	165.00	367.68	113.26	984.61	984.61	325.25	10.87	0.50
Y3	14,397.35	152.00	47.58	5.12	320.41	320.41	75.98	10.31	0.07
TSUB	13,301.21	3.00	0.02	0.04	97.44	97.44	43.20		
T2	12,038.75	211.00	118.20	67.95	100.07	100.07	135.50	12.41	0.11
W5	12,362.55	116.00	0.15	0.01	0.254.55	0.254.55	0.01	15.16	0.0[illegible]
YSUB	12,114.03	9.00	21.55	1.25	110.81	110.81	24.50		
O6	12,201.17	120.00	0.07	0.01	168.03	168.03	0.01	117.78	0.02
P5	12,041.16	108.00	7.02	0.05	80.89	80.89	10.38	140.21	0.07
TA71	10,805.56	4.00	0.15	0.01	64.65	64.65	0.01		
XSUB	9,015.04	3.00	0.29	0.03	72.46	72.46	11.00		
R2	9,419.16	176.00	348.59	206.53	1,415.42	1,415.42	622.95	10.05	0.11
T1	9,015.00	82.00	165.54	165.55	570.28	570.28	294.50	11.72	0.13
DSUB	8,890.24	11.00	0.46	0.02	29.25	29.25	1.00		
R1	8,779.00	208.00	92.44	0.24	352.42	352.42	92.75	[illegible]	0.11
O2	8,705.00	3.00	0.49	0.02	28.84	28.84	1.00		
O4	8,063.50	104.00	38.32	0.12	635.00	635.00	33.00	10.00	0.15
TA10	7,362.72	3.00	0.13	0.01	2,592.97	2,592.97	0.01		
D5	7,184.56	125.00	0.21	0.02	139.74	139.74	2.00	17.73	0.21
M4	7,111.55	118.00	2.06	0.03	30.52	30.52	16.50	34.53	0.35
ASUB	7,049.46	3.00	5.50	0.06	32.13	32.13	11.75		
A5	6,806.63	29.00	0.10	0.01	253.73	253.73	0.01	15.10	0.46
USUB	6,727.50	3.00	53.41	51.58	4,261.34	4,261.34	4,261.34		
H1	6,405.60	20.00	97.37	32.99	264.02	264.02	135.75	135.00	0.01
H2	6,350.45	23.00	1.53	0.02	630.30	630.30	0.01	35.10	0.35

Using 1992-2008 data, listing of the REASON for the outage versus the CAUSE of the outage. Useful for determing WHAT are causing the outages.

OVERALL OUTAGE CAUSE

CONSUMER HOURS

Sum of CONS HR	CAUSE																									
REASON	Line Open	ACR/OCB Open	Broken or Leaning Pole	Broken Cross Arm/Brace	Broken/Burned Jumper	Insulator or Tie	Burned Meter or Equipment	Burned Transformer	Fuse Out Transformer	Consumer Equipment	Guy/Anchor	Elbow/Junction/Splice	Jumper/Switch Opened	Arrester	Cable Failure	Riser/Terminator/Grip	Pedestal	Oil Sectionalizer	Regulator	Other	Dry Sectionalizer Open	Line/Riser Fuse	Hardware Broken or Loose	Grand Total
Planned	11,788.25	3,434.74	963.50	3.00	1.50	22.50	24.00	205.50	660.75	10.50		13.50	3,008.50	0.50	14.00		55.00	182.00	408.00	5,445.05	32.00	237.50	2,473.30	28,880.59
Lightning	15,980.80	62,514.38	5,744.00	20,276.75	235.00	2,584.00	1,708.00	5,796.20	12,641.86	100.00		377.00	75.00	1,189.25	884.00	207.50		653.50	2,520.00	6,702.25	2,656.75	14,423.00	203.00	157,675.24
Wind	18,511.00	49,623.02	250,278.88	1,415.25	604.90	3,075.00	63.50	4.00	742.75	382.05			186.00	4.00	23.00	77.25		1,573.50		2,581.75	311.00	244.00	32.25	326,813.90
Loose Connections	5,880.24	13,471.50			1,558.20		46.50	214.50	3,038.31	76.00	1,012.00	1,302.00	53.50	76.00		14.25		9,906.50		156.75		64.00	176.25	37,258.50
Low Voltage		20.00						75.50	15.50															111.00
High Voltage							5.00	49.00	12.00				3.00											142.45
Birds	10,272.50	32,538.43			3,107.00	1.50	13.50	90.00	12,179.22			49.00	0.50	312.00	23.00	66.25		13.00	53.45	6.00				64,205.15
Animals	122.15	1,945.00	110.00		784.00			48.75	4,149.70					1.50	26.00	16.25		1.00	3,400.00	450.00	58.00	1,565.50	57.75	14,237.35
Accidents	6,489.09	28,489.59	16,386.02	5,896.00	37.50	55.25	38.50	110.00	178.50	34.00	30.00	8.00	58.50		762.25	1.00	35.50	11.75		6,632.00	2.50	416.50		82,385.95
Overload	2,301.50	2,353.00			198.00		9.25	2,204.00	8,408.18	39.00		10.00	39.75			85.00		105.50		2,561.50	5.50	733.50	403.00	19,803.93
Vibration	6,699.75	2,288.50			598.50	519.00	1.00		41.50				662.00	210.00	0.75	3.00				179.50	450.50	3,522.75		15,576.25
Tree	3,859.75	6,859.50		365.50	33.50		1.00	8.50	119.60	6.00		2.00	1.00		44.00					333.50	72.00	9.50	4,057.25	13,435.10
Snowfice	628.00	2,224.00							9.00									27.75		91.00	177.50	8.50	19.00	3,014.00
Vandalism	596.00	1,408.00	60.00			120.00	4.00	12.00	3.50	2.50			5.00	6.00							9.00	146.00		7,643.00
Corrosion	151.50	8,476.15			109.00	97.00	2.00	52.00	113.25	139.75		171.00			749.50	6.00		2.00	2,100.00	1,093.00		75.00	2,156.00	16,457.65
Dirt										18.50								4.00		5,591.00	102.50	407.00	268.00	18.50
Dirty Oil								10.00																12.00
Underground Fault	971.50	10,594.00						480.50	41.75			2,249.60	3.00		42,659.65	1,999.75	114.75	1.50		8.50		25,639.52		84,964.02
Neutral Problem	51.50	819.75			1.50				1.00	6.00			4,847.50		392.00			0.75		11.00			6.00	6,139.00
Joint Use			24.00																					24.00
AEP/CO/Source	35,505.34	105,121.98	10,407.25	11,119.00	11,329.60													2,065.00		5,470.79				181,077.96
Other	1,181.25	36,602.20	9,710.28	9,412.00	530.50	315.00	57.00	25,290.75	3,250.00	42.50		2,188.50	24.50	554.00	569.50	126.25	7.00	4,000.00	3,950.00	6,788.58	282.50	2,180.95	437.00	109,542.26
Unknown	847.18	13,967.33	6.00	9.00	30.50		10.00	23,087.00	4,157.72	26.00	6.75	300.00	15.75	30.00	33.75	13.50		376.50		731.01	32.00	2,312.50	133.50	46,155.99
(blank)								4.00		0.25														4.25
Grand Total	121,712.30	384,761.07	293,889.93	48,496.50	19,227.20	6,891.05	1,984.25	57,740.20	49,794.09	886.05	1,048.75	6,870.60	9,024.50	2,383.25	46,201.40	2,622.00	212.25	19,126.25	12,429.45	46,833.18	4,193.75	52,205.72	10,442.30	1,198,778.03

NUMBER OF OUTAGES

Count of CONS HR	CAUSE																							
REASON	Line Open	ACR/OCB Open	Broken or Leaning Pole	Broken Cross Arm/Brace	Broken/Burned Jumper	Insulator or Tie	Burned Meter or Equipment	Burned Transformer	Fuse Out Transformer	Consumer Equipment	Guy/Anchor	Elbow/Junction/Splice	Jumper/Switch Opened	Arrester	Cable Failure	Riser/Terminator/Grip	Pedestal	Oil Sectionalizer	Regulator	Other	Dry Sectionalizer Open	Line/Riser Fuse	Hardware Broken or Loose	Grand Total
Planned	269.00	14.00	11.00	1.00	1.00	6.00	1.00	24.00	192.00	3.00		5.00	12.00	1.00	2.00		6.00	2.00	1.00	154.00	1.00	25.00	10.00	743.00
Lightning	132.00	321.00	22.00	14.00	5.00	26.00	17.00	721.00	1,034.00	18.00		3.00	5.00	53.00	8.00	19.00		21.00	1.00	10.00	72.00	379.00	3.00	2,885.00
Wind	65.00	134.00	159.00	9.00	77.00	18.00	1.00	1.00	105.00	11.00			10.00	2.00	5.00	5.00		6.00		23.00	6.00	20.00	9.00	666.00
Loose Connections	35.00	16.00			72.00		20.00	10.00	43.00	32.00	1.00	7.00	7.00	2.00		5.00		6.00		20.00		6.00	29.00	314.00
Low Voltage		1.00						8.00	5.00															14.00
High Voltage							2.00	7.00	5.00				1.00											20.00
Birds	27.00	65.00			5.00	1.00	2.00	17.00	2,325.00			2.00	1.00	4.00	2.00	13.00		1.00	1.00	3.00				2,651.00
Animals	9.00	11.00	3.00		3.00			9.00	718.00					1.00	2.00	8.00		1.00	1.00	1.00	3.00	180.00	1.00	833.00
Accidents	45.00	78.00	78.00	1.00	5.00	1.00	9.00	18.00	40.00	4.00	2.00	1.00	7.00		30.00	1.00	5.00	1.00		9.00	1.00	58.00		407.00
Overload	16.00	14.00			6.00		4.00	38.00	266.00	19.00		1.00	11.00			2.00		5.00		42.00	2.00	24.00	11.00	436.00
Vibration	27.00	6.00			23.00	4.00	1.00		28.00				4.00	1.00	1.00	1.00		3.00		12.00	4.00	40.00		112.00
Tree	55.00	48.00		3.00	7.00		1.00	3.00	22.00	2.00		1.00	1.00		14.00					4.00	2.00	3.00	7.00	181.00
Snowfice	3.00	18.00							5.00									5.00		19.00	4.00	3.00	3.00	33.00
Vandalism	4.00	2.00	1.00			2.00	2.00	1.00	2.00	3.00			1.00	1.00							3.00	4.00		33.00
Corrosion	2.00	12.00			8.00	2.00	2.00	9.00	42.00	14.00		3.00			23.00	2.00		1.00	1.00	7.00		1.00	4.00	146.00
Dirt										1.00								3.00		9.00	2.00	9.00	4.00	1.00
Dirty Oil								4.00																3.00
Underground Fault	19.00	19.00						5.00	10.00			21.00	1.00		596.00	15.00	1.00	1.00						1,011.00
Neutral Problem	8.00	4.00			2.00				1.00	1.00			1.00		2.00			1.00		2.00		320.00		29.00
Joint Use			1.00															2.00		4.00			4.00	1.00
AEP/CO/Source	30.00	21.00	8.00	3.00	3.00																			78.00
Other	24.00	93.00	14.00	5.00	6.00	2.00	6.00	37.00	202.00	26.00		17.00	5.00	2.00	12.00	9.00	2.00	1.00		10.00				613.00
Unknown	20.00	58.00	1.00	1.00	9.00		2.00	25.00	918.00	12.00	1.00	1.00	4.00	4.00	1.00	4.00		9.00	3.00	72.00	5.00	55.00	6.00	1,121.00
(blank)								1.00		1.00								10.00		16.00	5.00	104.00	2.00	2.00
Grand Total	791.00	935.00	298.00	37.00	233.00	62.00	70.00	959.00	5,853.00	145.00	4.00	62.00	71.00	71.00	695.00	83.00	16.00	78.00	8.00	417.00	110.00	1,233.00	93.00	12,343.00

Outage info DavidBryan

10:03 AM, 2/11/2009

2005-B
CUST. HRS

Using 1992-2008 data, listing REASON for outage versus YEAR. Useful for determining problems that are increasing.

CAUSES
1) WIND - 329,000
2) AEPCO (XMISSION SUPPLIER) - 181,000
3) LIGHTNING - 257,000

History of Outages by Type.

Customer Hours

Sum of CONS HR	REASON																								
Year	Planned	Lightning	Wind	Loose Connections	Low Voltage	High Voltage	Birds	Animals	Accidents	Overload	Vibration	Tree	Snowlice	Vandalism	Corrosion	Dirt	Dirty Oil	Underground Fault	Neutral Problem	Joint Use	AEPCO/Source	Other	Unknown	(blank)	Grand Total
1994	1,759.75	11,337.25	14,029.25	121.50			1,785.75	202.50	4,598.75	228.25	61.00	937.75	14.50	1,436.00	168.75			6,953.25	4.00		322.50	10,615.00			54,605.75
1995	9,067.74	4,731.75	1,498.50	1,812.25	11.00	1.00	1,870.75	446.00	1,706.75	285.25	180.50	393.75	712.00	57.00	143.50			6,271.00	4,856.50		1.00	4,833.00			38,969.24
1996	2,070.50	10,936.00	2,352.50	234.75	8.00	2.50	2,217.75	334.50	1,952.75	338.50	974.50	1,802.25	23.00	20.50	338.25	18.50		7,375.75	210.75		16,996.25	13,215.75			61,421.25
1997	218.50	6,823.75	10,898.00	216.50	1.50	21.50	1,190.25	836.50	3,856.85	924.25	4,015.75	2,774.75	335.00	40.00	161.50			9,227.25	11.25		17,376.25	1,726.75			60,258.10
1998	142.00	12,754.25	21,044.70	237.50	1.00	10.00	3,555.00	7,056.50	725.75	517.00	2,006.50	2,887.00	6.00	2,233.00	124.50			4,492.75	6.00		2,477.00	4,660.50			64,836.05
1999	276.75	9,250.70	50,019.25	10,810.50	20.00	4.00	1,104.00	132.00	1,444.65	58.75	289.75	1,014.75			190.50			5,230.75			22,205.52	3,052.25		4.00	105,127.12
2000	810.75	2,138.30	4,988.55	405.00	30.50		531.58	415.70	2,281.70	5,558.50	369.25	214.00	1,800.50	387.50	7,039.75		3.00	7,733.50	1.50		10,360.65	1,257.25		0.25	46,825.60
2001	491.75	21,341.00	3,653.50	13,795.50		4.00	6,542.00	82.25	9,851.25	1,008.50	2,203.50	158.50	7.00	131.00	1,124.50		3.50	5,016.00	501.00		18,719.10	10,743.00	2,136.00		98,612.85
2002	691.60	4,481.70	12,120.25	130.00	8.00	2.00	684.25	888.00	8,401.75	771.75	298.50	155.50	2.00	2.00	483.00			2,916.75			4,112.70	8,780.00	4,078.60		47,088.45
2003	2,594.50	13,509.25	105,182.65	2,168.75		22.50	1,142.75	277.15	3,878.50	1,274.00	111.50	523.75			164.00			9,173.40	404.50			2,020.50	584.35		142,808.05
2004	3,034.25	8,748.75	9,738.28	2,484.57			16,641.18	172.20	5,876.00	304.00	23.00	409.50	14.00	1,043.50	5,616.00			3,134.35			2,824.65	4,801.68	24,384.33		89,100.22
2005	31.80	18,272.90	8,403.25	2,311.45	1.00	1.00	4,431.88	2,643.65	3,239.40	1,202.93	1,841.50	518.50			56.50			2,240.25	2.00			8,153.00	1,692.60		55,145.61
2006	1,903.50	8,705.88	32,204.98	1,840.75		16.00	3,931.00	191.90	11,504.04	381.60	738.75	1,470.00		2,100.00	1.50		2.00	6,165.52	138.00		11,577.30	312.00	5,007.75		88,424.58
2007	5,131.80	12,284.68	26,643.80	465.25	2.00	55.95	14,458.41	240.25	2,793.91	6,921.65	2,362.25	3.00			39.50		3.50	2,990.50	2.00	24.00	72,291.27	27,344.00	2,650.59		176,706.29
2008	885.50	12,350.00	26,918.45	124.20	28.00		3,570.63	518.25	2,585.90	131.00	90.00	32.10		190.50	805.90			6,043.00	1.50		813.88	8,327.58	5,621.57		68,837.88
Grand Total	28,080.59	157,675.24	329,813.90	37,258.50	111.00	142.45	64,205.15	14,237.35	62,385.95	19,902.93	15,578.25	13,435.10	3,014.00	7,643.00	16,457.65	18.50	12.00	64,994.02	6,139.00	24.00	181,077.96	109,542.26	46,155.99	4.25	1,193,775.03

OF OUTAGES

Count of CONS HR	REASON																								
Year	Planned	Lightning	Wind	Loose Connections	Low Voltage	High Voltage	Birds	Animals	Accidents	Overload	Vibration	Tree	Snowlice	Vandalism	Corrosion	Dirt	Dirty Oil	Underground Fault	Neutral Problem	Joint Use	AEPCO/Source	Other	Unknown	(blank)	Grand Total
1994	111.00	220.00	56.00	27.00			212.00	59.00	29.00	26.00	5.00	18.00	3.00	5.00	18.00			78.00	2.00		1.00	62.00			830.00
1995	166.00	163.00	22.00	31.00	2.00	1.00	319.00	52.00	35.00	34.00	6.00	18.00	3.00	2.00	9.00			93.00	2.00		1.00	64.00			1,023.00
1996	127.00	243.00	49.00	25.00	3.00	1.00	266.00	57.00	30.00	23.00	9.00	17.00	4.00	5.00	13.00	1.00		96.00	3.00		18.00	35.00			1,024.00
1997	51.00	224.00	38.00	31.00	1.00	4.00	239.00	62.00	32.00	28.00	9.00	20.00	4.00	3.00	19.00			91.00	4.00		9.00	39.00			917.00
1998	19.00	171.00	66.00	28.00	1.00	3.00	303.00	47.00	43.00	20.00	11.00	14.00	2.00	6.00	11.00			75.00	1.00		1.00	24.00			848.00
1999	10.00	261.00	52.00	26.00	1.00	2.00	216.00	58.00	19.00	20.00	8.00	13.00			12.00			78.00			20.00	38.00		1.00	835.00
2000	31.00	203.00	24.00	19.00	2.00		215.00	81.00	33.00	47.00	8.00	9.00	13.00	3.00	16.00		1.00	79.00	2.00		11.00	89.00		1.00	863.00
2001	74.00	190.00	25.00	26.00		1.00	258.00	51.00	34.00	27.00	10.00	15.00	2.00	3.00	10.00		2.00	64.00	4.00		4.00	72.00	34.00		906.00
2002	84.00	127.00	30.00	13.00	1.00	1.00	136.00	69.00	25.00	36.00	10.00	11.00	1.00	1.00	9.00			63.00			1.00	42.00	125.00		785.00
2003	21.00	189.00	58.00	15.00		1.00	87.00	52.00	19.00	16.00	7.00	13.00			4.00			67.00	6.00			25.00	132.00		692.00
2004	17.00	182.00	34.00	9.00			89.00	47.00	30.00	16.00	3.00	10.00	1.00	1.00	5.00			44.00			1.00	29.00	149.00		669.00
2005	6.00	158.00	37.00	19.00	1.00	1.00	88.00	44.00	20.00	61.00	6.00	9.00			6.00			43.00	1.00			22.00	187.00		686.00
2006	11.00	178.00	57.00	15.00		3.00	87.00	58.00	20.00	38.00	11.00	8.00		1.00	1.00		1.00	53.00	2.00		4.00	18.00	140.00		590.00
2007	11.00	207.00	57.00	13.00	1.00	2.00	98.00	76.00	23.00	34.00	7.00	1.00			9.00		1.00	32.00	1.00	1.00	4.00	21.00	169.00		768.00
2008	4.00	169.00	61.00	14.00	1.00		79.00	40.00	15.00	10.00	3.00	8.00		3.00	5.00			50.00	1.00		1.00	35.00	205.00		704.00
Grand Total	743.00	2,865.00	666.00	314.00	13.00	20.00	2,651.00	833.00	407.00	436.00	112.00	191.00	33.00	33.00	149.00	1.00	5.00	1,011.00	29.00	1.00	76.00	813.00	1,121.00	2.00	12,343.00

TABLE 11

Sulphur Springs Electric Cooperative 6.4.2

2008 Year to Date Number of Service Locations (Normal Configuration) Data Compiled: November 2008

Area	Substation	Feeder	Service Locations	Substation
AREA 1	SS.San Simon	A-1	North	34
	B17338847	A-3	South	194
	(Redtail)(PCB RT12)	A-5	West	273
				501
	BW.Bowie	B-3	North & South	86
	B14034852	B-5	East	10
	(Redtail)(PCB RT12)	B-7	Town	375
				471
AREA 2	BO.BONITA	C-1	Spare	0
	X09248945	C-2	East	1
	(Stewart)(PCB ST11)	C-3	West	0
	(Redtail)(PCB RT10)			1
	MN.MORTENSON	D-1	North	108
	X09248989	D-5	South	342
	(Stewart)(PCB ST11)	D-7	West	65
	(Redtail)(PCB RT10)			515
	ST.STEWART	E-1	North	74
	A10341089	E-2	West	229
	(Redtail)(PCB RT10)	E-3	East	723
				1026
	WX.WILLCOX	F-3	Airport Rd.	1250
	C11051150	F-4	East	94
	(apache)(PCB 013)	F-7	Stewart	910
		F-8	Willcox	879
				3133
	CC.COCHISE	H-3	North	398
	E10104649	H-4	South	1510
	(Apache)(PCB 015)			1908
	KS.KANSAS	J-3	North	598
	E11268711	J-5	South & West	160
	(Apache)(PCB 014)	J-7	East	170
				928
	CA.CHIRICAHUA	K-1	North	33
	G12101345	K-2	East	798
	(Apache)(PCB 014)			831
AREA 3	WB.WEBB	M-1	North	222
	H12331388	M-3	East	146
	(Apache)(PCB 014)	M-4	South & Elfrida	504
		M-5	West	125
				997
	MC.McNEAL	N-1	North & San Bernardino	431
	K12098881	N-2	South	607
	(Apache)(PCB 014)			1038
AREA 4	MS.MESCAL 12.47 KV	O-3	East	788
	F06049071	O-4	Benson	961
	(Apache)(PCB 015)			1749
	MS.MESCAL 25 KV	O-5		2049
	F06049071	O-8		585
	(Apache)(PCB 015)			2634
	BE.BENSON	P-5	East & South	902
	F07076141	P-7	Pomerene	528
	(Apache)(PCB 015)	P-8	Airport Rd.	632
				2062
	SD.ST. DAVID	Q-3	North	576
	G07075177	Q-5	South	324
	(Apache)(PCB 015)	Q-7	Apache Nitrogen	11
				911

Feeder	Service Locations	Substation	Area
RA.RAMSEY	R-1 North	506	AREA 5
L06018620	R-2 South	754	
(San Rafael)(PCB 005)	R-3 West	2208	
	R-4	1010	
		4478	
TM.TOMBSTONE	S-3 South & East		
I08034370	S-7 North		
(San Rafael)(PCB 004)			
KG.KEATING	T-1 West	1416	
K06021388	T-2 East	807	
(San Rafael)(PCB 001)	T-3 South	1488	
	T-4 North	380	
		4091	
SV.SIERRA VISTA	U-3 East	654	
J06348613	U-5 South & East	870	
(Kartchner)(PCB 005)	U-6 South & West	1489	
	U-7 West	828	
		3841	
HW.HUACHUCA WEST	V-7 Sonoita	2424	
I05136152		2424	
(Kartchner)(PCB 003)			
HW.HUACHUCA EAST	W-3 North & East	1260	
I05136152	W-5 South	1527	
(Kartchner)(PCB 003)		2787	
HW.HAWES WEST	X-1 West	2075	
K07182386	X-7 South	1997	
(San Rafael)(PCB 001)	X-8 North	465	
		4537	
HW.HAWES EAST	X-3 Spare	0	
K07182386	X-5 East & North	944	
(San Rafael)(PCB 001)	X-6 Spare	0	
		944	
BV.BELLA VISTA	Y-1 West	1042	
J06361267	Y-2 South	514	
(Kartchner)(PCB 005)	Y-3 East	679	
	Y-4 North	1404	
		3639	
PB.PUEBLO	Z-1 South	204	
K07068848	Z-2 South & East	360	
(San Rafael)(PCB 004)	Z-3 North	2079	
	Z-4 West	2514	
		5157	

TOTALS		
Redtail PCB RT12	(Bowie / San Simon)	972
Stewart PCB ST11	(Bonita / Mortenson)	516
Redtail PCB RT10	(Stewart / Bonita* / Motenson*)	1026
*customers not included in the total		
Apache PCB 013	(Willcox)	3133
Apache PCB 014	(Kansas / Chirichua / Webb / McNeal)	3794
Apache PCB 015	(Cochise / Mescal 25 KV / Mescal 12.47 KV / Benson / St. David)	9264
San Rafael PCB 001	(Hawes East / Hawes West / Keating	9572
San Rafael PCB 004	Tombstone / Pueblo	5157
San Rafael PCB 005	(Ramsey)	4478
Kartcher PCB 003	(Huachuca West /Huachuca East)	5211
Kartcher PCB 005	(Sierra Vista / Bella Vista)	7480

Total Customers: 50603

RELIABILITY SOLUTIONS IMPLEMENTED FOR HIGH OUTAGE FEEDERS

O5 FEEDER:

The O5 feeder has historically shown a potential for high growth. Because of this and the limited flexibility of this long feeder it has recently been the focus of many recently completed, or proposed future upgrades. Within the last few years two large portions of the main line have been completely rebuilt and upgraded to larger conductors. In conjunction with these projects coordination/sectionalizing studies where conducted and protection equipment was installed to limit exposure and large outages. A new substation, Cottonwood, is currently in the commissioning stage. This substation will significantly shorten the older portion of the feeder by several miles. It also provides the availability to split this circuit into up to six smaller circuits to limit exposure. Along with all of this, there are several smaller upgrades proposed for the upcoming work plan that is in development. These include, but are not limited to; replacing and/or upgrading the remaining two sections of the main line that have not yet been done, upgrading an existing tie line to provide additional backup capacity to a portion of the circuit, and installing a new underground tie to a commercial area that has no backup capability.

K2 FEEDER:

The K2 feeder is an unusual feeder. It is really two feeders in one. One mile from the sub this feeder splits. One section feeds an agricultural area. Because of significant load growth in the last five years, a lot of work has been done in this area to increase capacity and reliability. The second portion of this feeder is very long serving a very large loosely populated area. It has a significant amount of overhead line which results in a large exposure to weather related outages. In the fall of 2008 eleven miles of this circuit where rebuilt with a primary goal of increasing reliability. The majority of this project replaced a single phase line with a three phase line splitting up the service area in hopes of significantly decreasing the severity of outages. During this project approximately 30 sectionalizing devices where either added, moved, or modified to make the circuit more reliable.

J3 FEEDER:

The J3 feeder is similar to the K2 feeder in that it not only serves a very large irrigation load, but also serves several areas of very sparsely populated residential load. This feeder has been the subject several small upgrades in the recent past, along with an upgrade of seven miles of the main circuit leaving the substation. Because of its age, and significant amount of exposure J3 is high on the list of priorities for future sectionalizing studies as well as maintenance and pole replacement programs.

R3 FEEDER:

The R3 feeder is in a rapid high growth area of large subdivisions and large upscale residences. Because of this and the limited flexibility of this long feeder it has recently been proposed for an upgrade which involves the installation of a new substation, Hereford, central to the load area, and nine miles of new 69kV sub-transmission line. This substation will significantly shorten the feeder by several miles. It also provides the availability to split this circuit into up to four smaller circuits to limit exposure. Along with all of this, there are several smaller upgrades proposed for the upcoming work plan that is in development. These include, but are not limited to; replacing and/or upgrading the existing distribution sections of the main line, upgrading an existing tie line to provide additional backup capacity to a portion of the circuit, and installing a new underground tie to a residential area that has no backup capability.

Daniel Wilson
Standards and Line Design Engineer
SSVEC
Willcox, AZ
520.384.5498

SECTION B: DISCUSSION OF WORK PLAN DEVELOPMENT

The Work Plan Development Process

The workplan was developed using the following steps:

1. System Analysis – The Milsoft© WindMil distribution system modeling and analysis software package was used to evaluate the distribution system for voltage and ampacity issues. All feeders outside of Sierra Vista, Ramsey R3, and the Sierra Vista substation were modeled using 2005 system configuration and 2006 summer loads. All other Sierra Vista substations are not modeled yet. In Milsoft©, loads on each of the feeders were grown significantly to see if any problems [voltage or ampacity] occurred. Other than 5 areas of concerns, which were already known, there weren't any other issues identified.

2. Coordination Meetings – This was the "heart" of the development of the workplan. Coordination meetings were held with Engineering, Operations, Construction, and ICS personnel to seek input on project identification, project need, and project priorities.

3. Meeting with Senior Staff Review and Approval – At the May 22, 2007 regular Senior Staff meeting, Engineering presented a detailed review and discussion of all projects proposed at that time. After some discussion, a list of projects to be postponed and not included in this workplan was developed. Criteria used in this process included cost, need, and workforce capacity to implement projects. All projects presented in this workplan were presented and approved by Senior Staff at this meeting.

4. Communications Projects – The Technology Manager presented narrative and cost estimates for proposed fiber optic and communications facilities as well as the automated meter reading plan. These projects were reviewed and approved as presented with the exception of one fiber optic project which was postponed.

5. Input from Accounting and Finance – Accounting and financial information was provided accounting and finance personnel. Recent trends in expenditure in various cost categories were provided to Engineering and used in deriving estimated amounts for the 2008-2009 timeframe. Recent closure of a number of older work orders skewed this trend analysis and every effort was made to account for this abnormality.

Areas of Concern

Six areas of special concern were identified prior to the development of this workplan. Each is discussed in detail below. They are:

(1) Feeder R3 - Hereford/Palominas area
(2) H4 [Cochise/Sunsites]
(3) V7 [Sonoita/Patagonia]
(4) W5 [Huachuca City/Whetstone]
(5) O5 [Cottonwood/ J6/Mescal Lakes]

In addition, the overall condition of SSVEC's aging 69 kV sub-transmission system is of concern and is addressed below.

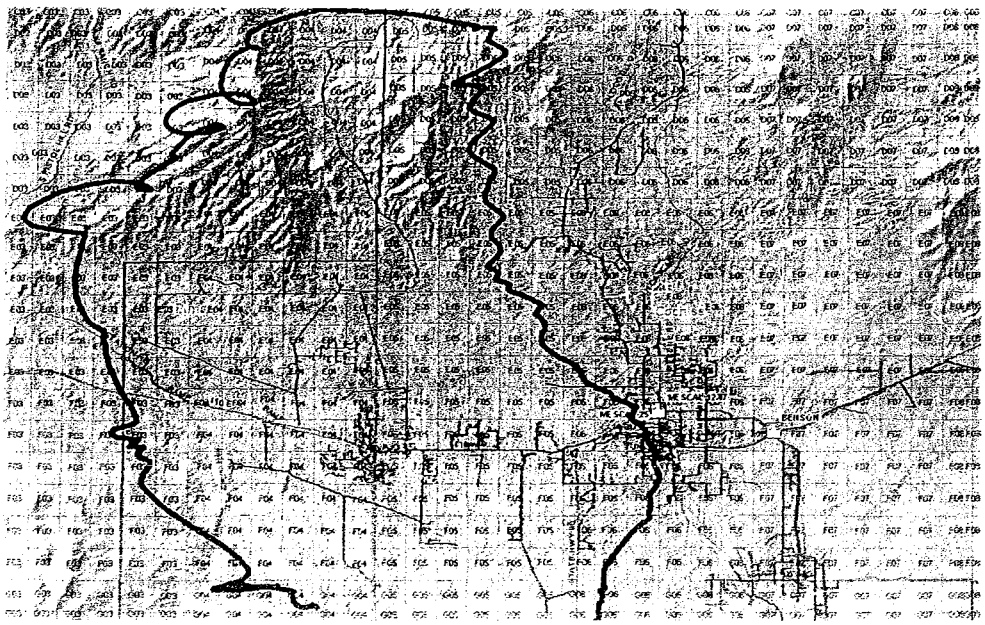
1. Feeder O5 - Cottonwood, J6, and Mescal Lakes Area

Electric service to the Mescal Lakes, J6, and to the West and North of these areas is presently provided by a single 25kV feeder designated O5, which extends from the Mescal substation located near I-10 and Ocotillo Road in Benson, to SSVEC's Western-most boundary in Pima County. The three-phase portion of this feeder extends approximately 20 miles from the substation where an additional 35 miles of single-phase line completes the circuit. The feeder consists of #4/0ACSR conductor from the substation to Ocotillo Road, then 336 ACSR to SSVEC's new Benson office, then 1/0ACSR to the steel pole on the North side of I-10/SR90 interchange, and then #4ACSR conductor the remainder of the way. See area map on the following page.

The concern in this area is the rapid growth primarily from large underground subdivisions such as Cottonwood, Kartchner Vistas, and the future developments further South. This load, compounded by approximately 5 MW of new load growth in the J6 and Mescal Lakes areas, has created a conductor overload on portions of the O5 feeder.

To address this concern, SSVEC recently started to upgrade conductor size on the portion of the feeder along I-10 from Holiday Inn Express to the J6/Mescal Lakes interchange. This upgrade will alleviate much of the overloading problems currently being experienced.

SSVEC recently acquired a substation site adjacent to the new Benson office facility and associated rights-of-way to complete the 69 kV sub-transmission line from St.



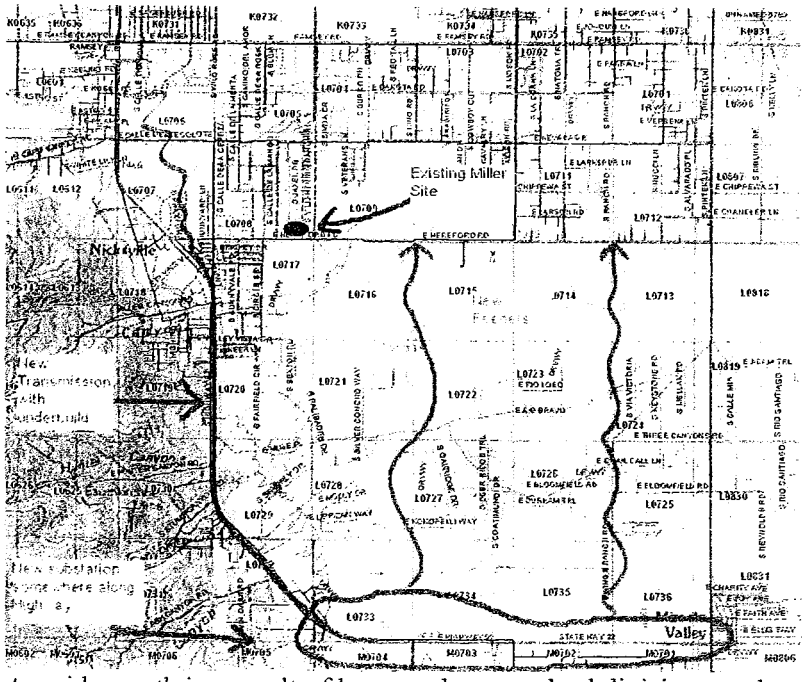
David substation to the new Cottonwood Substation. Design and construction of these facilities will meet current and near-term load growth in the area.

Should the recent downturn in the home market reverse and significant new growth occur, additional upgrades may be necessary in the area – but this is not expected within the term of this workplan.

SSVEC had planned to build a new 230/69 kV substation and power delivery point North of Benson. This new facility, the Sloan Substation, has been postponed in light of the recent downturn in the housing market and would likely be the next upgrade for the area. The Sloan Substation will eventually allow for a 69 kV loop to serve the Mescal, Cottonwood, Guindani (future substation), St. David and Benson substations. This loop will allow for additional load carrying and back-up capacity in the area.

Feeder R3 - Hereford/Palominas Area

The following graphic shows the area served by the R3 feeder out of Ramsey Substation. This 12.47 kV line serves a fast growing area in the Southern part of SSVEC's service territory. The feeder has one mile of 336 ACSR conductor , then 2.5 miles #4/0ACSR, then four miles #1/0ACSR and then #4ACSR conductor to the end.



Recent rapid growth is a result of large underground subdivisions such as Kinjockity Phase I, and larger homes on large lots. Continued growth is expected in this area.

SSVEC owns the Miller Substation site located near the intersection of Y-Lightening and Hereford Roads. The Long Range Plan analysis started in 2006 shows that this substation location is too close to the existing Ramsey Substation and too far North of the new load center.

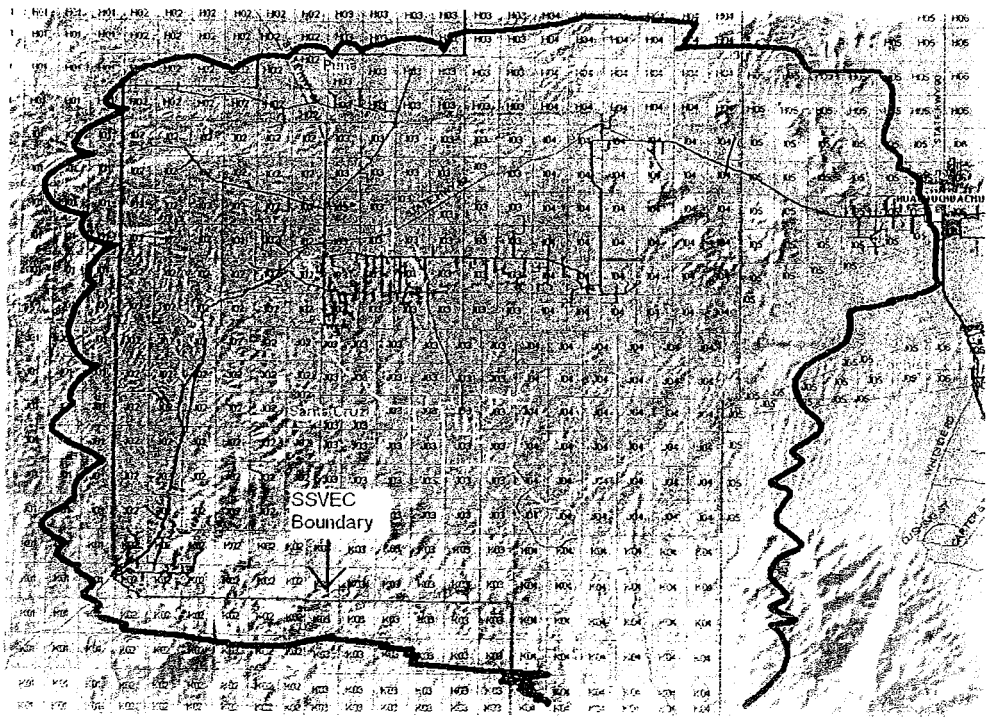
Options considered were:

a. Build a smaller Miller Substation at the existing site and build a second and similarly-sized substation further South in the future,
b. Build Miller Substation at the existing site, retire Ramsey Substation, and install a substation in the future between Miller and Hawes;
c. Don't use the Miller site but rather build a new substation to the South of the Miller site.

Option C is considered the best option considering cost, operability and expandability to cover future loads in the area. SSVEC is already looking into possible substation sites and sub-transmission corridors for this project.

2. <u>Feeder V7 - Sonoita/Patagonia Area</u>

This area has long been a source of concern and now has reached the limits of the existing feeder's capability to serve the over 2,300 members. At present the V7 feeder utilizes five stages of voltage regulation and is a source of frequent outages due to its extensive length and current condition. This radial feeder also has no secondary feed options. A separate detailed report on its limitations and possible solutions for this area was produced by SSVEC's Engineering Division. Findings from this report substantiate the recommendations contained herein.



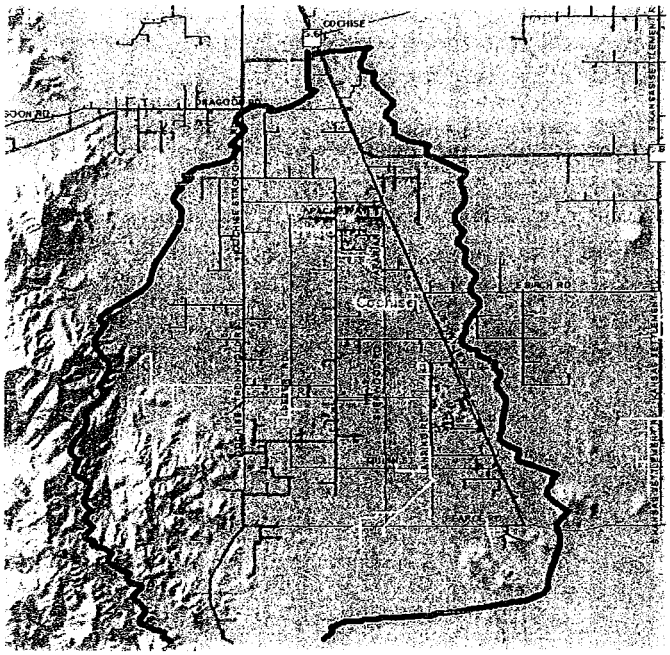
In 1978, SSVEC purchased an easement from the Babacomari Ranch Company for a 69 kV sub-transmission corridor to serve the area. In 1991, this purchase was contested by the ranch. Recent legal action and settlement negotiations indicate that a near-term resolution is likely.

Given the likelihood of a settlement, included in this workplan [carried over from the previously approved work plan] is funding for design and construction of approximately 23 miles 69 kV sub-transmission line from Hwy 90 near Huachuca City to the Sonoita area, a new 69/25 kV substation, and feeders to connect the new facilities to the existing system.

3. Feeder H4 - Sunsites/Pearce Area

The Sunsites and Pearce areas have experienced steady growth over many years. Recently a new large subdivision in Sunsites was approved and will add to the continued growth.

Both the Sunsites and the Pearce areas are currently served by a single 12.47 kV feeder from the Cochise Substation. The substation is located adjacent to the Apache Generating Station. The substation is four miles away from the nearest load center on the feeder, and more than 7 miles from Sunsites. Much of the mainline feeder is #4/0 ACSR conductor.



A substation has been planned in the Sunsites area for some time now though no land or sub-transmission rights-of-way have been acquired. This workplan includes costs for land acquisition and sub-transmission rights-of-way for this new Sunsites Substation though no construction is planned in 2008-2009.

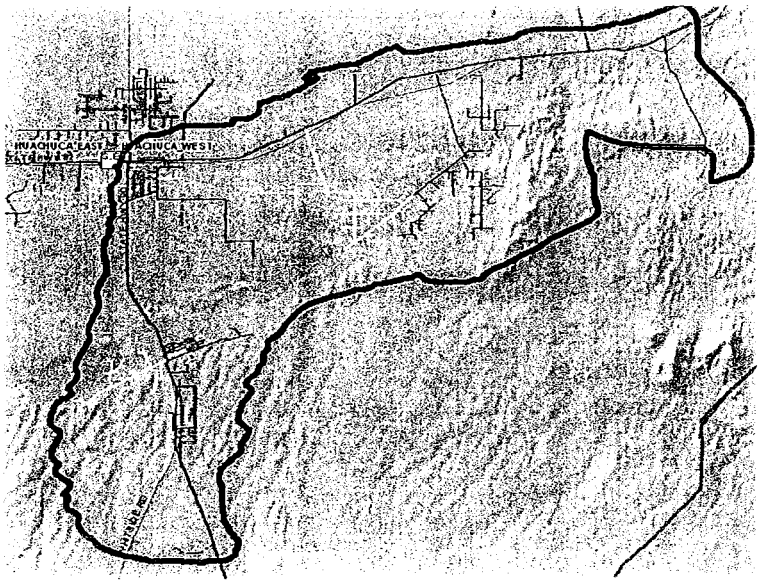
Long Range Plan analysis started in 2006 indicates that the best way to meet the near-term load growth in this area is to convert the H4 feeder from 12.47 kV to 25 kV. Further analysis revealed that beginning the voltage conversion beginning at the ends

of the feeder and working back toward the existing substation would be the best way to implement this conversion.

Once this conversion is completed in 2009, the next workplan will call for construction of the new Sunsites Substation and 69 kV sub-transmission line. Tie lines to the newly-converted feeder will be constructed. This will provide facilities to meet load growth for years to come in this area. The voltage conversion will also allow for back-up feed capability from/to the neighboring Kansas Substation to the East and Chiricahua Substation to the SouthEast.

4. <u>Feeder W5 - Huachuca City/Whetstone Area</u>
Huachuca City, Whetstone and what was formerly known as the Babocomari Land Grant is growing rapidly. This area is located North of Sierra Vista, and just North of the Fort Huachuca Military Reservation. The area is served by a single 12.47 kV feeder extending South from the Huachuca East Substation.

The Babocomari Land Grant has been owned by a single entity for many years and is now in the hands of a partnership. There are now over 800 platted home sites on the old land grant and approximately 100 homes are now built.



SSVEC's Long Range Plan analysis started for this area is to convert to 25 kV. This will increase load-serving capability and increase reliability by matching voltage with the neighboring existing Huachuca West Substation and future substations between Benson and Whetstone. In development of this workplan, discussion took place regarding the option to convert the Southern portion of this feeder beginning at the Mustang Corner area and extending South to complete the conversion during the next workplan. However, due to the amount of work already in the 2008-9 workplan, this project was postponed.

Project: Sonoita Substation New Feeders
CWP Item Number: 200.119 **Estimated Cost:** $900,000
Year: 2009

DESCRIPTION OF PROPOSED CONSTRUCTION

Build new, upgrading existing, and/or rerouting distribution lines as a result of the new Sonoita Substation or upgrading existing lines as needed since Sonoita substation has not been built.

Exact description can't be done since the substation site hasn't been bought yet.

REASON FOR PROPOSED CONSTRUCTION

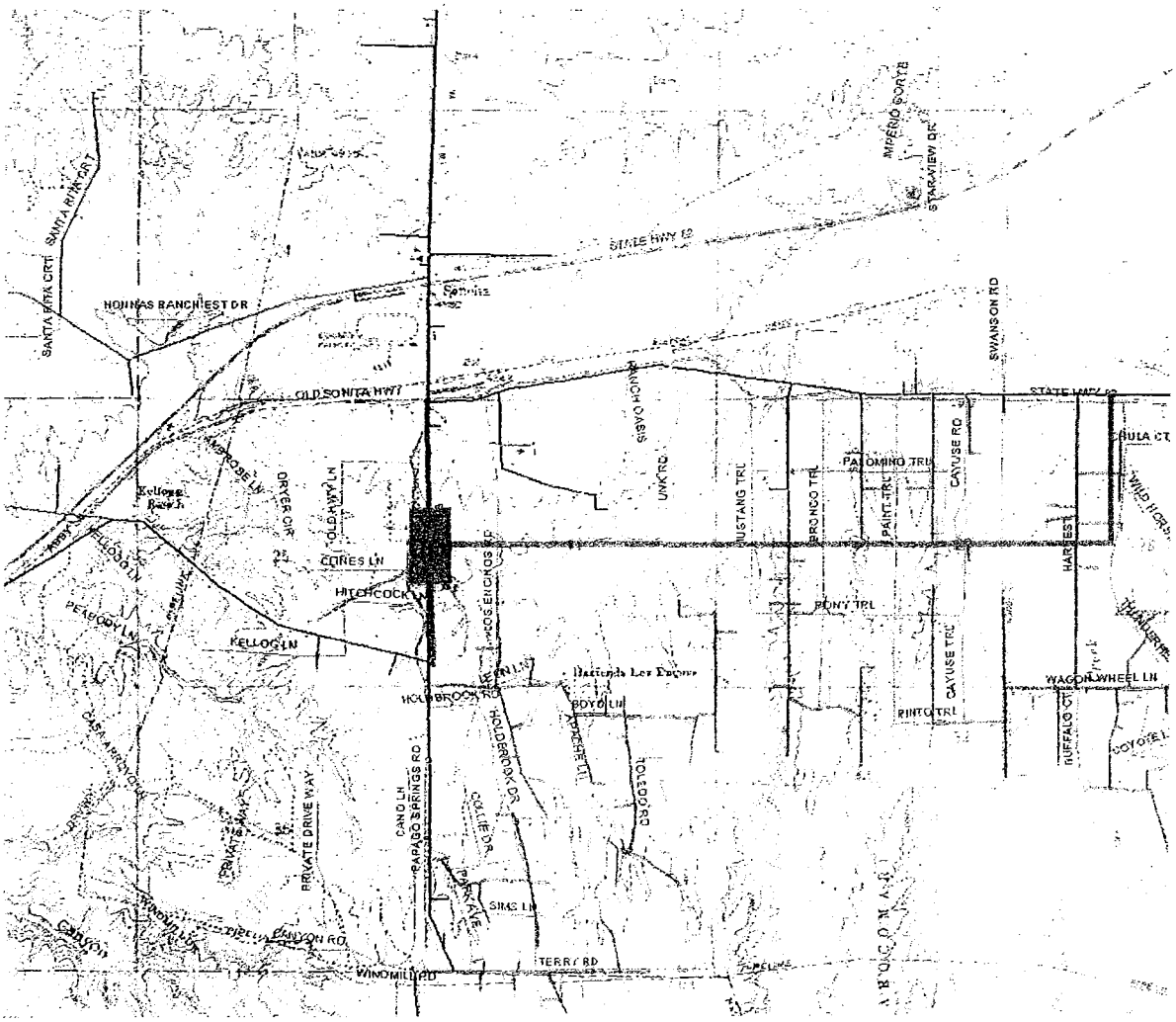
The work is due to a new substation, or to continue to serve loads from existing facilities due to the lack of the Sonoita substation. See page 9 for more details.

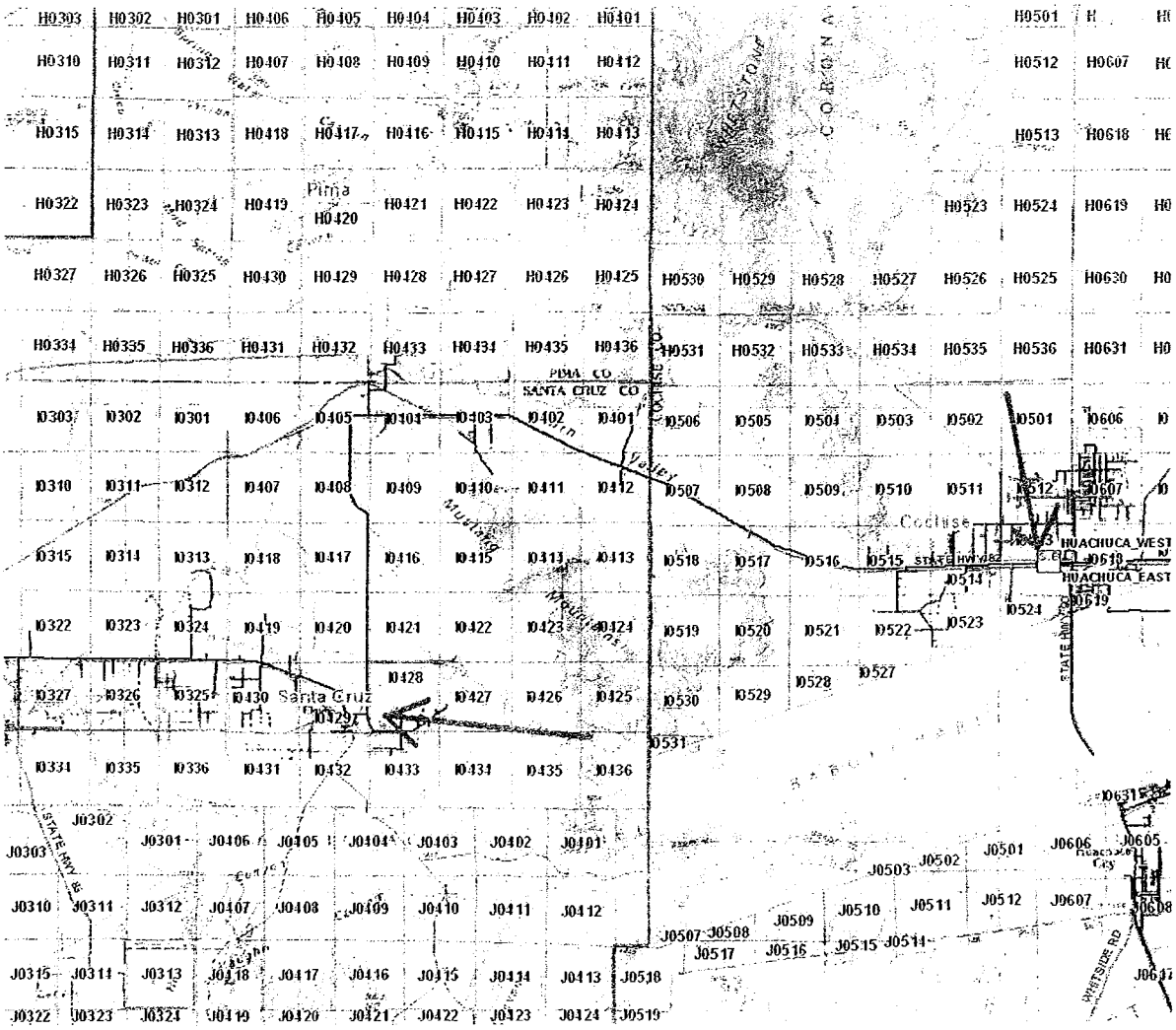
If the new substation cannot completed in time to meet the load requirements, the existing feeder will need to be rebuilt to a larger conductor from the substation to Elgin road.

RESULTS OF PROPOSED CONSTRUCTION

ALTERNATES TO PROPOSED CONSTRUCTION

There are no meaningful alternatives.


SANTA RITA CIR
SANTA RITA DR
HONINAS RANCH EST DR
Kellogg Ranch
ABBY
KELLOGG LN
PEABODY LN
CASA ARROYO
CANYON
PRIVATE DRIVE WAY
OLD SONTA HWY
MEADOW LN
DRYER CIR
OLD HWY LN
CORES LN
HITCHCOCK LN
KELLOGG LN
CANO LN
PARADISE SPRINGS RD
HOLLBROOK RD
HOLLBROOK DR
COLLIE DR
PARK AVE
SIMS LN
TERRY RD
WINDMILL RD
TIELL CANYON RD
Hacienda Los Encinos
BOYD LN
HOLLBROOK
STATE HWY 12
Sonoma
SIGNO OASIS
UNK RD
MUSTANG TRL
BRONCO TRL
PAINT TRL
PALOMINO TRL
CAYUSE RD
SWANSON RD
STATE HWY 12
HARVEST
PONY TRL
CAYUSE TRL
RINTO TRL
WAGON WHEEL LN
BUFFALO CT
COYOTE
STAGVIEW DR
IMPERIO SORYE
BULA CT
WILD HORSE


H0303 H0302 H0301 H0406 H0405 H0404 H0403 H0402 H0401
H0310 H0311 H0312 H0407 H0408 H0409 H0410 H0411 H0412
H0315 H0314 H0313 H0418 H0417 H0416 H0415 H0414 H0413
H0322 H0323 H0324 H0419 H0420 H0421 H0422 H0423 H0424
H0327 H0326 H0325 H0430 H0429 H0428 H0427 H0426 H0425
H0334 H0335 H0336 H0431 H0432 H0433 H0434 H0435 H0436
Pima
PIMA CO
SANTA CRUZ CO
I0303 I0302 I0301 I0406 I0405 I0404 I0403 I0402 I0401
I0310 I0311 I0312 I0407 I0408 I0409 I0410 I0411 I0412
I0315 I0314 I0313 I0418 I0417 I0416 I0415 I0414 I0413
I0322 I0323 I0324 I0419 I0420 I0421 I0422 I0423 I0424
I0327 I0326 I0325 I0430 I0429 I0428 I0427 I0426 I0425
I0334 I0335 I0336 I0431 I0432 I0433 I0434 I0435 I0436
Santa Cruz
Cochise
HUACHUCA_WEST
HUACHUCA_EAST
STATE HWY 82
J0302 J0301 J0406 J0405 J0404 J0403 J0402 J0401
J0310 J0311 J0312 J0407 J0408 J0409 J0410 J0411 J0412
J0315 J0311 J0313 J0418 J0417 J0416 J0415 J0414 J0413
J0322 J0323 J0324 J0419 J0420 J0421 J0422 J0423 J0424
J0507 J0508 J0509 J0510 J0511 J0512 J0607
J0517 J0516 J0515 J0514
J0503 J0502 J0501 J0606 J0605
WHITSIDE RD

Project: R3 Three Canyons Road
CWP Item Number: 200.120 **Estimated Cost:** $225,000
Year: 2008

DESCRIPTION OF PROPOSED CONSTRUCTION

Build 4 miles, 3-phase, underground 4/0 ACSR conductor. Construction will begin at or near location L0729-1110, and end at or near location L0723-88890. All of the construction will be done in existing rights-of-way. Some of the conduit has been installed already as this project has been known for awhile.

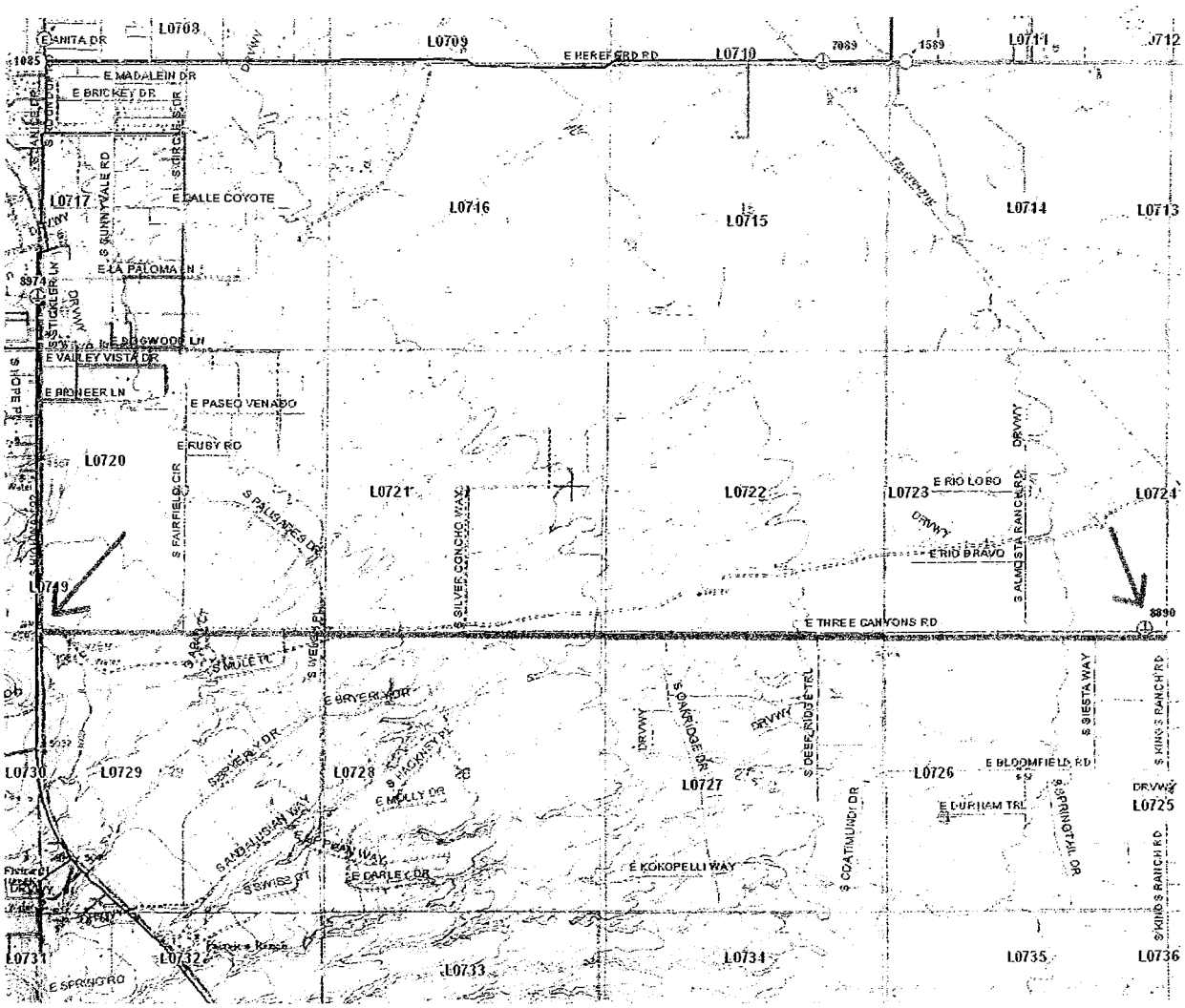
REASON FOR PROPOSED CONSTRUCTION

This area is growing rapidly. Furthermore, the new Hereford substation will be built shortly. This project provides voltage support and line capacity to the area along with increased back up capability between Ramsey and Hereford substations.

RESULTS OF PROPOSED CONSTRUCTION

1) The existing feed winds for 8 miles to serve the existing load. The new feed will serve the load by a direct route of 3 miles.
2) Building this feeder section will also provide loop feed possibilities for scheduled and emergency outages.

ALTERNATES TO PROPOSED CONSTRUCTION
There are no meaningful alternatives.


L0708
L0709
L0710
L0711
L0712
L0713
L0714
L0715
L0716
L0717
L0720
L0721
L0722
L0723
L0724
L0725
L0726
L0727
L0728
L0729
L0730
L0731
L0732
L0733
L0734
L0735
L0736
E HEREFORD RD
E MADALEIN DR
E BRICKEY DR
E ALLE COYOTE
E LA PALOMA LN
E VALLEY VISTA DR
E PIONEER LN
E PASEO VENADO
E RUBY RD
E RIO LOBO
E RIO BRAVO
E THREE CANYONS RD
E BLOOMFIELD RD
E DURHAM TRL
E KOKOPELLI WAY
E SPRING RD
S FAIRFIELD CIR
S SILVER CONCHO WAY
S ALMOSTA RANCH RD
S SIESTA WAY
S KING'S RANCH RD
S COATIMUNDI DR
S SPRINGTAIL DR
S DEER RIDGE TRL
S MULE TR
E BRYER WDR
E MOLLY DR
E CARLEY DR
S SWISS PT

Project: Cottonwood Feeders
CWP Item Number: 200.130 **Estimated Cost:** $200,000
Year: 2008

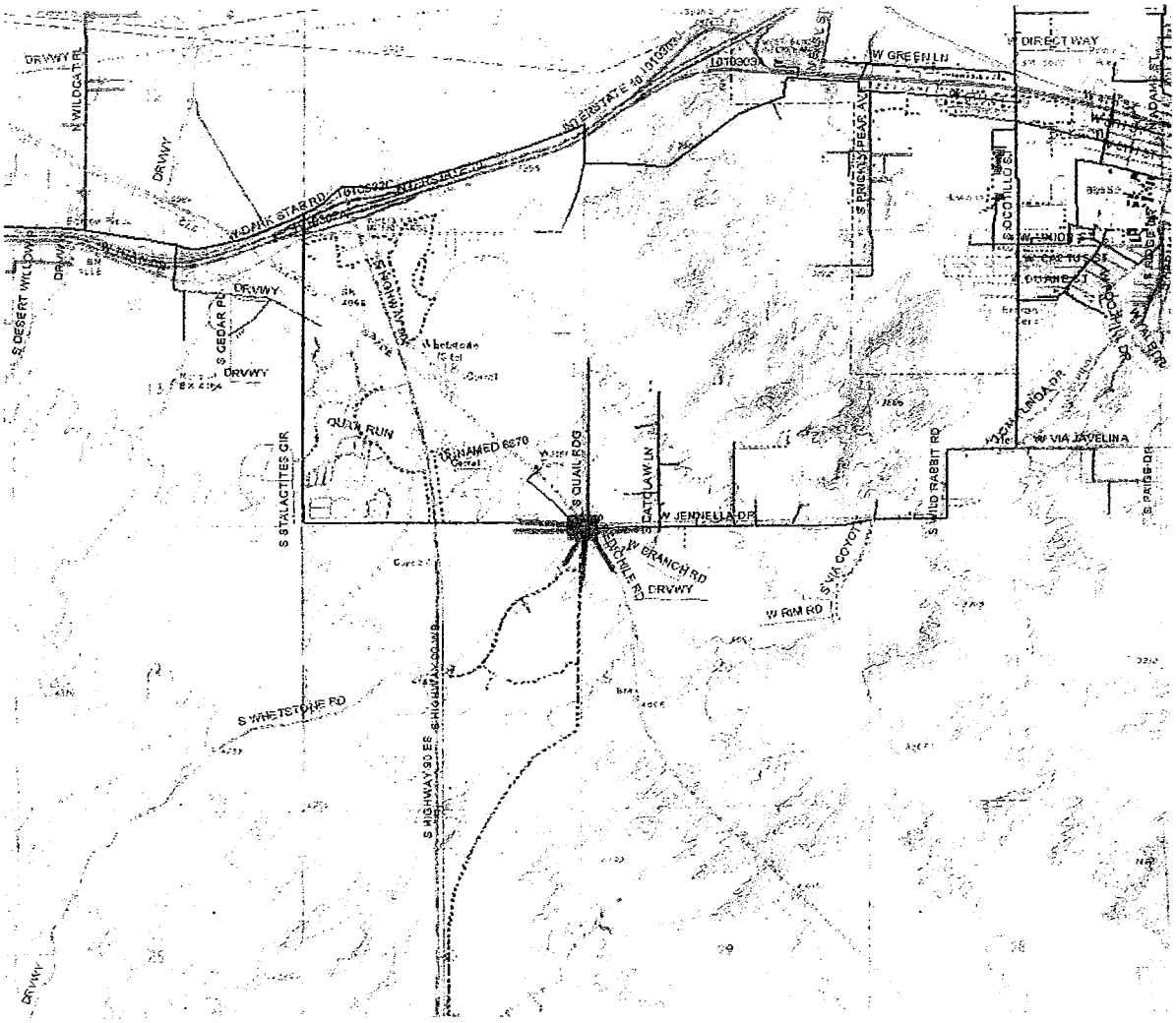
DESCRIPTION OF PROPOSED CONSTRUCTION

Build 3-phase, 500MCM underground or 477 ACSR overhead as needed to connect substation to system. There shouldn't be much construction as many of the existing lines have been built with the substation in mind.

REASON FOR PROPOSED CONSTRUCTION
This project allows to power to come from the Cottonwood substation. This substation and its feeders will provide adequate electric service to the fast growing areas along Highway 90, J6/Mescal Lakes, and areas West of the Benson area. See page 7 for more details.

RESULTS OF PROPOSED CONSTRUCTION

ALTERNATES TO PROPOSED CONSTRUCTION
There are no meaningful alternatives.


W GREEN LN
W DIRECT WAY
N VILLOCA TR
DRVWY
W DARK STAR RD
S DESERT WILLOW
S CEDAR RD
S STALACTITES GIR
QUAIL RUN
UNNAMED 6870
S QUAIL RDG
CATCLAW LN
W JENDELLA DR
W BRANCH RD
W RIM RD
S WHETSTONE RD
S HIGHWAY 90 E6
S WILD RABBIT RD
W VIA JAVELINA
S PRIDE DR

Project: Hereford Substation New Feeders
CWP Item Number: 200.132 **Estimated Cost:** $1,900,000
Year: 2009

DESCRIPTION OF PROPOSED CONSTRUCTION

Build new, upgrading existing, and/or rerouting distribution lines as a result of the new Hereford Substation. Possibly up to 4 miles of 500mcm underground and 5 miles of 4/0 underground.

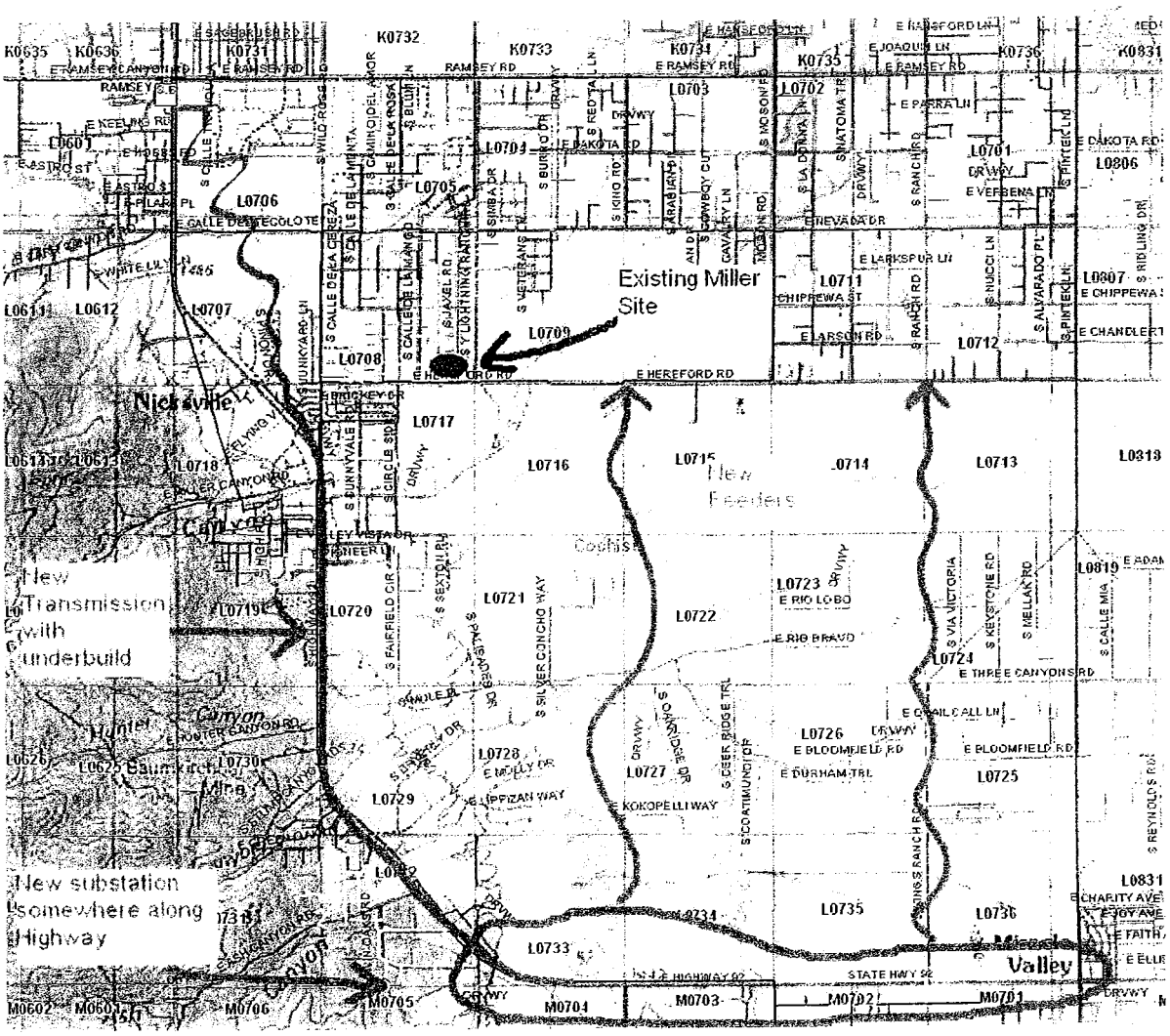
REASON FOR PROPOSED CONSTRUCTION

The work is due to a new substation. See page 8 for more details.

RESULTS OF PROPOSED CONSTRUCTION

ALTERNATES TO PROPOSED CONSTRUCTION

There are no meaningful alternatives.


Existing Miller Site
Nickelville
Canyon
New Transmission with underbuild
Hamlet
Canyon
Baumkirch Mine
New substation somewhere along Highway
New Feeders
Valley
E HEREFORD RD
RAMSEY RD
STATE HWY 92

Project: Sonoita Substation
CWP Item Number: 400.001 **Estimated Cost:** $2,500,000
Year: 2008, 2009

DESCRIPTION OF PROPOSED CONSTRUCTION

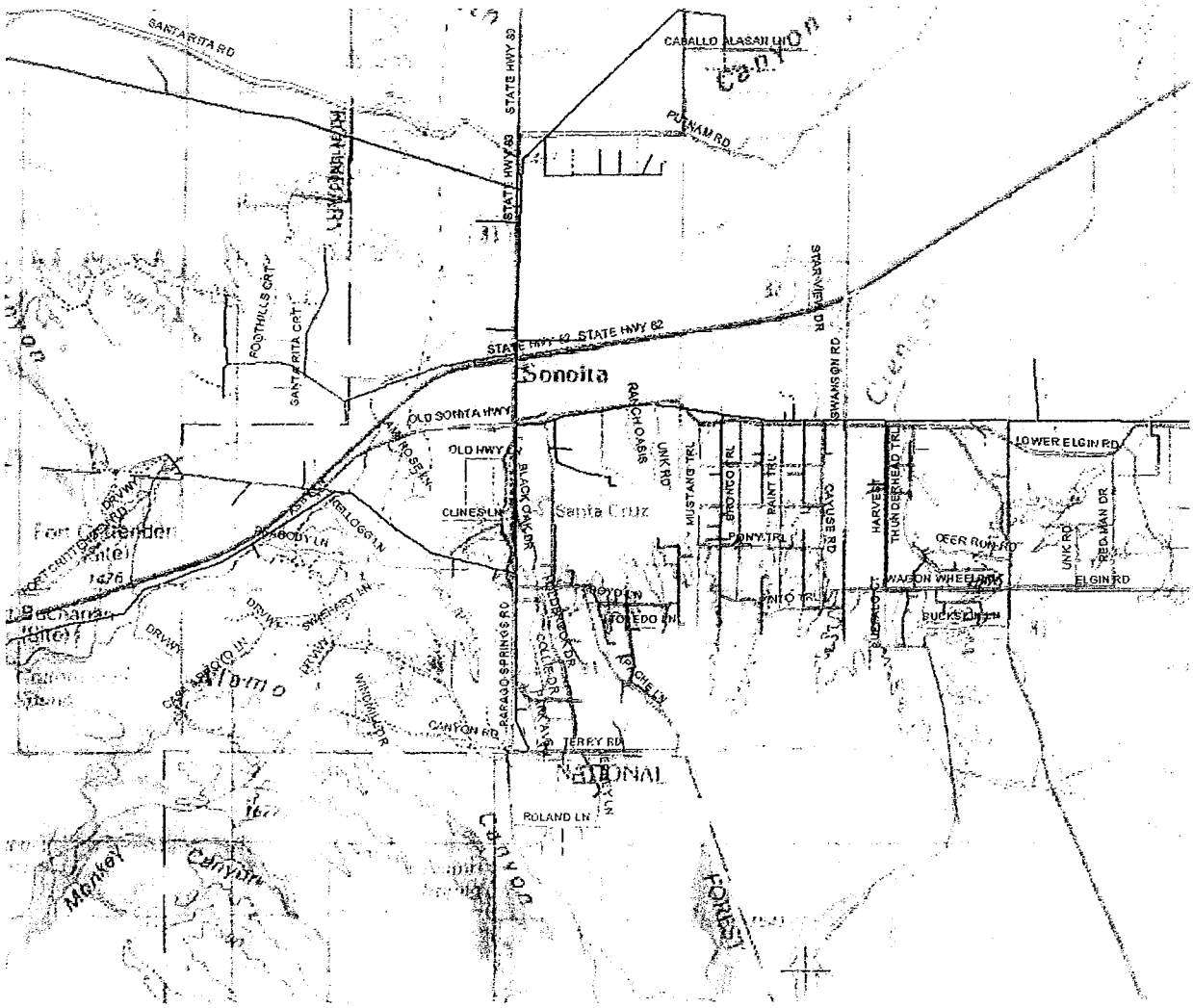
Obtain the necessary rights-of-way and build a new 69/24.9 kV Sonoita Substation to help serve the load of the Huachuca West Substation. The Sonoita Substation will have four feeder bays with a 10/12/14 MVA transformer.

REASON FOR PROPOSED CONSTRUCTION

The existing feeder serving the Sonoita, Patagonia, and nearby areas has reached it power serving capacity. The load continues to grow. A sub-transmission line, substation, and feeders are required. See page 9 for more details.

RESULTS OF PROPOSED CONSTRUCTION

ALTERNATES TO PROPOSED CONSTRUCTION


SANTA RITA RD
STATE HWY 83
STATE HWY 82
Sonoita
Santa Cruz
OLD SONOITA HWY
OLD HWY 82
RANCHO OASIS
UNK RD
MUSTANG TRL
BRONCO TRL
PAINT TRL
PONY TRL
CAYUSE RD
HARVEST
THUNDERHEAD TRL
LOWER ELGIN RD
DEER RUN RD
WAGON WHEEL WAY
ELGIN RD
BUCKSKIN TRL
UNK RD
TED MAN DR
CUNES LN
BLACK CANYON
PARAGO SPRINGS RD
CANYON RD
JERRY RD
ROLAND LN
FOOTHILLS CRT
SANTA RITA CRT
STARVIEW DR
PUTNAM RD
CABALLO ALASAN LN
Canyon
Market
FOREST
NATIONAL

Project: Cottonwood Substation
CWP Item Number: 400.004 **Estimated Cost:** $2,000,000
Year: 2008

DESCRIPTION OF PROPOSED CONSTRUCTION

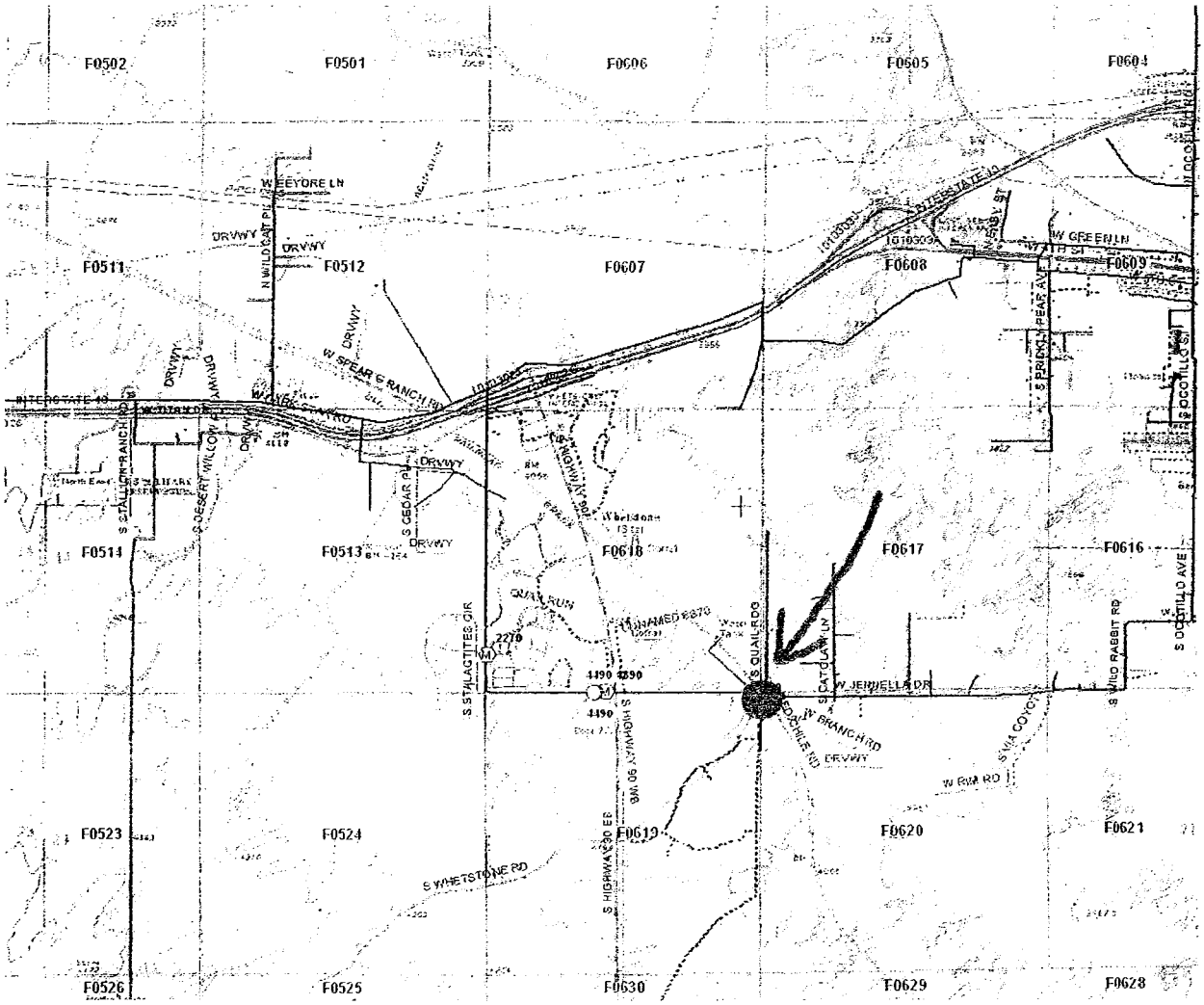
Build a new 69/25 kV substation in the Benson area to serve new load.

REASON FOR PROPOSED CONSTRUCTION

This substation and its feeders will provide adequate electric service to the fast growing areas along Highway 90, J6/Mescal Lakes, and areas West of the Benson area. See page 7 for more details.

RESULTS OF PROPOSED CONSTRUCTION

ALTERNATES TO PROPOSED CONSTRUCTION


F0502
F0501
F0606
F0605
F0604
F0511
F0512
F0607
F0608
F0609
F0514
F0513
F0618
F0617
F0616
F0523
F0524
F0619
F0620
F0621
F0526
F0525
F0630
F0629
F0628
W EEYORE LN
W GREEN LN
W SPEAR S RANCH RD
S STALLION RANCH RD
S DESERT WILLOW
S CEDAR PL
S STALACTITES DR
S QUAIL RDG
S CATCLAW LN
W JENNELLA DR
S RIO RABBIT RD
S OCOTILLO AVE
W BIM RD
S WHETSTONE RD
S HIGHWAY 90 EB
QUAIL RUN
DRVWY

Project: Hereford Substation
CWP Item Number: 400.005 **Estimated Cost:** $2,500,000
Year: 2008, 2009

DESCRIPTION OF PROPOSED CONSTRUCTION

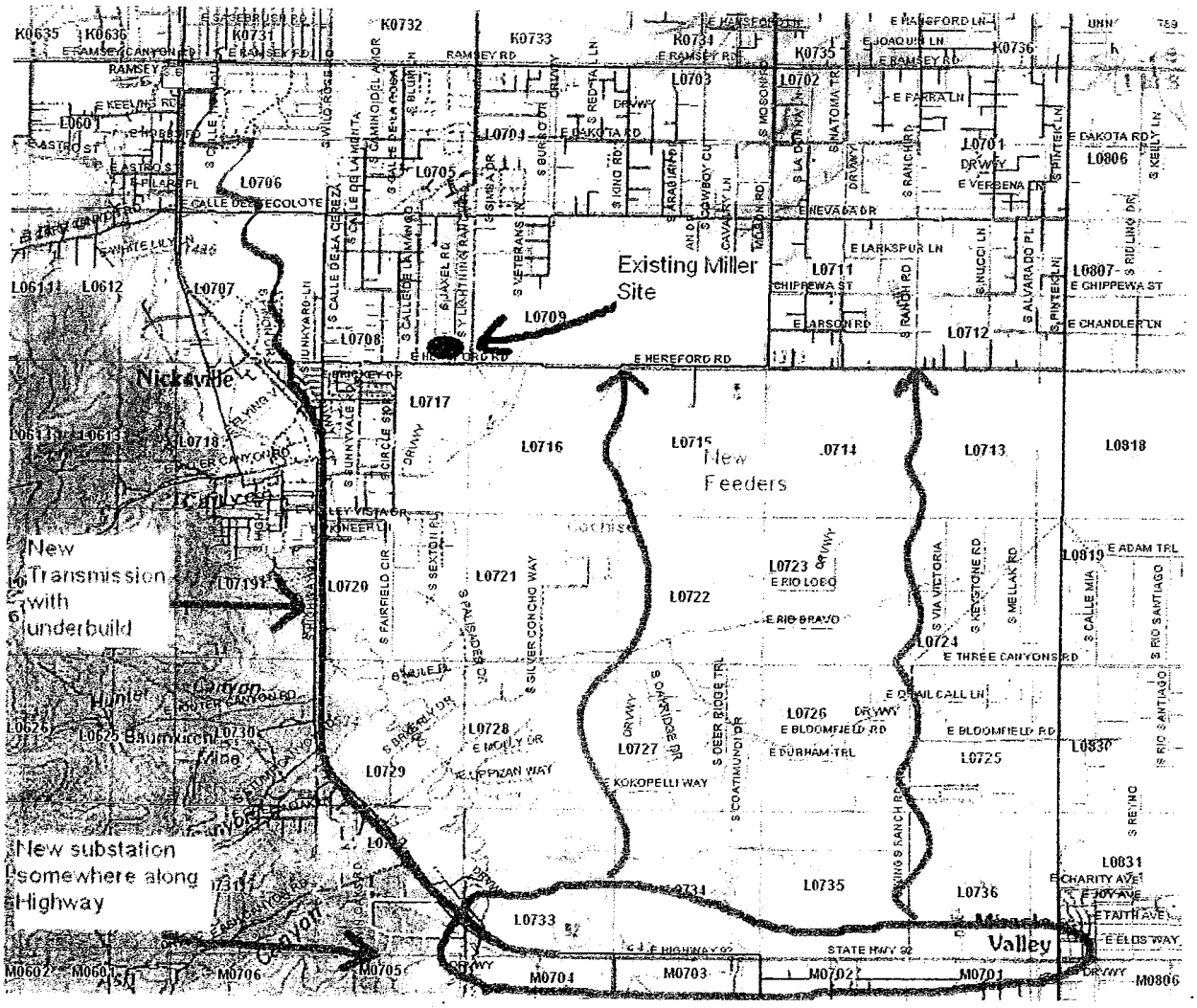
Buy the substation site and necessary rights-of-way, and do the engineering for the substation in 2008. Construct the substation in 2009. This is assuming the proposed rights-of-way for the source sub-transmission and substation site can be obtained.

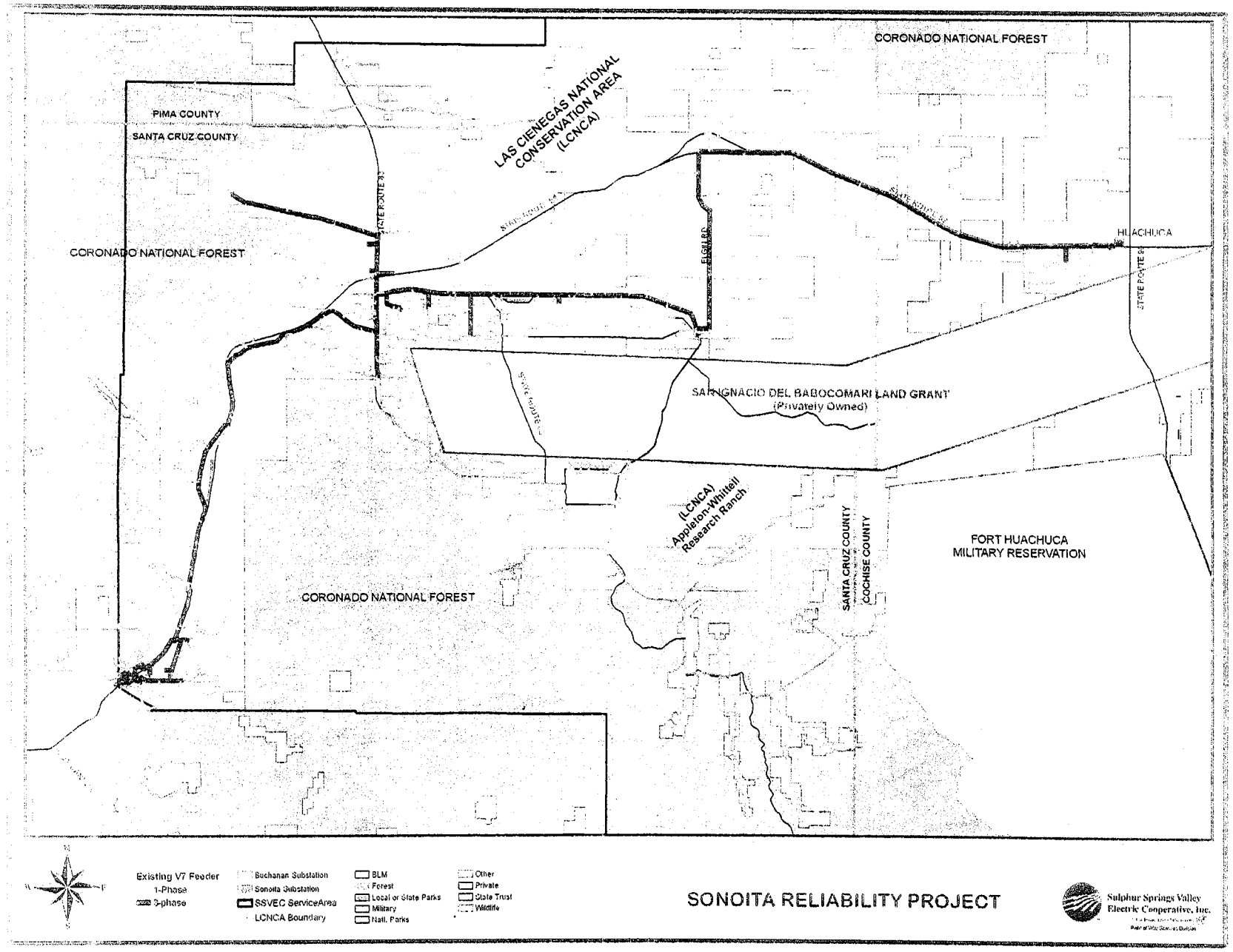
REASON FOR PROPOSED CONSTRUCTION

The work is due to a new substation. See page 8 for more details.

RESULTS OF PROPOSED CONSTRUCTION

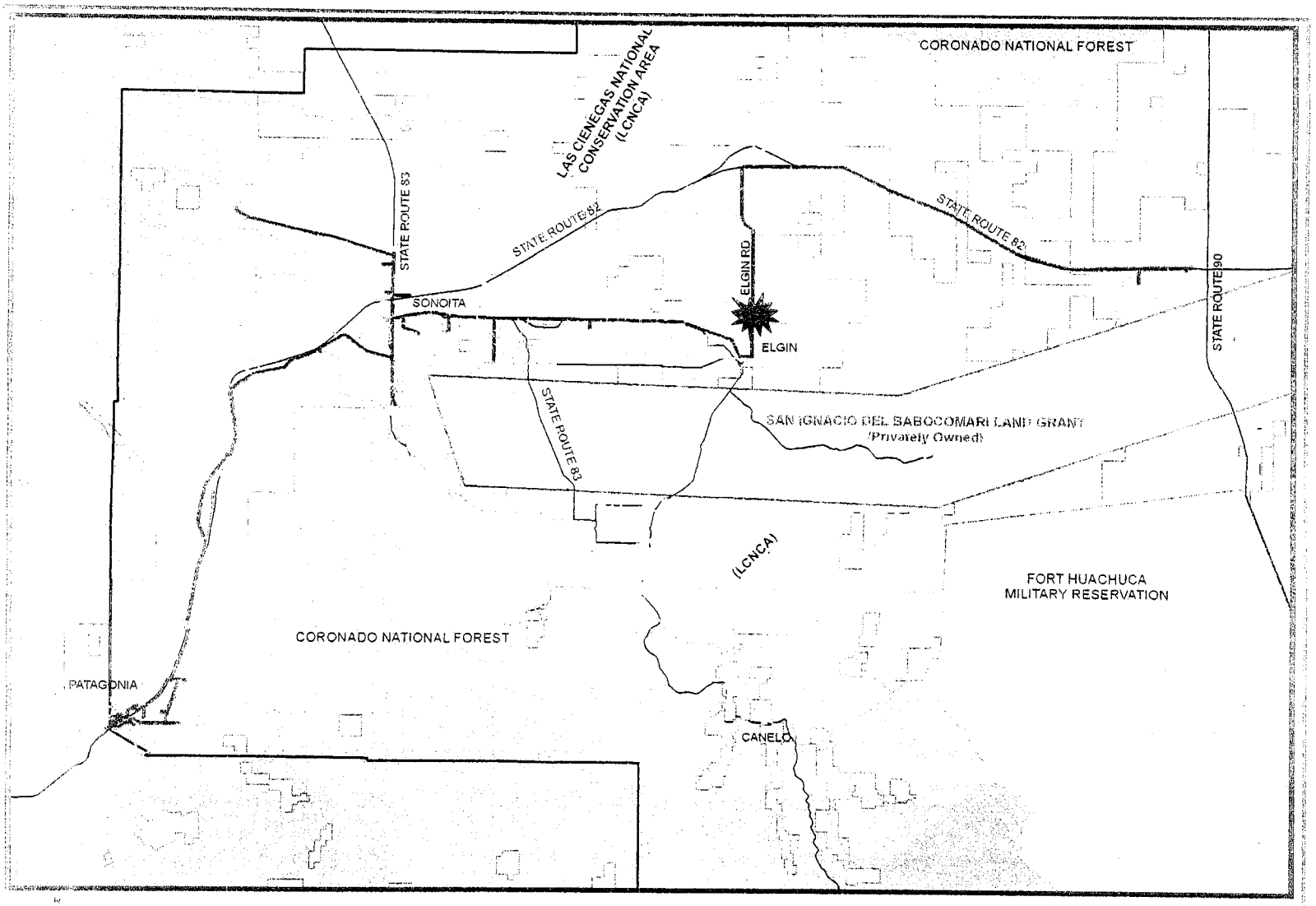
ALTERNATES TO PROPOSED CONSTRUCTION


Existing Miller Site
New Feeders
New Transmission with underbuild
New substation somewhere along Highway
Nicksville
Valley
E HEREFORD RD
STATE HWY 92



SONOITA RELIABILITY PROJECT

Sulphur Springs Valley Electric Cooperative, Inc.



Existing V7 Feeder

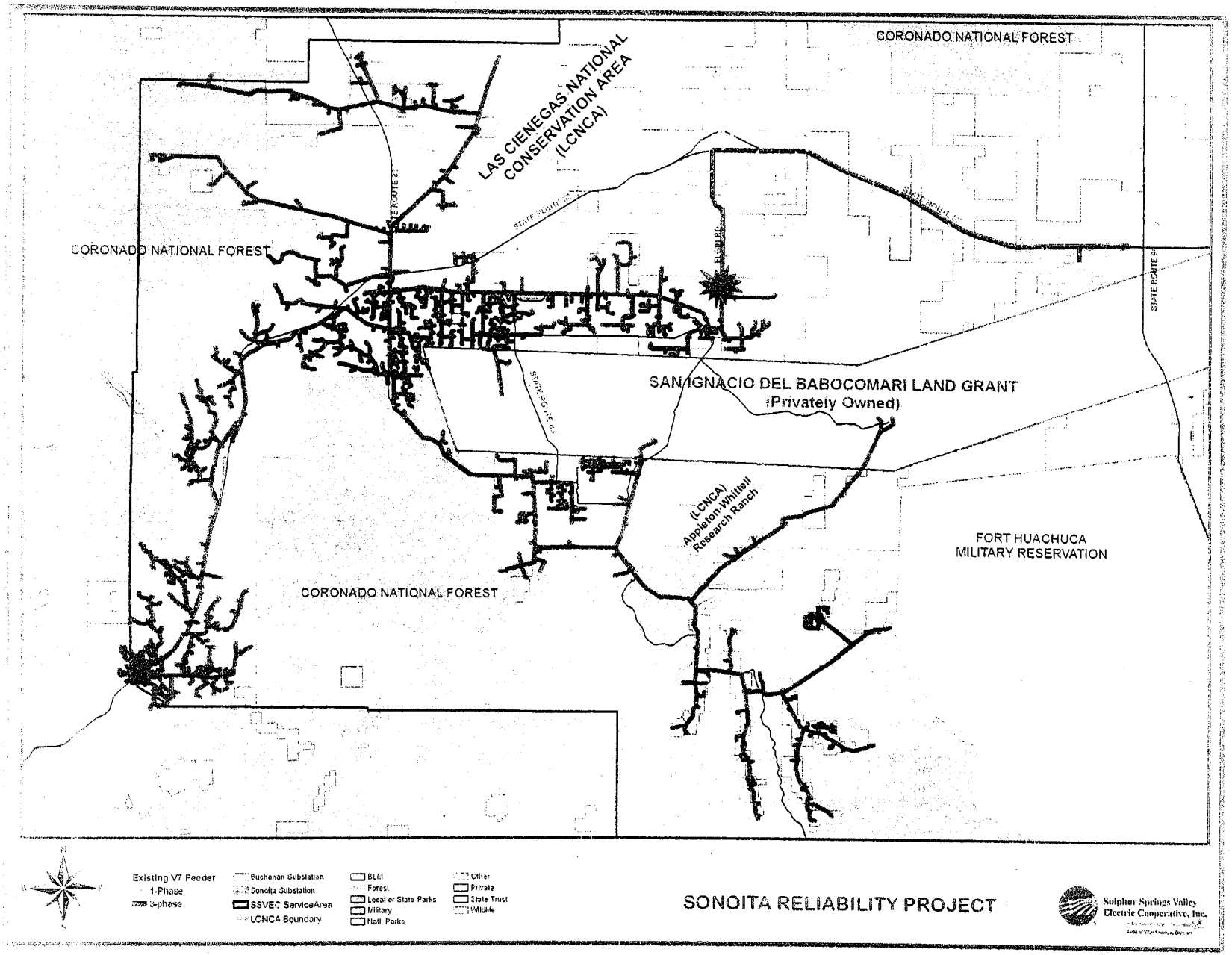
Buchanan Substation
Sonoita Substation
SIDB Boundary
LCNCA Boundary
SSVEC ServiceArea

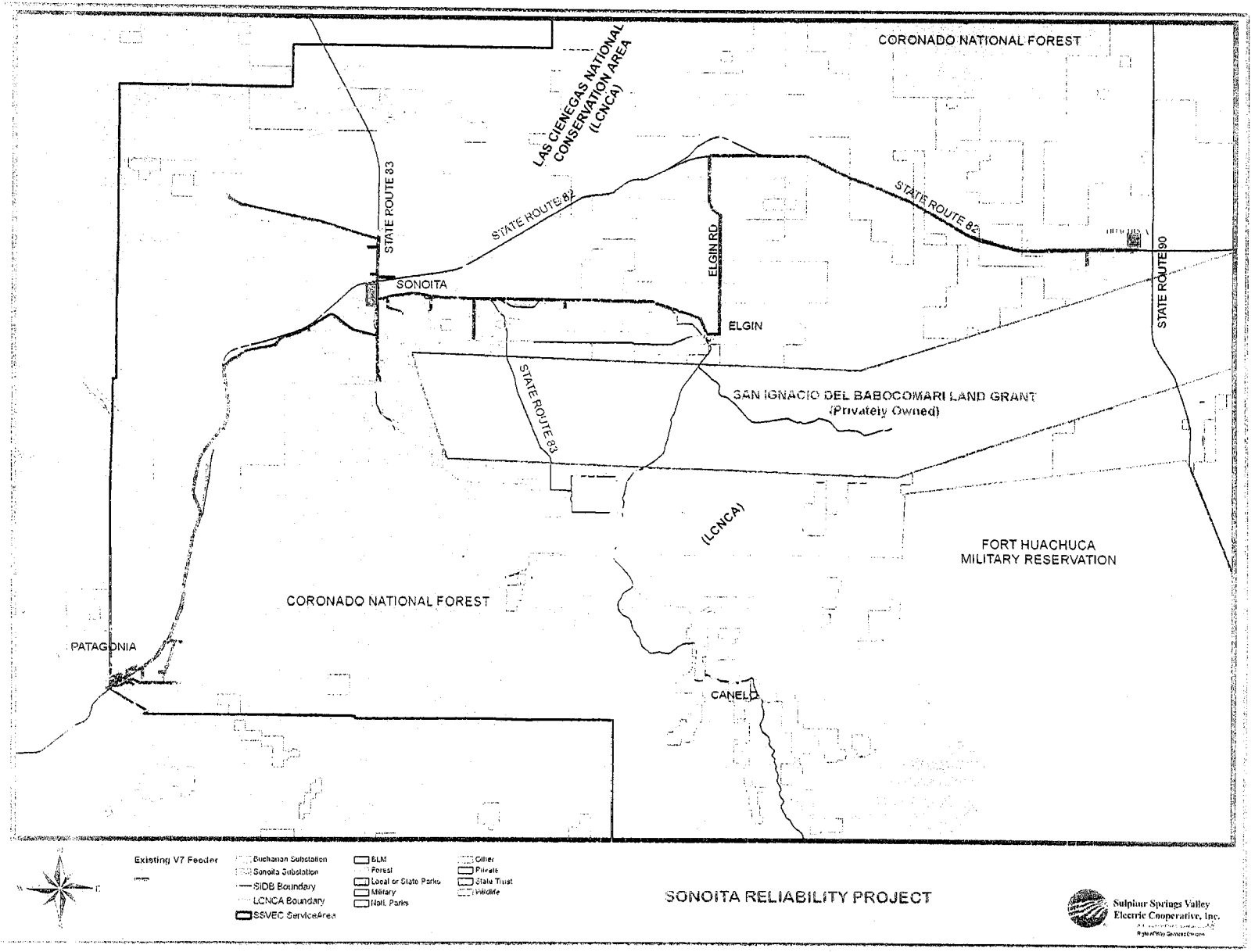
BLM
Forest
Local or State Parks
Military
Natl. Parks

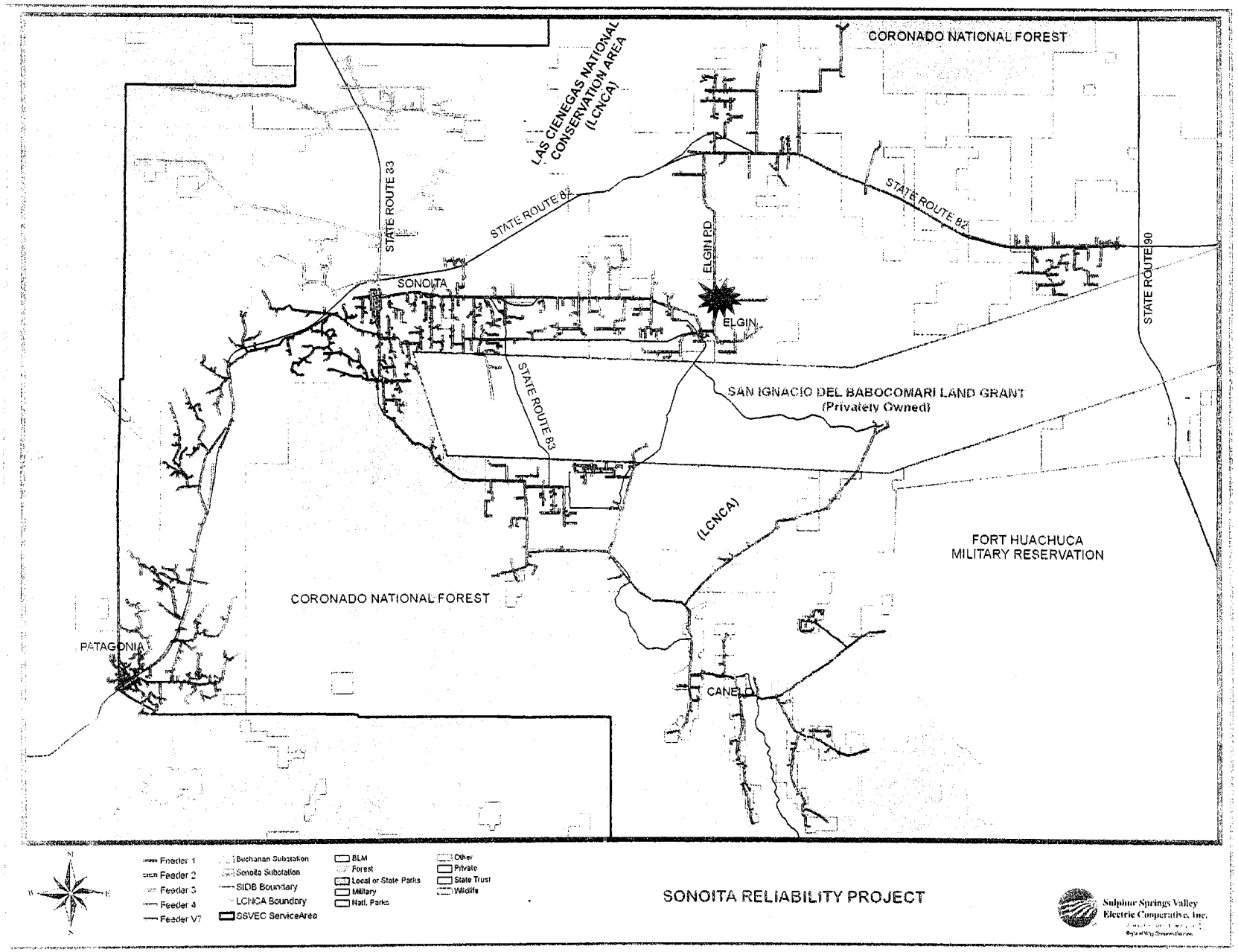
Other
Private
State Trust
Wildlife

SONOITA RELIABILITY PROJECT

Sulphur Springs Valley Electric Cooperative, Inc.

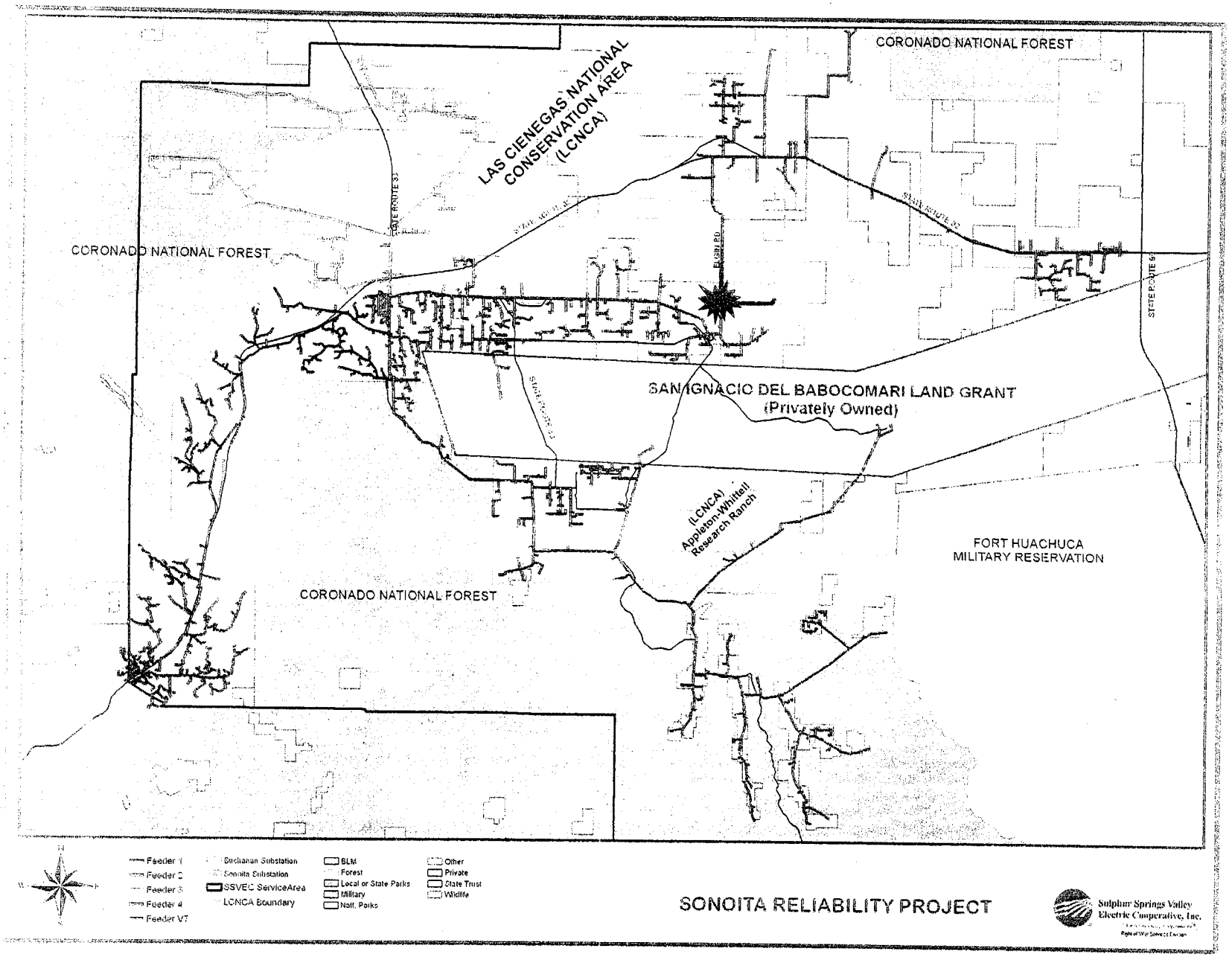

CORONADO NATIONAL FOREST
LAS CIENEGAS NATIONAL CONSERVATION AREA (LCNCA)
CORONADO NATIONAL FOREST
STATE ROUTE 82
STATE ROUTE 90
STATE ROUTE 92
STATE ROUTE 83
STATE ROUTE 80
SAN IGNACIO DEL BABOCOMARI LAND GRANT (Privately Owned)
(LCNCA) Appleton-Whittell Research Ranch
FORT HUACHUCA MILITARY RESERVATION
CORONADO NATIONAL FOREST
N
Existing V7 Feeder
1-Phase
3-phase
Buchanan Substation
Sonoita Substation
SSVEC ServiceArea
LCNCA Boundary
BLM
Forest
Local or State Parks
Military
Natl. Parks
Other
Private
State Trust
Wildlife
SONOITA RELIABILITY PROJECT
Sulphur Springs Valley Electric Cooperative, Inc.


CORONADO NATIONAL FOREST
LAS CIENEGAS NATIONAL CONSERVATION AREA (LCNCA)
STATE ROUTE 83
STATE ROUTE 82
STATE ROUTE 82
ELGIN RD
SONOITA
ELGIN
STATE ROUTE 90
STATE ROUTE 83
SAN IGNACIO DEL BABOCOMARI LAND GRANT
(Privately Owned)
(LCNCA)
FORT HUACHUCA
MILITARY RESERVATION
CORONADO NATIONAL FOREST
PATAGONIA
CANELO
Existing V7 Feeder
Buchanan Substation
Sonoita Substation
SIDB Boundary
LCNCA Boundary
SSVEC ServiceArea
BLM
Forest
Local or State Parks
Military
Natl. Parks
Other
Private
State Trust
Wildlife
SONOITA RELIABILITY PROJECT
Sulphur Springs Valley
Electric Cooperative, Inc.



SONOITA RELIABILITY PROJECT

Sulphur Springs Valley Electric Cooperative, Inc.


CORONADO NATIONAL FOREST
LAS CIENEGAS NATIONAL CONSERVATION AREA (LCNCA)
CORONADO NATIONAL FOREST
STATE ROUTE 83
STATE ROUTE 92
STATE ROUTE 90
STATE ROUTE 82
SAN IGNACIO DEL BABOCOMARI LAND GRANT (Privately Owned)
(LCNCA) Appleton-Whittell Research Ranch
FORT HUACHUCA MILITARY RESERVATION
CORONADO NATIONAL FOREST
Feeder 1
Feeder 2
Feeder 3
Feeder 4
Feeder V7
Buchanan Substation
Sonoita Substation
SSVEC ServiceArea
LCNCA Boundary
BLM
Forest
Local or State Parks
Military
Natl. Parks
Other
Private
State Trust
Wildlife
SONOITA RELIABILITY PROJECT
Sulphur Springs Valley Electric Cooperative, Inc.

WORK
5 YR AVG

PH: J
1996
~~BOAR~~ ~~ANNUAL~~
~~REPORT~~
WORK
PLAN

TOTAL NUMBER OF INTERRUPTIONS 1992-1996

SUBSTATION	1992	1993	1994	1995	1996	Average
SYSTEM TOTAL	885	795	925	1023	934	912
SAN SIMON TOTALS	26	20	18	22	14	20
A1	0	0	2	0	0	0
A3	10	14	9	14	8	11
A5	16	5	7	8	6	6
Outages of Entire Sub A	0	1	0	0	0	0
BOWIE TOTALS	9	12	9	17	10	11
B3	3	5	4	6	3	4
B5	0	2	1	2	2	1
B7	6	5	4	9	5	6
Outages of Entire Sub B	0	0	0	0	0	0
MORTENSON TOTALS	15	11	15	15	19	15
D1	2	3	6	1	3	3
D5	9	4	4	13	12	8
D7	4	4	4	1	2	3
Outages of Entire Sub D	0	0	1	0	2	1
STEWART TOTALS	21	37	21	24	31	27
E1	8	3	1	2	2	3
E2	2	13	4	11	13	9
E3	11	21	16	11	15	15
Outages of Entire Sub E	0	0	0	0	1	0
WILCOX TOTALS	30	25	34	21	23	28
F1	7	4	10	7	9	7
F4	8	9	4	2	0	5
F7	20	10	15	8	12	13
F8	3	2	5	4	1	3
Outages of Entire Sub F	0	0	0	0	1	0
COCHISE TOTALS	33	25	35	41	40	35
H3	17	14	9	9	9	12
H4	16	11	26	32	31	23
Outages of Entire Sub H	0	0	0	0	0	0
KANSAS TOTALS	123	125	145	149	114	151
J3	40	34	46	63	53	47
J5	10	9	8	11	9	9
J7	73	82	89	75	50	74
Outages of Entire Sub J	0	0	2	0	2	1
WEBB TOTALS	34	48	29	34	26	34
M1	7	17	9	14	11	12
M3	7	6	2	5	4	5
M4	15	21	10	12	8	14
M5	5	3	5	3	2	4
Outages of Entire Sub M	0	1	0	0	1	0
MCNEAL TOTALS	27	34	58	35	51	41
N1	17	13	25	18	23	19
N2	10	21	30	17	27	21
Outages of Entire Sub N	0	0	3	0	1	1
MESCAL TOTALS	44	59	62	109	103	79
O1	11	24	26	40	54	31
O2	41	25	29	54	42	38
O3	0	1	0	0	2	1
O4	12	9	7	15	4	9
Outages of Entire Sub O	0	0	0	0	1	0

SUBSTATION	1992	1993	1994	1995	1996	Average
SYSTEM TOTAL	885	795	925	1023	934	912
BENSON TOTALS	40	24	26	34	28	30
P5	17	13	7	16	11	13
P7	12	1	7	8	4	6
P8	11	10	10	10	12	11
Outages of Entire Sub P	0	0	0	0	1	0
ST DAVID TOTALS	3	4	7	5	8	5
Q3	0	2	3	2	5	2
Q5	3	1	4	1	2	2
Q7	0	0	0	0	0	0
Outages of Entire Sub Q	0	1	0	2	1	1
RAMSEY TOTALS	108	82	96	66	89	88
R1	15	11	50	8	15	20
R2	34	37	12	18	17	24
R3	59	34	34	40	57	45
Outages of Entire Sub R	0	0	0	0	0	0
TOMBSTONE TOTALS	18	2	7	9	12	10
S3	17	2	7	7	11	9
S7	1	0	0	1	1	1
Outages of Entire Sub S	0	0	0	1	0	0
KEATING TOTALS	27	23	42	52	34	36
T1	8	4	9	14	5	8
T2	6	4	14	21	16	12
T3	4	6	6	6	5	5
T4	9	9	13	10	8	10
Outages of Entire Sub T	0	0	0	1	0	0
SIERRA VISTA TOTALS	28	18	32	36	27	28
U3	4	1	1	5	1	2
U5	3	1	0	7	10	6
U6	19	13	18	13	13	15
U7	2	3	5	11	3	5
Outages of Entire Sub U	0	0	0	0	0	0
HUACHUCA WEST TOTALS	169	146	164	184	147	162
V7	169	146	163	182	145	161
Outages of Entire Sub V	0	0	1	2	2	1
HUACHUCA EAST TOTALS	41	20	27	46	49	37
W3	15	14	21	20	26	19
W5	26	6	6	25	22	17
Outages of Entire Sub W	0	0	0	1	1	0
HAWES TOTALS	31	50	58	74	66	56
X1	2	1	2	5	1	2
X5	22	32	33	40	32	32
X7	0	8	9	7	19	9
X8	7	9	13	24	14	13
Outages of Entire Sub X	0	0	1	0	0	0
BELLA VISTA TOTALS	30	30	40	48	43	38
Y1	7	4	0	2	1	3
Y2	3	7	9	8	1	4
Y3	13	9	20	32	29	21
Y4	7	8	8	6	8	7
Outages of Entire Sub Y	0	0	3	0	4	1

18% OF ALL OUTAGES WERE ON V7

TOTAL NUMBER OF CONSUMER OUTAGE HOURS 1992 - 1996

SUBSTATION	1992	1993	1994	1995	1996	AVERAGE
SYSTEM TOTAL	32,497	34,594	49,726	38,969	56,011	42,359
SAN SIMON TOTALS	835	641	437	217	494	525
A1	0	0	14	0	0	3
A3	156	309	98	139	277	196
A5	680	45	325	78	218	269
Outages of Entire Sub A	0	288	0	0	0	58
BOWIE TOTALS	274	260	154	162	56	185
B2	237	168	50	56	22	111
B5	0	15	16	67	6	21
B7	37	77	88	39	23	53
Outages of Entire Sub B	0	0	0	0	0	0
MORTENSON TOTALS	345	46	446	72	593	300
D1	3	31	144	1	3	36
D5	279	10	4	70	44	51
D7	63	5	9	1	4	16
Outages of Entire Sub D	0	0	290	0	542	166
STEWART TOTALS	37	1209	138	212	854	490
E1	13	33	2	4	5	11
E2	6	221	6	171	85	98
E3	19	955	130	38	23	233
Outages of Entire Sub E	0	0	0	0	741	148
WILLCOX TOTALS	1798	2261	1730	369	1296	1491
F3	1264	504	826	36	23	531
F4	151	635	142	74	0	206
F7	346	1119	733	26	80	462
F8	8	3	28	233	3	55
Outages of Entire Sub F	0	0	0	0	1183	237
COCHISE TOTALS	607	76	223	582	703	438
H3	113	47	22	42	19	48
H4	495	29	201	541	685	390
Outages of Entire Sub H	0	0	0	0	0	0
KANSAS TOTALS	1998	855	5287	830	3833	2560
J3	137	146	759	372	682	419
J5	32	112	14	160	16	67
J7	1829	597	1978	297	1208	1182
Outages of Entire Sub J	0	0	2537	0	1928	893
WEBB TOTALS	585	913	3006	388	663	1311
M1	159	117	132	122	21	110
M3	42	94	4	50	37	45
M4	364	120	2761	69	260	715
M5	20	3	110	148	24	61
Outages of Entire Sub M	0	579	0	0	322	180
MCNEAL TOTALS	1169	336	2850	710	2811	1581
N1	1153	40	201	396	161	390
N2	16	298	982	314	1384	590
Outages of Entire Sub N	0	0	1698	0	1265	593
MESCAL TOTALS	963	4588	3395	5156	11092	5036
O1	177	2341	3034	1942	6620	2822
O2	304	2101	239	2111	2155	1352
O3	0	4	0	0	6	2
O4	482	144	108	1103	1636	674
Outages of Entire Sub O	0	0	0	0	676	135

SUBSTATION	1992	1993	1994	1995	1996	AVERAGE
SYSTEM TOTAL	32,497	34,594	49,726	38,969	56,011	42,359
BENSON TOTALS	2233	1646	993	2115	2251	1848
P5	1867	1318	116	2025	386	1142
P7	333	24	177	70	34	127
P8	34	304	700	21	999	411
Outages of Entire Sub P	0	0	0	0	833	167
ST DAVID TOTALS	14	195	53	581	334	235
Q3	0	4	4	34	59	20
Q5	14	8	49	1	4	15
Q7	0	0	0	0	0	0
Outages of Entire Sub Q	0	183	0	547	271	200
RAMSEY TOTALS	4366	5145	2775	886	1516	2937
R1	430	833	1348	288	381	656
R2	3730	2424	521	342	133	1430
R3	206	1888	906	256	1001	851
Outages of Entire Sub R	0	0	0	0	0	0
TOMBSTONE TOTALS	30	15	646	419	944	411
S3	27	15	646	16	942	329
S7	3	0	0	1	2	1
Outages of Entire Sub S	0	0	0	402	0	80
KEATING TOTALS	2935	2981	4565	7872	1920	4054
T1	2519	336	536	1772	178	1068
T2	77	1495	1274	553	423	764
T3	80	697	218	219	438	330
T4	260	453	2539	480	882	923
Outages of Entire Sub T	0	0	0	4848	0	970
SIERRA VISTA TOTALS	2504	1045	2154	591	1120	1483
U3	11	10	300	62	7	78
U5	80	2	318	305	643	269
U6	1763	1026	1186	119	329	884
U7	651	8	351	107	141	251
Outages of Entire Sub U	0	0	0	0	0	0
HUACHUCA WEST TOTALS	5392	5841	4563	8804	8166	6553
V7	5392	5841	2313	2804	2214	3713
Outages of Entire Sub V	0	0	2250	6000	5952	2840
HUACHUCA EAST TOTALS	594	1017	282	4519	4230	2128
W3	138	522	160	185	2508	702
W5	457	495	122	855	264	438
Outages of Entire Sub W	0	0	0	3480	1458	988
HAWES TOTALS	3494	2907	7632	2543	3443	4004
X1	14	6	8	109	3	28
X5	1800	377	2669	827	1237	1392
X7	0	2277	2048	430	766	1104
X8	1680	247	728	1178	1438	1054
Outages of Entire Sub X	0	0	2179	0	0	436
BELLA VISTA TOTALS	2328	2601	8382	1944	9696	4990
Y1	1316	521	0	21	0	373
Y2	540	1005	104	198	1	370
Y3	207	252	1518	1575	3256	1362
Y4	266	824	505	151	704	490
Outages of Entire Sub Y	0	0	6255	0	5727	2396

15% OF CUST. OUTA HAS CAUSED BY V7

TOTAL NUMBER OF CONSUMER OUTAGE HOURS PER CONSUMER 1992 - 1996

SUBSTATION	1992	1993	1994	1995	1996	Sub/Fdr Average	Comparison to System
SYSTEM TOTAL	1.083	1.119	1.540	1.145	1.549	1.287	1.287
SAN SIMON TOTALS	2.730	2.029	1.349	0.644	1.261	1.604	0.016
A1	0.000	0.000	1.077	0.000	0.000	0.215	
A3	1.767	3.782	1.077	1.350	2.212	1.937	
A5	3.348	0.213	1.484	0.351	0.868	1.253	
Outages of Entire Sub A	0.000	0.911	0.000	0.000	0.000	0.182	
ROWE TOTALS	0.769	0.787	0.434	0.437	0.134	0.512	0.004
B3	4.472	3.414	0.900	0.862	0.355	2.000	
B5	0.000	0.556	0.580	2.481	0.167	0.757	
B7	0.135	0.281	0.325	0.140	0.075	0.191	
Outages of Entire Sub B	0.000	0.000	0.000	0.000	0.000	0.000	
MORTENSON TOTALS	1.611	0.232	2.166	0.325	2.219	1.311	0.009
D1	0.056	0.803	3.892	0.034	0.103	0.978	
D5	2.050	0.003	0.029	0.486	0.249	0.509	
D7	2.324	0.132	0.201	0.020	0.065	0.548	
Outages of Entire Sub D	0.000	0.000	1.405	0.000	2.030	0.687	
STEWART TOTALS	0.070	2.210	0.236	0.330	1.171	0.806	0.015
E1	0.781	1.711	0.091	0.190	0.185	0.592	
E2	0.073	2.030	0.047	1.184	0.496	0.766	
E3	0.045	2.290	0.299	0.079	0.042	0.551	
Outages of Entire Sub E	0.000	0.000	0.000	0.000	1.016	0.203	
WILLCOX TOTALS	0.029	1.016	0.786	0.165	0.551	0.669	0.047
F3	1.762	0.773	1.341	0.072	0.030	0.836	
F4	0.097	3.432	1.329	0.892	0.000	1.330	
F7	0.654	2.046	1.331	0.045	0.145	0.844	
F8	0.010	0.003	0.030	0.214	0.003	0.052	
Outages of Entire Sub F	0.000	0.000	0.000	0.000	0.503	0.101	
COCHISE TOTALS	0.541	0.066	0.180	0.463	0.515	0.355	0.013
H3	0.504	0.208	0.094	0.167	0.047	0.208	
H4	0.550	0.031	0.211	0.536	0.630	0.392	
Outages of Entire Sub H	0.000	0.000	0.000	0.000	0.000	0.000	
KANSAS TOTALS	2.509	1.030	5.571	0.809	3.262	2.636	0.078
J3	0.636	0.630	2.455	1.964	1.685	1.504	
J5	0.435	1.403	0.176	1.905	0.165	0.823	
J7	2.593	1.313	3.538	0.502	1.789	2.107	
Outages of Entire Sub J	0.000	0.000	2.673	0.000	1.640	0.863	
WEBB TOTALS	0.956	1.467	4.646	0.577	0.871	1.704	0.034
M1	1.336	1.026	1.069	0.984	0.133	0.910	
M3	0.553	1.154	0.040	0.509	0.394	0.547	
M4	0.785	0.317	7.025	0.162	0.556	1.809	
M5	0.426	0.060	2.330	3.524	0.522	1.273	
Outages of Entire Sub M	0.000	0.931	0.000	0.000	0.422	0.271	
MONTAL TOTALS	1.948	0.547	4.479	1.023	3.655	2.337	0.045
N1	4.845	0.165	0.765	1.394	0.506	1.536	
N2	0.043	0.795	2.563	0.778	3.062	1.448	
Outages of Entire Sub N	0.000	0.000	2.640	0.000	1.646	0.857	
MESCAL TOTALS	0.457	2.104	1.475	2.073	4.113	2.045	0.149
O1	0.249	3.123	3.773	2.074	6.287	3.101	
O2	1.101	7.956	0.624	6.536	5.686	4.437	
O3	0.000	0.875	0.000	0.000	1.150	0.405	
O4	0.426	0.123	0.090	0.902	1.297	0.568	
Outages of Entire Sub O	0.000	0.000	0.000	0.000	0.251	0.050	

SUBSTATION	1992	1993	1994	1995	1996	Sub/Fdr Average	Comparison to System
SYSTEM TOTAL	1.083	1.119	1.540	1.145	1.549	1.287	1.287
BENSON TOTALS	1.395	1.010	0.593	1.186	1.176	1.072	0.057
P5	2.547	1.755	0.151	2.512	0.450	1.483	
P7	1.403	0.099	0.712	0.253	0.111	0.516	
P8	0.053	0.477	1.064	0.030	1.330	0.591	
Outages of Entire Sub P	0.000	0.000	0.000	0.000	0.435	0.087	
ST DAVID TOTALS	0.056	0.763	0.191	1.849	0.945	0.761	0.007
Q3	0.000	0.042	0.045	0.332	0.534	0.191	
Q5	0.084	0.047	0.261	0.002	0.015	0.002	
Q7	0.000	0.000	0.000	0.000	0.000	0.000	
Outages of Entire Sub Q	0.000	0.718	0.000	1.740	0.768	0.645	
RAMSEY TOTALS	1.414	1.701	0.988	0.259	0.400	0.952	0.093
R1	1.100	1.842	2.982	0.563	0.785	1.438	
R2	2.603	1.796	0.451	0.252	0.091	1.038	
R3	0.163	1.542	0.754	0.164	0.562	0.637	
Outages of Entire Sub R	0.000	0.000	0.000	0.000	0.000	0.000	
TOMBSTONE TOTALS	0.154	0.073	3.102	1.903	3.900	1.843	0.012
S3	0.151	0.080	0.455	0.079	4.383	1.429	
S7	0.188	0.000	0.000	0.050	0.056	0.059	
Outages of Entire Sub S	0.000	0.000	0.000	1.827	0.000	0.365	
KEATING TOTALS	0.070	0.036	1.177	2.063	0.495	1.080	0.124
T1	1.939	0.271	0.420	1.510	0.152	0.858	
T2	0.064	1.396	1.318	0.476	0.331	0.717	
T3	0.150	1.279	0.398	0.338	0.756	0.594	
T4	0.771	0.634	2.331	0.524	1.041	1.061	
Outages of Entire Sub T	0.000	0.000	0.000	1.270	0.000	0.254	
SIERRA VISTA TOTALS	0.749	0.310	0.613	0.163	0.299	0.427	0.046
U3	0.018	0.019	0.429	0.130	0.014	0.162	
U5	0.102	0.002	0.319	0.284	0.564	0.254	
U6	1.318	0.768	0.843	0.002	0.221	0.647	
U7	1.036	0.012	0.550	0.169	0.221	0.398	
Outages of Entire Sub U	0.000	0.000	0.000	0.000	0.000	0.000	
HUACHUCA WEST TOTALS	3.827	4.042	3.058	5.482	4.642	4.210	0.199
V7	3.827	4.042	1.550	1.746	1.259	2.485	
Outages of Entire Sub V	0.000	0.000	1.508	3.736	3.383	1.725	
HUACHUCA EAST TOTALS	0.364	0.602	0.162	2.445	2.153	1.145	0.062
W3	0.226	0.819	0.245	0.255	3.127	0.934	
W5	0.446	0.470	0.112	0.760	0.227	0.403	
Outages of Entire Sub W	0.000	0.000	0.000	1.083	0.742	0.525	
HAWES TOTALS	0.971	0.740	1.600	0.510	0.675	0.903	0.120
X1	0.033	0.011	0.011	0.126	0.003	0.037	
X5	1.044	0.216	1.435	0.434	0.632	0.753	
X7	0.000	6.817	5.910	1.145	1.969	3.170	
X8	1.223	0.164	0.395	0.638	0.790	0.642	
Outages of Entire Sub X	0.000	0.000	0.457	0.000	0.000	0.000	
BELLA VISTA TOTALS	0.821	0.937	3.294	0.786	3.894	1.946	0.149
Y1	2.193	1.611	0.000	1.079	0.533	1.083	
Y2	0.609	1.128	0.115	0.220	0.001	0.414	
Y3	0.252	0.258	1.500	1.461	2.846	1.267	
Y4	0.501	1.406	0.849	0.315	1.554	0.925	
Outages of Entire Sub Y	0.000	0.000	2.458	0.000	2.300	0.952	

V7
HIGHEST
CUST OUT
HRS/CUST

THIS
1999
OUTAGE REPORT

substation and feeder. This information is analyzed, and is then used to recommend further system and design standards and improvements.

Outages that result in service interruptions to more than 100 consumers, or more than 100 consumer hours are reported to SSVEC's Board of Directors and are included in the monthly board report. Additional outage information such as a year-to-date summary, and a historical interruption summary for that particular month are also included in the monthly board report. The end of the year board report contains outages that result in service interruptions to more than 1000 consumers, or more than 1000 consumer hours, interruption totals on a monthly basis for that year, and a historical annual interruption summary for the past 10 years. This information is presented so that management and the Board of Directors can track SSVEC's progress in reducing service interruptions, and their impacts on SSVEC's customers.

Outage Statistics and Analysis

The data collected in the field and processed by the Engineering Department has been tabulated, reviewed and analyzed through 1999.

Number of Interruptions

The following table labeled "Total Number of Interruptions 1995-1999" shows the total number of outages for the overall system, each substation, and each feeder for the last five years, as well as an average for the five year period which is represented by the associated chart labeled "Average of Total Interruptions per Substation". The highest number of interruptions by feeder occurred on the Huachuca West V-7.

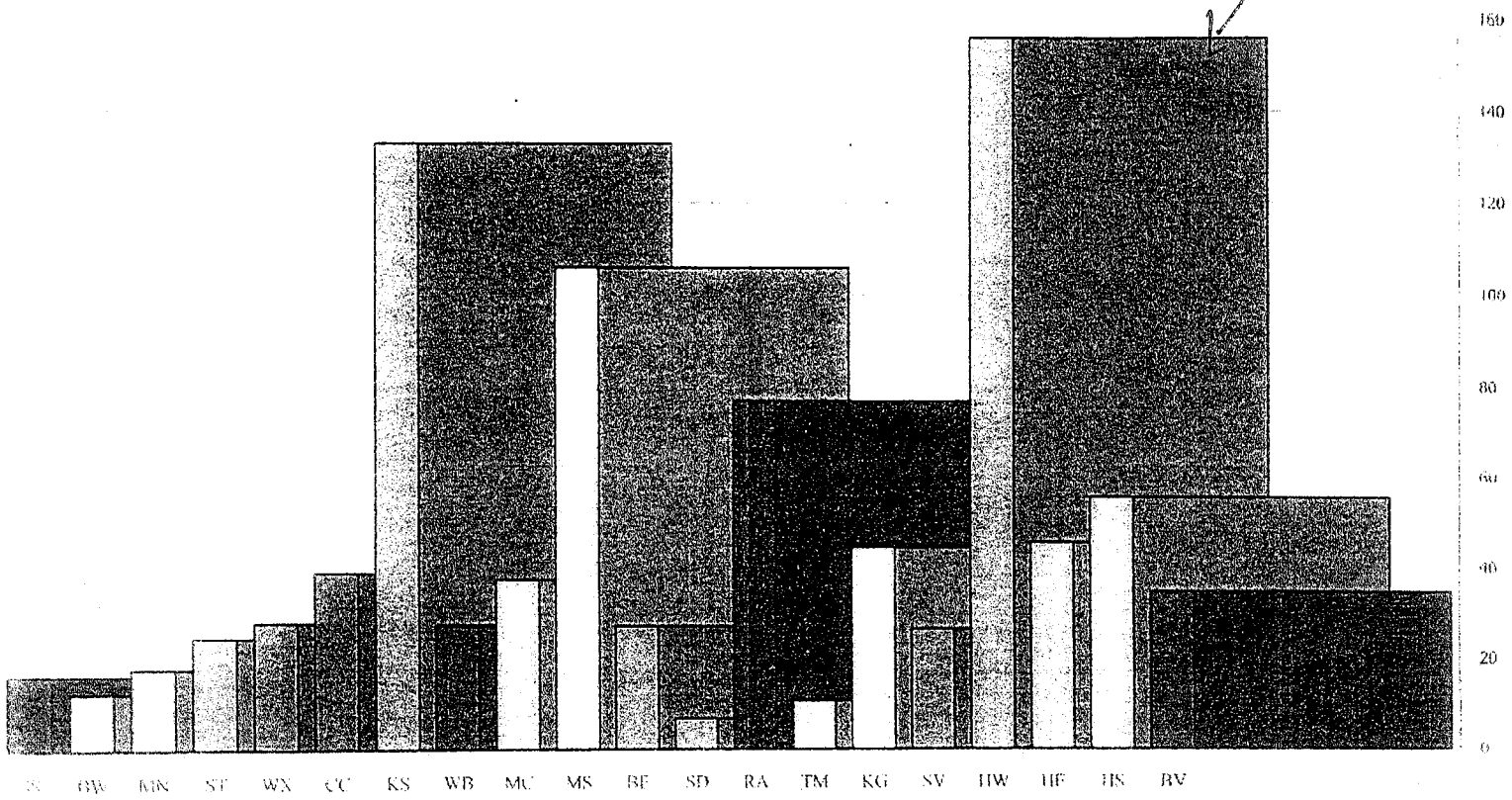
TOTAL NUMBER OF INTERRUPTIONS 1995 -1999

SUBSTATION	1995	1996	1997	1998	1999	Average
SYSTEM TOTAL	1,023	1,024	917	845	835	929
SAN SIMON TOTALS	22	14	17	12	16	14
A1	0	0	1	1	1	1
A3	14	8	7	5	11	9
A5	8	6	9	6	3	6
Outages at Entire Sub A	0	0	0	0	1	0
BOWIE TOTALS	17	14	9	8	12	12
B3	6	7	5	2	3	5
B5	2	2	2	2	1	2
B7	9	7	2	4	7	6
Outages at Entire Sub B	0	0	0	0	1	0
MORTENSON TOTALS	15	21	18	14	20	18
D1	1	3	2	4	1	2
D5	13	12	10	7	12	11
D7	1	3	3	3	6	3
Outages at Entire Sub D	0	3	3	0	1	1
STEWART TOTALS	24	34	32	12	20	24
E1	2	2	1	2	0	1
E2	11	14	9	1	4	8
E3	11	17	22	9	15	15
Outages at Entire Sub E	0	1	0	0	1	0
WILCOX TOTALS	21	25	24	35	34	28
F3	7	11	3	11	8	8
F4	2	0	2	4	1	2
F7	8	12	15	15	12	12
F8	4	1	4	5	12	5
Outages at Entire Sub F	0	1	0	0	1	0
COCHISE TOTALS	41	40	46	43	24	39
H3	9	9	18	15	9	12
H4	32	31	28	28	15	27
Outages at Entire Sub H	0	0	0	0	1	0
KANSAS TOTALS	149	127	154	126	108	133
J3	63	57	62	45	37	54
J5	11	11	17	7	11	11
J7	75	57	75	54	64	65
Outages at Entire Sub J	0	2	0	0	1	1
WEBB TOTALS	34	29	19	30	25	27
M1	14	11	3	16	8	10
M3	5	4	3	1	6	4
M4	12	11	10	12	8	11
M5	3	2	3	1	2	2
Outages at Entire Sub M	0	1	0	0	1	0
MCNEAL TOTALS	35	59	29	34	29	37
N1	18	24	20	14	12	18
N2	17	34	9	19	16	19
Outages at Entire Sub N	0	1	0	0	1	0
HESCAL TOTALS	109	110	91	96	127	106
O1	40	57	55	50	78	54
O2	54	44	27	33	37	39
O3	0	2	0	0	0	0
O4	15	4	9	13	6	9
Outages at Entire Sub O	0	1	0	0	1	0
no transmission outage	0	3	8	2	1	3

SUBSTATION	1995	1996	1997	1998	1999	Average
SYSTEM TOTAL	1,023	1,024	917	845	835	929
BENSON TOTALS	34	30	24	31	28	27
P5	14	11	14	18	12	14
P7	8	4	2	3	4	5
P8	10	14	8	10	9	10
Outages at Entire Sub P	0	1	0	0	1	0
ST DAVID TOTALS	5	8	4	7	10	7
Q3	2	5	3	2	4	4
Q5	1	2	1	4	1	2
Q7	0	0	0	1	1	0
Outages at Entire Sub Q	2	1	0	0	2	1
RAMSEY TOTALS	44	95	80	47	76	77
R1	8	15	19	13	7	12
R2	16	18	17	12	14	14
R3	40	42	44	40	54	48
Outages at Entire Sub R	0	0	0	2	1	1
TOMBSTONE TOTALS	9	13	14	7	11	11
S3	7	12	12	6	5	8
S7	1	1	2	1	5	2
Outages at Entire Sub S	1	0	0	0	1	0
KEARNY TOTALS	52	41	35	45	48	44
T1	14	6	9	4	4	7
T2	21	17	8	15	23	17
T3	6	7	7	6	9	7
T4	10	11	11	20	11	13
Outages at Entire Sub T	1	0	0	0	1	0
SIERRA VISTA TOTALS	34	31	19	30	14	26
U3	3	3	0	4	4	3
U5	7	10	6	8	4	7
U6	13	14	6	9	3	9
U7	11	4	7	6	4	6
Outages at Entire Sub U	0	0	0	3	1	1
HUACHUCA WEST TOTAL	184	160	157	150	130	156
V7	182	158	157	150	129	155
Outages at Entire Sub V	2	2	0	0	1	1
HUACHUCA EAST TOTALS	46	54	42	34	49	45
W3	20	29	24	22	20	23
W5	25	24	18	14	28	22
Outages at Entire Sub W	1	1	0	0	1	1
HAWES TOTALS	74	68	55	40	39	54
X1	5	1	2	1	3	2
X3	40	33	33	22	18	29
X7	7	20	8	11	9	11
X8	24	14	12	6	7	13
Outages at Entire Sub X	0	0	0	0	2	0
BELLA VISTA TOTALS	48	44	40	22	17	35
Y1	7	1	5	0	1	2
Y2	8	2	10	3	3	5
Y3	32	31	21	14	9	21
Y4	6	8	4	5	3	5
Outages at Entire Sub Y	0	4	0	0	1	1

V7

AVERAGE OF TOTAL INTERRUPTIONS PER SUBSTATION 1995 - 1999

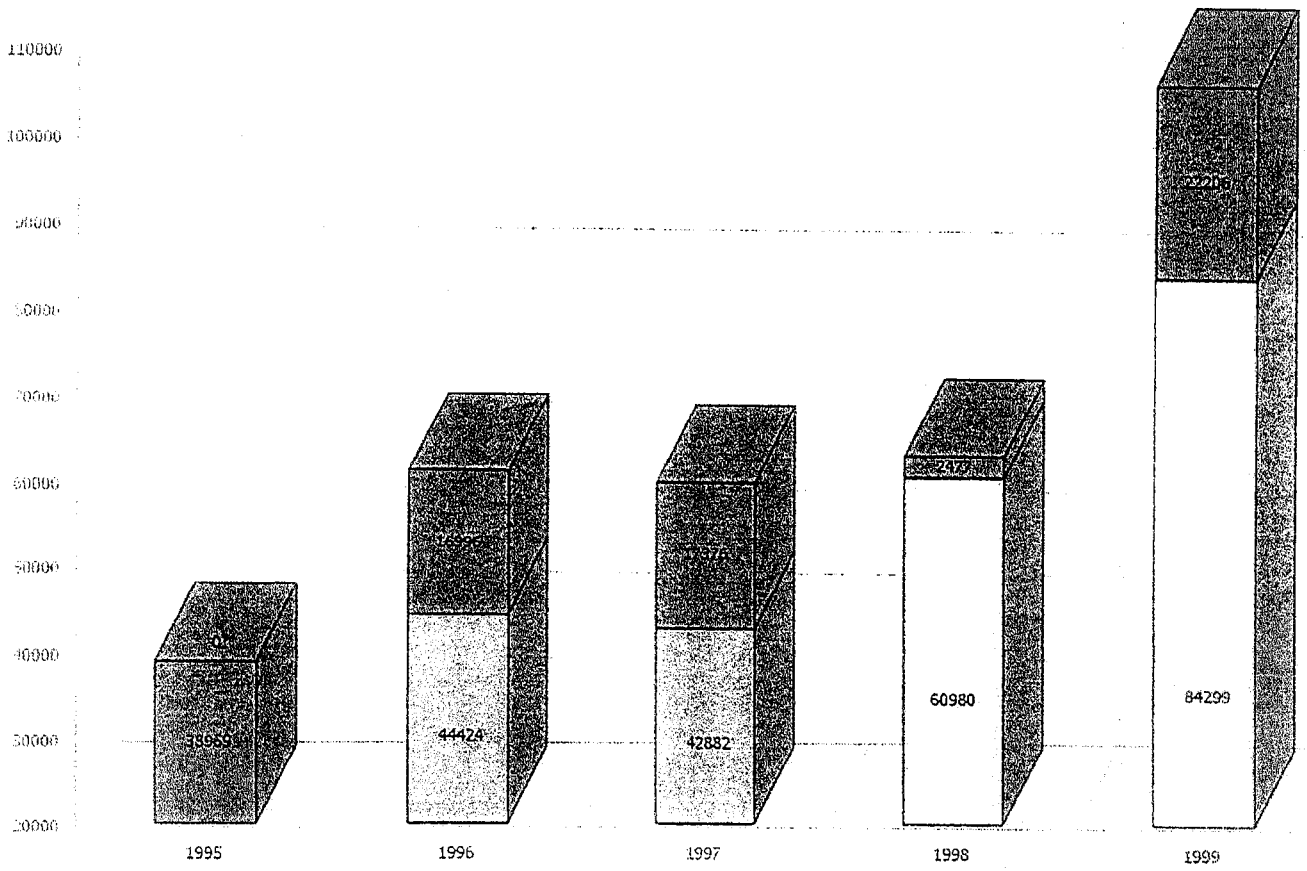


TOTAL NUMBER OF CONSUMER OUTAGE HOURS 1995 - 1999

SUBSTATION	1995	1996	1997	1998	1999	AVERAGE
SYSTEM TOTAL	38969	61,420	60,258	63,457	106,505	66,122
SAN SIMON TOTALS	217	494	417	31	380	308
A1	0	0	40	3	1	9
A3	139	277	297	10	23	149
A5	78	218	81	18	6	80
Outages of Entire Sub A	0	0	0	0	350	70
BOWIE TOTALS	162	137	111	158	779	269
B3	58	100	16	37	75	57
B5	67	6	14	65	2	31
B7	39	31	81	56	326	107
Outages of Entire Sub B	0	0	0	0	377	75
MORTENSON TOTALS	72	797	1561	197	1177	760
D1	1	3	18	170	2	39
D5	70	44	15	10	792	186
D7	1	5	8	17	143	16
Outages of Entire Sub D	0	745	1521	0	240	501
STEWART TOTALS	212	860	509	79	3547	1049
E1	4	5	1	3	0	3
E2	171	86	437	38	12	149
E3	38	28	71	38	2921	619
Outages of Entire Sub E	0	741	0	0	654	279
WILLCOX TOTALS	369	1298	110	338	2420	907
F3	36	25	41	26	10	24
F4	74	0	4	28	1	21
F7	26	88	56	242	100	102
F8	233	3	9	43	245	107
Outages of Entire Sub F	0	1183	0	0	2065	650
COCHISE TOTALS	582	703	558	913	877	747
H3	42	19	91	656	421	246
H4	541	685	587	257	79	426
Outages of Entire Sub H	0	0	0	0	377	75
KANSAS TOTALS	830	3850	5995	1240	5037	3590
J3	372	687	230	1035	340	533
J5	160	18	26	8	287	100
J7	297	1218	5740	196	4213	2333
Outages of Entire Sub J	0	1928	0	0	1197	625
WEBB TOTALS	348	1037	130	1832	921	862
M1	122	21	6	386	56	118
M3	50	37	13	1	28	26
M4	69	634	93	1425	41	452
M5	148	24	19	20	8	44
Outages of Entire Sub M	0	322	0	0	788	222
MCNEAL TOTALS	710	2667	1011	1069	2071	1545
N1	396	165	715	1023	1193	696
N2	314	1437	296	46	104	439
Outages of Entire Sub N	0	1266	0	0	774	408
MESCAL TOTALS	5156	11135	3819	2106	3707	5384
O1	1942	8646	2159	495	2086	2666
O2	2111	2172	569	1392	857	1420
O3	0	6	0	0	0	1
O4	1103	1636	1091	219	13	812
Outages of Entire Sub O	0	676	0	0	751	285
Misc. Transmission outage	0	2318	17545	3977	2400	5248

SUBSTATION	1995	1996	1997	1998	1999	TOTAL
SYSTEM TOTAL	38,969	61,420	60,258	63,457	106,505	330,609
BENSON TOTALS	2115	2259	1258	1146	3837	2123
P5	2025	386	1052	1050	1559	1214
P7	70	34	2	7	364	95
P8	21	1006	204	89	1365	541
Outages of Entire Sub P	0	833	0	0	529	272
ST DAVID TOTALS	541	334	54	440	729	427
Q3	34	59	4	423	64	117
Q5	1	4	50	12	9	15
Q7	0	0	0	5	4	2
Outages of Entire Sub Q	547	271	0	0	652	294
RAMSEY TOTALS	866	1527	2239	11773	16770	6639
R1	286	383	1757	720	1123	854
R2	342	137	204	5554	162	1280
R3	256	1008	278	5500	10781	3565
Outages of Entire Sub R	0	0	0	0	4704	941
TOMBSTONE TOTALS	419	946	357	137	472	466
S3	16	944	229	136	221	309
S7	1	2	128	1	147	56
Outages of Entire Sub S	402	0	0	0	104	101
KEATING TOTALS	7672	2064	4461	3691	12032	6064
T1	1772	181	1381	2210	298	1168
T2	553	426	417	860	1708	793
T3	219	464	950	133	511	455
T4	440	994	1713	690	562	848
Outages of Entire Sub T	4648	0	0	0	8953	2760
SIERRA VISTA TOTALS	591	1157	766	5137	3201	2170
U3	62	39	0	60	118	55
U5	305	643	443	914	166	498
U6	119	329	75	99	18	128
U7	107	146	248	115	104	144
Outages of Entire Sub U	0	0	0	3950	2776	1346
HUACHUCA WEST TOTALS	8804	8257	4747	21265	17757	12166
V7	2804	2306	4747	21265	18929	9610
Outages of Entire Sub V	6000	5952	0	0	828	2558
HUACHUCA EAST TOTALS	4519	5978	6834	697	1003	3806
W3	165	4250	6051	83	144	2143
W5	856	270	782	615	118	528
Outages of Entire Sub W	3490	1458	0	0	741	1136
HAWES TOTALS	2543	3494	6436	3893	25027	8278
X1	109	3	4	6	3276	680
X5	827	1238	4718	2582	5157	2904
X7	430	816	282	605	622	551
X8	1178	1438	1433	700	8232	2596
Outages of Entire Sub X	0	0	0	0	7739	1548
BELLA VISTA TOTALS	1944	9912	1245	3140	1323	3512
Y1	21	8	83	0	30	28
Y2	198	191	209	152	11	152
Y3	1575	3282	551	2835	173	1683
Y4	151	704	402	153	83	298
Outages of Entire Sub Y	0	5727	0	0	1026	1351

SSVEC System Consumer Outage Hours 1995 - 1999



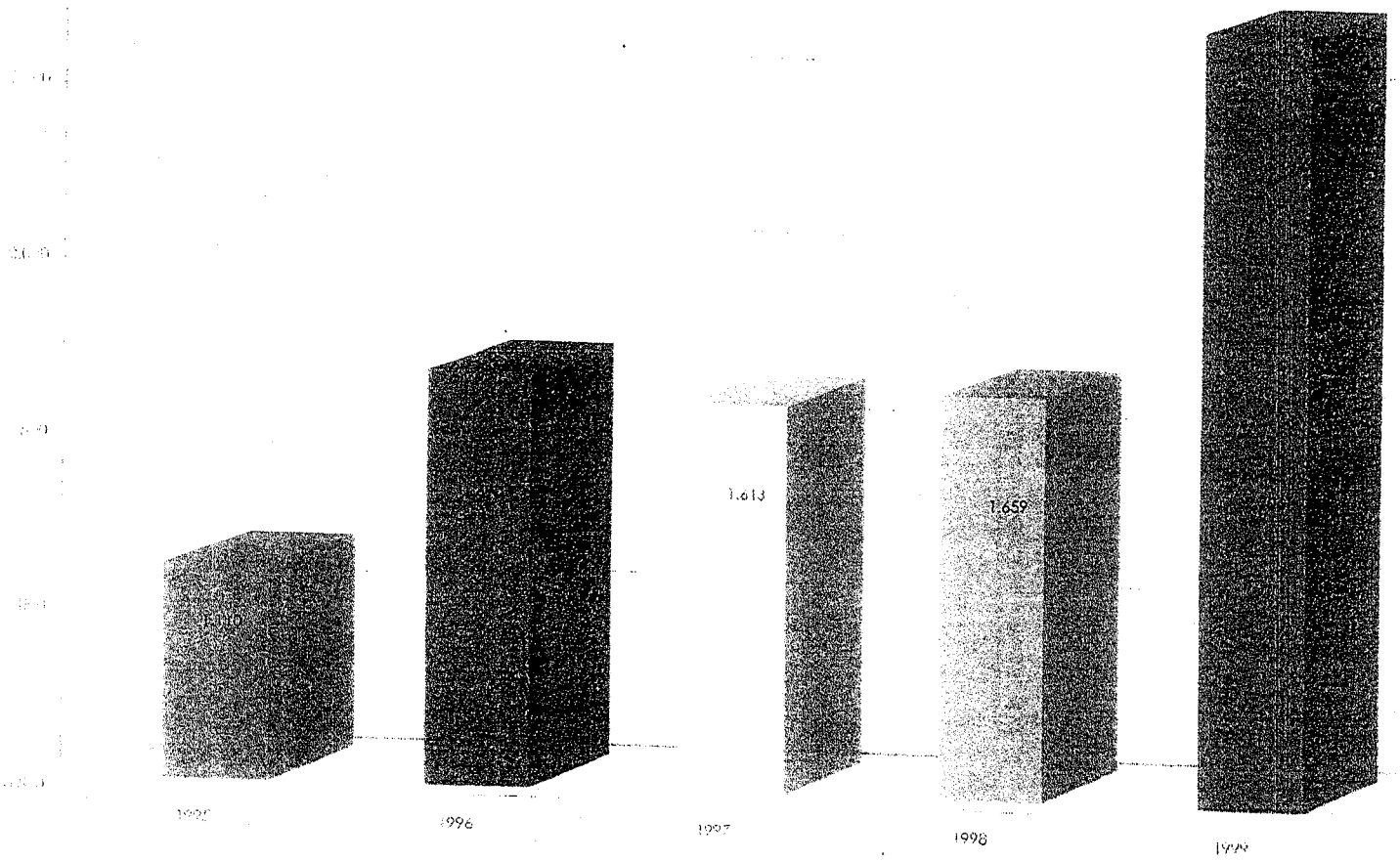
Note: Area in Green Indicates AEPCO Portion of Outages
Other Colors Indicate SSVEC Portion

TOTAL NUMBER OF CONSUMER OUTAGE HOURS PER CONSUMER 1995 - 1999

SUBSTATION	1995	1996	1997	1998	1999	Sub/Fdr Average	% Comparison to System
SYSTEM TOTAL	1.110	1.690	1.613	1.659	2.706	1.756	
SAN SIMON TOTALS	0.642	1.559	1.291	0.090	0.969	0.910	52%
A1	0.000	0.000	2.353	0.143	0.057	0.511	
A3	1.350	2.212	1.901	0.069	0.162	1.139	
A5	0.351	0.868	0.247	0.068	0.022	0.311	
Outages of Entire Sub A	0.000	0.000	0.000	0.000	0.810	0.162	
BOWIE TOTALS	0.438	0.327	0.215	0.346	1.708	0.607	35%
B3	0.862	1.316	0.174	0.440	0.887	0.736	
B5	2.481	0.167	0.264	1.757	0.042	0.942	
B7	0.140	0.100	0.217	0.167	0.970	0.319	
Outages of Entire Sub B	0.000	0.000	0.000	0.000	0.827	0.165	
MORTENSON TOTALS	0.324	2.995	3.931	0.676	3.961	2.377	135%
D1	0.034	0.103	0.321	5.862	0.069	1.278	
D5	0.486	0.249	0.058	0.052	3.880	0.945	
D7	0.020	0.081	0.083	0.250	2.234	0.534	
Outages of Entire Sub D	0.000	2.802	3.830	0.000	0.808	1.488	
STEWART TOTALS	0.330	1.180	0.547	0.099	4.506	1.333	76%
E1	0.190	0.185	0.014	0.097	0.000	0.097	
E2	1.184	0.500	1.986	0.197	0.042	0.786	
E3	0.079	0.053	0.105	0.067	5.107	1.062	
Outages of Entire Sub E	0.000	1.016	0.000	0.000	0.822	0.368	
WILLCOX TOTALS	0.165	0.552	0.041	0.135	0.956	0.370	21%
F3	0.072	0.033	0.046	0.031	0.011	0.039	
F4	0.892	0.000	0.035	0.301	0.011	0.248	
F7	0.045	0.145	0.059	0.374	0.147	0.154	
F8	0.214	0.003	0.012	0.046	0.262	0.107	
Outages of Entire Sub F	0.000	0.503	0.000	0.000	0.816	0.264	
COCHISE TOTALS	0.463	0.516	0.413	0.625	0.595	0.522	30%
H3	0.147	0.067	0.273	2.186	1.403	0.819	
H4	0.536	0.630	0.450	0.221	0.067	0.381	
Outages of Entire Sub H	0.000	0.000	0.000	0.000	0.256	0.051	
KANSAS TOTALS	0.808	3.279	4.172	0.963	4.665	2.778	158%
J3	1.064	1.696	0.460	2.265	0.742	1.245	
J5	1.905	0.191	0.201	0.090	2.786	1.035	
J7	0.502	1.804	7.095	0.268	5.748	3.083	
Outages of Entire Sub J	0.000	1.642	0.000	0.000	0.925	0.513	
WEBB TOTALS	0.577	1.363	0.143	2.165	1.081	1.066	61%
M1	0.984	0.133	0.029	2.195	0.318	0.732	
M3	0.589	0.394	0.112	0.007	0.259	0.272	
M4	0.162	1.358	0.167	2.777	0.079	0.909	
M5	0.524	0.522	0.365	0.408	0.160	0.996	
Outages of Entire Sub M	0.000	0.422	0.000	0.000	0.925	0.269	
MCNEAL TOTALS	1.033	3.728	1.094	1.284	2.480	1.924	110%
N1	1.394	0.519	1.815	2.921	3.399	2.010	
N2	0.778	3.178	0.558	0.095	0.215	0.965	
Outages of Entire Sub N	0.000	1.646	0.000	0.000	0.927	0.515	
MESCAL TOTALS	2.073	4.127	1.240	0.724	1.268	1.886	107%
O1	2.074	6.311	1.723	0.433	1.603	2.469	
O2	6.536	5.730	1.253	3.291	2.021	3.766	
O3	0.000	1.150	0.000	0.000	0.000	0.230	
O4	0.902	1.297	0.799	0.164	0.010	0.634	
Outages of Entire Sub O	0.000	0.251	0.000	0.000	0.257	0.101	

SUBSTATION	1995	1996	1997	1998	1999	Sub/Fdr Average	Comparison to System
SYSTEM TOTAL	1.145	1.699	1.509	1.675	2.735	1.753	129%
BENSON TOTALS	1.186	1.180	0.582	0.560	1.863	1.074	61%
P5	2.512	0.450	1.091	1.154	1.709	1.383	
P7	0.253	0.111	0.005	0.022	1.064	0.291	
P8	0.030	1.340	0.240	0.111	1.718	0.688	
Outages of Entire Sub P	0.000	0.435	0.000	0.000	0.257	0.138	
ST DAVID TOTALS	1.849	0.945	0.130	1.142	1.889	1.191	68%
Q3	0.332	0.534	0.024	3.467	0.523	0.976	
Q5	0.002	0.015	0.187	0.046	0.035	0.057	
Q7	0.000	0.000	0.000	4.500	4.000	1.700	
Outages of Entire Sub Q	1.740	0.768	0.000	0.000	1.689	0.839	
RAMSEY TOTALS	0.259	0.403	0.542	0.667	4.141	1.802	103%
R1	0.563	0.705	0.105	1.251	1.949	1.514	
R2	0.252	0.094	0.132	3.592	0.104	0.835	
R3	0.164	0.566	0.138	5.046	5.633	2.309	
Outages of Entire Sub R	0.000	0.000	0.000	0.000	1.161	0.232	
TOMBSTONE TOTALS	1.903	3.908	1.584	0.519	1.781	1.939	111%
S3	0.079	4.392	1.205	0.586	0.948	1.442	
S7	0.050	0.056	3.643	0.031	4.594	1.675	
Outages of Entire Sub S	1.827	0.000	0.000	0.000	0.392	0.444	
KEATING TOTALS	2.063	0.533	1.056	0.931	2.865	1.489	85%
T1	1.510	0.154	0.944	1.663	0.222	0.899	
T2	0.476	0.333	0.436	0.875	1.736	0.771	
T3	0.388	0.801	1.550	0.212	0.814	0.753	
T4	0.524	1.174	1.437	0.555	0.451	0.828	
Outages of Entire Sub T	1.270	0.000	0.000	0.000	2.132	0.680	
SIERRA VISTA TOTALS	0.163	0.309	0.210	1.299	0.804	0.557	32%
U3	0.130	0.081	0.000	0.118	0.224	0.111	
U5	0.284	0.564	0.386	0.763	0.153	0.430	
U6	0.082	0.221	0.055	0.063	0.011	0.086	
U7	0.169	0.229	0.384	0.171	0.154	0.221	
Outages of Entire Sub U	0.000	0.000	0.000	0.999	0.697	0.339	
HUACHUCA WEST TOTALS	5.482	4.694	2.406	11.263	9.380	6.645	379%
V2	1.746	1.311	2.406	11.263	8.943	5.134	
Outages of Entire Sub V	3.736	3.383	0.000	0.000	0.437	1.511	
HUACHUCA EAST TOTALS	2.445	3.042	3.204	0.330	0.472	1.899	108%
W3	0.255	5.300	6.739	0.097	0.148	2.512	
W5	0.768	0.232	0.633	0.469	0.093	0.442	
Outages of Entire Sub W	1.883	0.742	0.000	0.000	0.349	0.595	
HAWES TOTALS	0.510	0.685	1.177	0.717	4.503	1.554	88%
X1	0.126	0.003	0.003	0.006	0.223	0.472	
X5	0.434	0.633	2.295	1.243	2.464	1.414	
X7	1.145	2.097	0.713	1.483	1.490	1.386	
X8	0.638	0.790	0.738	0.363	4.256	1.357	
Outages of Entire Sub X	0.000	0.000	0.000	0.000	1.417	0.283	
BELLA VISTA TOTALS	0.786	3.981	0.480	1.201	0.503	1.390	79%
Y1	1.079	0.533	5.533	0.000	1.765	1.782	
Y2	0.220	0.215	0.229	0.164	0.011	0.168	
Y3	1.461	2.889	0.461	2.374	0.145	1.466	
Y4	0.315	1.554	0.855	0.320	0.173	0.443	
Outages of Entire Sub Y	0.000	2.300	0.000	0.000	0.390	0.538	

SSVEC Consumer Hours Per Consumer
1995 - 1999



Huachuca West

This substation has the highest outage rate when measured in consumer hours per consumer, number of outages, or customer hours interrupted. The distribution of outage causes is shown in the previous mentioned chart labeled "Huachuca West Substation Outages by Reason".

Huachuca West is a single feeder substation. The feeder has more than 1800 customers, 247+ connected miles, and traverses remote areas. Outages are long because of the time required to access and patrol this line. Outages tend to affect large numbers of customers because of the large line lengths that can be affected by any one outage. Voltage is also challenging to maintain on this line.

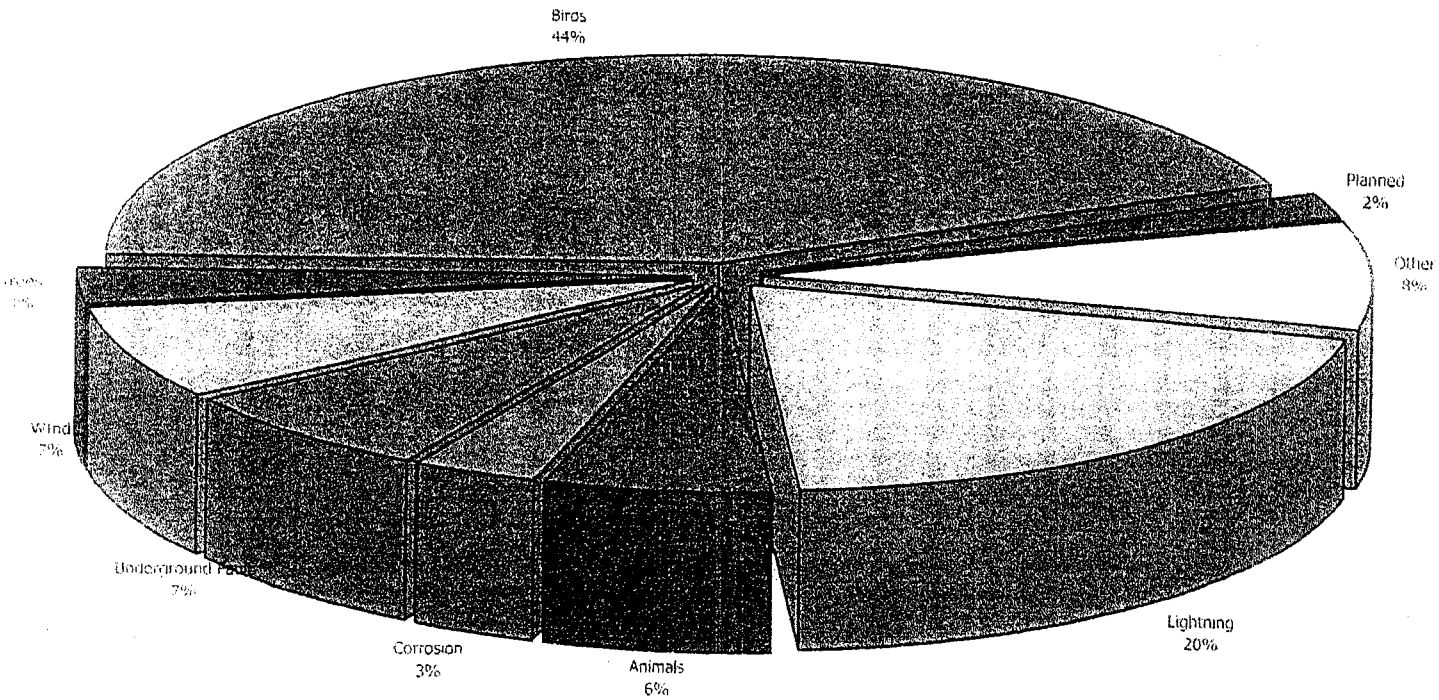
In accordance with the Long-Range Plan a new substation is planned for this area after the year 2000. The new substation will dramatically improve reliability, by splitting the existing V-7 feeder into three feeders which will improve sectionalizing. Until the new substation is justified and developed, the best opportunity for improving the reliability of this feeder is to reduce the number of bird outages, reduce lightning outages, and try to develop more information about the large number of "Unknown" causes at this location. Reclosers at the substation and on line downstream have data recorders that can be used to record fault currents, which may be useful in estimating the location of problems. In summary, the following is proposed for improvement prior to the new substation;

- Use data recorders on substation and line reclosers to identify problem areas
- Reduce bird outages with continued use of insulated bushing covers and raptor perches
- Review SSVEC standards for proper lightning protection installation.
- Investigate advancements in lightning protection technology and review for use on system in problem areas.
- Work with the Line Department to try and reduce the number of "Unknown" outage causes

Summary

The Cooperative has taken pride in the fact that our overall system outage rate is quite below the standards set by RUS, it reveals that our line maintenance schedules are satisfactory, our sectionalizing schemes are successful, and our constant commitment is to our customers.

Huachuca West Substation Outages by Reason 1995 - 1999



INTERRUPTION REPORT

Sulphur Springs Valley Electric Cooperative, Inc.

Date:	Reported By:		Hours off	# of Consumers	Consumer Hours
Time Off:	Time On:	Time Reported:			

Location of Area Affected - Name of Subdivision:

Pole No. SSVEC Location No:

Did Sectionalizing Work Property?
☐ Yes ☐ No (explain)

Corrective Action Taken

Secondary Voltage (if measured) Completed By:

☐ Secondary ☐ Primary ☐ Transmission

☐ Overhead ☐ Underground

Round Trip Mileage
(if consumer equip. or accident)

USE 24 HOUR TIME SYSTEM

☑ *Operating Component or Component Failure*	☑ *Reason*	☑ *Substation / Feeder*	
☐ *Normal Operation* ☐ *Component Failure*	☐ *Known Reason* ☐ *Probable Reason*		
☐ A - Line Open	☐ 1 - Planned	☐ SS - San Simon A	☐ FT - Fort Huachuca
☐ B - ACR/OCB Open	☐ 2 - Lightning	☐ BW - Bowie B	☐ TJ - Tombstone J
☐ C - Broken or Leaning Pole	☐ 3 - Wind	☐ MN - Mortenson D	☐ TL - San Rafeal
☐ D - Broken Cross Arm/Brace	☐ 4 - Loose Connections	☐ ST - Stewart E	☐ TK - Kartchner
☐ E - Broken/Burned Jumper	☐ 5 - Low Voltage	☐ WX - Willcox F	☐ TR - Redtail
☐ F - Insulator or Tie	☐ 6 - High Voltage	☐ CC - Cochise H	☐ TS - Stewart 69
☐ G - Burned Meter or Equipment	☐ 7 - Birds	☐ KS - Kansas J	☐ -
☐ H - Burned Transformer	☐ 8 - Animals	☐ CI - Chiricahua K	☐ TZ - System TTL
☐ I - Fuse Out Transformer	☐ 9 - Accidents	☐ WB - Webb M	☐ -
☐ J - Consumer Equipment	☐ 10 - Overload	☐ MC - McNeal N	☐ - Circuit as Labeled
☐ K - Guy/Anchor	☐ 11 - Vibration	☐ MS - Mescal O	☐ 1 -
☐ L - Elbow/Junction/Splice	☐ 12 - Tree	☐ BE - Benson P	☐ 2 -
☐ M - Jumper/Switch Opened	☐ 13 - Snow/Ice	☐ SD - St David Q	☐ 3 -
☐ N - Arrestor	☐ 14 - Vandalism	☐ RA - Ramsey R	☐ 4 -
☐ O - Cable Failure	☐ 15 - Corrosion	☐ TS - Tombstone S	☐ 5 -
☐ P - Riser/Terminator/Grip	☐ 16 - Dirt	☐ KG - Keating T	☐ 6 -
☐ Q - Pedestal	☐ 17 - Dirty Oil	☐ SV - Sierra Vista U	☐ 7 -
☐ R - Oil Sectionalizer	☐ 18 - Underground Fault	☐ HW - Huachuca V	☐ 8 -
☐ S - Regulator	☐ 19 - Neutral Problem	☐ HE - Huachuca W	☐ 9 - Sub High
☐ T - Other (explain)	☐ 20 - Joint Use	☐ HS - Hawes X	☐ - Fuse or Switcher
☐ U - Dry Sectionalizer Open	☐ 21 - AEPCO/Source	☐ BV - Bella Vista Y	☐
☐ V - Line/Riser Fuse	☐ 22 - Other (explain)	☐ PU - Pueblo Z	☐
☐ W - Hardware Broken or Loose	☐ 23 - Unknown	☐ TA - Apache	☐

Avian Protection Units	
Unit	*Quantity*
VP3-1	
VP3-2	
VP4-1	
VP5-1	
VP6-1	
VP6-2	
VP7-1	
VP7-2	
VP8-1	
☐ Single Phase	
☐ Three Phase	

Species

Crow _____
Raven _____
Red Tail
Hawk _____
Dove _____
Blackbird _____
Woodpecker _____
Vulture _____
Other _____

Comments/Explanation

ACC Notification - Mandatory for outages that exceed 100 consumers and 1 hour.

Date:	ACC Person Contacted:	ACC Notification Completed By:

DISCRIPTION OF UNITS
VP3-1 PERCH GUARD
VP3-2 BIRD DETERRENT
VP4-1 INSULATOR & LINE COVER
VP5-1 ARRESTER COVER
VP6-1 BUSHING COVERS (LARGE)
VP6-2 BUSHING COVERS (SMALL)
VP7-1 PROTECTIVE TUBING .464"X8'
VP7-2 PROTECTIVE TUBING 1.084"X8'
VP8-1 SQUIRREL GUARD

***If bird protection installed, complete blanket work order.**

SSVEC

Growth Forecasts

WHAT IS THE V-7 GROWTH FORECASTS

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Patagonia CCD	**3,323**	**3,394**	**3,464**	**3,533**	**3,602**	**3,671**	**3,738**	**3,806**	**3,872**	**3,937**	**4,000**	**4,063**	**4,124**
Elgin CDP	441	458	475	492	509	525	542	558	574	590	605	621	636
Patagonia town	946	954	962	971	979	987	995	1,003	1,011	1,019	1,026	1,034	1,041
Sonoita CDP	1,084	1,117	1,151	1,184	1,217	1,249	1,281	1,314	1,345	1,376	1,406	1,436	1,465
Remainder of Patagonia CCD	853	864	876	887	898	909	920	931	942	952	963	973	983

Source: Arizona Department of Economic Security, Research Administration, Population Statistics Unit, 12/01/06.

Seago / DES Population Statistics approved June 6, 2007

Even without considering the present economic decline, the future growth is slow for the entire V-7 feeder area.

3SEG

When looking at the official Arizona population projections for each community in the V-7 feeder area, the existing 3325 total population last year is not expected to reach 4,000 persons until 2018. This is about 70-80 persons per year. These numbers include the "Remainder of the Patagonia CCD" which includes San Rafael Valley most of which is in the UNS Electric service area; thus these estimates are higher than the actual population.

Using the ratio used by SSVEC of 2.7 persons per household, then less than 30 homes per year are the anticipated growth for the whole area. No major industries now exist or plan to move into an area, that already has a serious shortage of water resources for its existing population.

Based on electric demand, installation of large numbers of single-home PV systems, larger 20-100 MW commercial PV systems, and two or three 1-3 MW renewable energy "plant" systems (with backup for sunless periods of time), there is NO URGENCY for the proposed 69 kV project. The numbers just are not there.

SSVEC Response

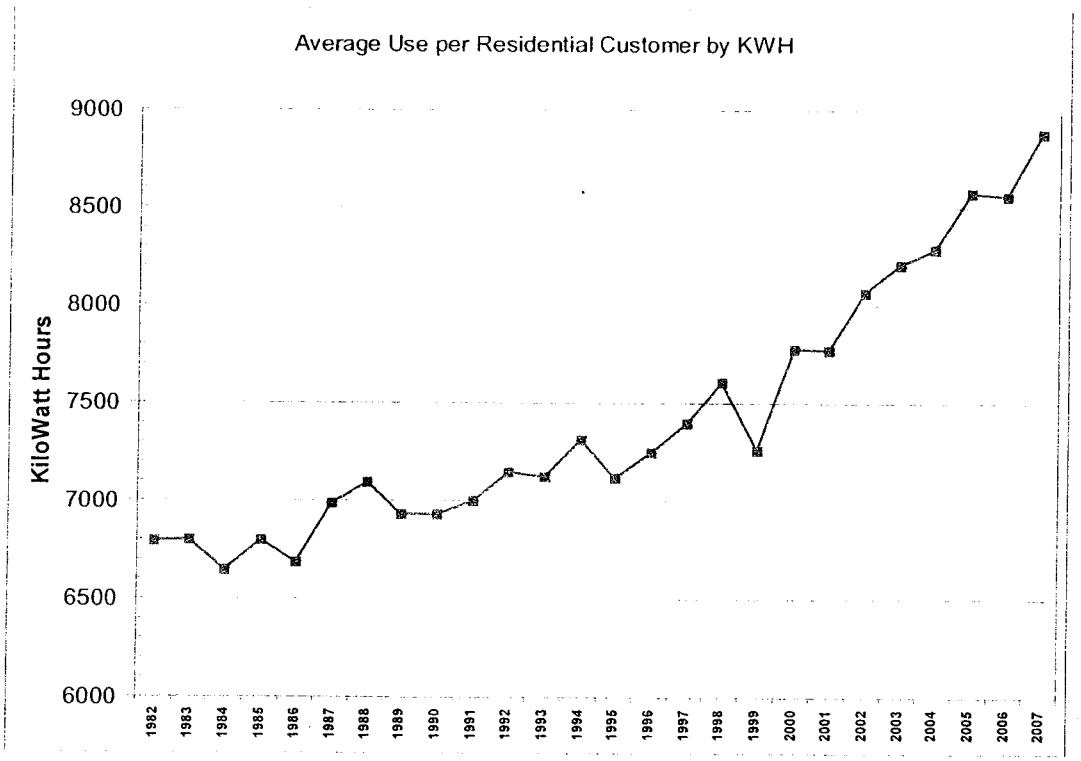
- **The growth forecast above shows an average annual percentage rate increase of approximately 1.82% for the entire Patagonia Census County Division, which does not seem significant; however this does equate to 801 people in the next twenty**

years. Using an average of 2.33 persons per household (City-Data) the following table indicates the number of homes the projected growth will likely incur:

TERM - YRS	PROJECTED POPULATION INCREASE	NUMBER OF HOMES
20	801	344
5	344	147
2	139	59

In SSVEC's analysis of the EXPRESS feeder option, the additional DEMAND LOAD upgrade would be 362kW, considering that each home uses 7KW per year, which will only allow for an additional 52 HOMES to be served. As the growth forecast above projects, this will be within the next TWO years!

Furthermore as the graph below indicates, the ACTUAL USE of electricity has also been on the rise. In 2007 the average USE per residential customer, considering a five-year period between 2003 and 2007, indicates an 8.26% increase, the same increase applied to the DEMAND LOAD would reduce the number of houses V7 is capable of serving to 47.



SSVEC

Visual Impact

VISUAL IMPACT

- ❑ Traffic Count
  - ADOT 2006-07 report shows

6 times more vehicles will see the new distribution express feeder along Hwy 82 than will see the 69kV line along Hwy 83.

SR 82 Mustang Heights Rd --> SR 90	3,000 cars per day
SR 83 Vaughn Loop Rd --> S. Elgin Rd.	510 cars per day

- ❑ **pole color study done**

- ❑ **fewer poles with 69kV**
  (202 poles @65-75' vs. 382 poles @45-50')

- ❑ **remote siting**
  (4.4 mi. along paved road with 69kV vs. 23.3 mi. with V7 route)

Ron Orozco

From: Daniel Wilson
Sent: Wednesday, July 22, 2009 12:48 PM
To: Ron Orozco
Cc: Becky Witte
Subject: Traffic counts

Attachments: traffic counts.pdf

traffic counts.pdf
(112 KB)

Ron

Here is the latest counts published by ADOT. The information you are looking for i[illegible] the top of page 10. Brief summary below using 2007 AADT (Average Annual Daily Traffi[illegible]

SR 82 Sonoita --> Mustang heights Road	2,200
SR 82 Mustang Heights Rd --> SR 90	3,000
SR 83 Vaughn Loop Rd --> S. Elgin Rd.	510
SR 83 S. Elgin Rd. --> Sonoita	1,400

I think it would be accurate to state that "the distribution route has a visual imp[illegible] on approximately twice the number of motorist as the proposed 69kV line"

Daniel

ATR = Automatic Traffic Recorder, BMP = Beginning Milepost, EMP = Ending Milepost, AADT = Average Annual Daily Traffic, POS_Dir = Positive Direction (North or East), NEG_Dir = Negative Direction (South or West), Last Year = Last year count was taken, B = Section reinstated, C = New Station, D = No longer part of State Hwy System, E = Closed for construction, N/A = Not available

See Data Dictionary on webpage for definitions of these factors.

Segment	ATR	Route	BMP	Place	EMP	Place	AADT	POS_Dir	NEG_Dir	Last Year	Factor	Factor	Factor
1244	NO	SR 82	5.63	South River Rd/Duquesne Rd.	12.15	Patagonia Lake Rd	2300	2300	N/A	N/A	2007	N/A	N/A	N/A
1245	NO	SR 83	12.15	Patagonia Lake Rd	19.47	3rd Ave	2300	2300	N/A	N/A	2007	11	55	11
1246	YES	SR 83	19.47	3rd Ave	32.36	SR 83 - Sonoita	2300	2300	1200	1200	2007	11	55	11
526	NO	SR 83	32.38	SR 83 - Sonoita	49.90	Mustang Heights Rd	2200	2200	1100	1100	2007	N/A	N/A	26
527	NO	SR 83	49.90	Mustang Heights Rd	51.60	SR 90	2800	3000	1500	1500	2007	N/A	N/A	26
528	NO	SR 83	51.60	SR 90	67.57	SR 80	930	860	460	430	2007	N/A	N/A	14
529	NO	SR 83	3.13	Parker Canyon Lake	20.20	Vaughn Loop Rd	90	100	N/A	N/A	2007	12	64	5
529	NO	SR 83	20.20	Vaughn Loop Rd	27.46	South Elgin Rd	500	510	N/A	N/A	2007	12	64	5
529	YES	SR 83	27.46	South Elgin Rd	31.63	SR 82 - Sonoita	1400	1400	700	700	2007	12	64	5
1244	NO	SR 83	31.63	SR 82	55.36	Sahuarita Rd	2400	2100	N/A	N/A	2007	12	64	5
1245	NO	SR 83	55.36	Sahuarita Rd	59.53	I-10 (Exit 281)	2000	3000	N/A	N/A	2007	12	64	5
930	NO	SR 84	155.16	I-8 (Exit 151)	160.87	SR 347 / Maricopa Rd	1300	1200	590	650	2007	N/A	N/A	15
531	NO	SR 84	160.87	SR 347 / Maricopa Rd	165.91	Stanfield Rd	3500	3500	N/A	N/A	2006	N/A	N/A	15
532	NO	SR 84	165.91	Stanfield Rd	175.94	Burris Rd - Casa Grande	4400	4300	N/A	N/A	2006	N/A	N/A	15
1246	NO	SR 84	175.94	Burris Rd - Casa Grande	176.95	Thornton Rd	9700	7600	3100	3100	2007	N/A	N/A	15
1247	NO	SR 84	176.95	Thornton Rd	177.95	SR 287 / SR 387	12200	10600	N/A	N/A	2007	N/A	N/A	15
530	NO	SR 84	195.36	SR 87 / County Control (MP 195.20)	196.08	I-10 (Exit 211)	2800	2800	N/A	N/A	2006	N/A	N/A	N/A
531	NO	SR 85 (1)	0.00	SB 3 (3) - Gila Bend	0.58	I-8 (Exit 116)	3100	2500	N/A	N/A	2007	14	69	9
532	NO	SR 85 (1)	0.58	I-8 (Exit 116)	3.17	Gila Bend Air Base Access Rd	2200	2300	N/A	N/A	2007	14	69	9
925	NO	SR 85 (1)	3.17	Gila Bend Air Base access Rd	38.11	Hayworth Rd	1900	1800	920	830	2007	14	69	9
1248	NO	SR 85 (1)	38.11	Hayworth Rd	40.59	Rasmussen Rd	6200	2600	N/A	N/A	2007	14	69	9
1249	NO	SR 85 (1)	40.59	Rasmussen Rd	42.30	La Mina Ave / Plaza St (SE)	5000	5500	3000	2500	2007	14	69	9
545	NO	SR 85 (1)	42.30	La Mina Ave / Plaza St (SE)	42.50	Ajo Well No. 1 Rd	2700	4700	2400	2300	2007	14	69	9
926	YES	SR 85 (1)	42.50	Ajo Well No. 1 Rd	53.06	SR 86 - Why	2600	2600	1300	1300	2007	14	69	9
546	NO	SR 85 (1)	53.06	SR 86 - Why	74.99	Puerto Blanco Dr / Organ Pipe Nat'l Monument	1500	1500	840	700	2007	N/A	N/A	11
927	NO	SR 85 (1)	74.99	Puerto Blanco Rd / Organ Pipe National Monument	80.69	International Border & POE - Lukeville	1500	1500	730	670	2007	N/A	N/A	11
1250	NO	SR 85 (2)	120.32	SB-3 (3) - Gila Bend	140.13	Landfill entrance Rd	11300	9700	5100	4500	2007	N/A	N/A	31
1251	NO	SR 85 (2)	140.13	Landfill entrance Rd	150.49	Buckeye Rd	10400	11600	5800	5700	2007	N/A	N/A	31
931	NO	SR 85 (2)	150.49	Buckeye Rd - Buckeye	154.48	I-10 (Exit 112)	16500	13000	N/A	N/A	2007	N/A	N/A	31
547	NO	SR 86	53.06	SR 85 - Why	92.31	BIA Rte 15 - Quijotoa	930	1000	N/A	N/A	2007	N/A	N/A	12
548	NO	SR 86	92.31	BIA Rte 15 - Quijotoa	114.06	Sells Rd South	2000	1800	930	920	2007	10	61	5
549	NO	SR 86	114.06	Sells Rd South	134.36	SR 386	2800	2700	N/A	N/A	2007	10	61	5
550	YES	SR 86	134.36	SR 386	150.43	SR 286 - Robles Jct	2900	2800	1400	1400	2007	10	61	5
931	NO	SR 86	150.43	SR 286 - Robles Junction	159.59	Valencia Rd	6300	8700	N/A	N/A	2007	N/A	N/A	10
932	NO	SR 86	159.59	Valencia Rd	163.41	San Joquin Rd	8400	7800	N/A	N/A	2007	N/A	N/A	10
551	NO	SR 86	163.41	San Joaquin Rd	166.28	Kinney Rd	17700	17200	N/A	N/A	2007	N/A	N/A	10
552	NO	SR 86	166.28	Kinney Rd	169.86	La Cholla Blvd	33400	33300	16800	16500	2007	N/A	N/A	10
553	NO	SR 86	169.86	La Cholla Blvd	170.35	Mission Rd	30900	30900	16300	14600	2007	N/A	N/A	10
554	NO	SR 86	170.35	Mission Rd	171.41	I-19 (Exit 99)	39100	39200	18700	20500	2007	N/A	N/A	10
1252	NO	SR 87	115.77	SR 84 - Picacho	117.90	Battaglia Dr	2200	2900	N/A	N/A	2007	9	54	6
1253	NO	SR 87	117.90	Battaglia Dr	125.92	SR 287	3700	5000	N/A	N/A	2007	9	54	6
537	NO	SR 87	125.92	SR 287	131.50	Martin Rd - Coolidge	6300	7100	3600	3500	2007	9	54	6
538	NO	SR 87	131.50	Martin Rd - Coolidge	132.51	Coolidge Ave	12800	7900	N/A	N/A	2007	9	54	6
539	NO	SR 87	132.51	Coolidge Ave	133.05	Central Ave	15000	16000	N/A	N/A	2007	9	54	6
1254	NO	SR 87	133.05	Central Ave	133.76	Florence Ave / Vah Ki Inn Rd	16200	14400	7400	7000	2007	9	54	6
1255	NO	SR 87	133.76	Florence Ave / Vah Ki Inn Rd	134.75	SR 287	15000	15000	N/A	N/A	2006	9	54	6
1256	NO	SR 87	134.75	SR 287	136.62	Skousen Rd	9900	9000	N/A	N/A	2006	9	54	6
1257	YES	SR 87	136.62	Skousen Rd	141.48	SR 387	9200	7600	3900	3800	2007	9	54	6
935	NO	SR 87	141.48	SR 387	145.43	SR 187	5500	5400	2700	2600	2007	9	54	6
936	NO	SR 87	145.43	SR 187	151.29	Sacaton Rd / BIA Rte 7	4700	6700	3400	3300	2007	9	54	6
562	NO	SR 87	151.29	BIA Rte 7 / Sacaton Rd	159.70	SR 587	6600	7600	N/A	N/A	2007	9	54	6
1258	NO	SR 87	159.70	SR 587	160.67	Riggs Rd	12600	11000	5500	5500	2007	9	54	0
1259	NO	SR 87	160.67	Riggs Rd	161.68	Chandler Heights Rd	16000	16000	N/A	N/A	2005	15	66	10
1260	NO	SR 87	161.68	Chandler Heights Rd	162.69	Ocotillo Rd	26000	28000	N/A	N/A	2005	15	66	10
1261	NO	SR 87	170.26	Western Canal	171.72	Baseline Rd	46000	46000	N/A	N/A	2005	15	66	10
1262	NO	SR 87	176.74	McKellips Rd	177.04	SR 202	30000	30000	N/A	N/A	2005	15	66	10
1263	NO	SR 87	177.04	SR 202	177.79	McDowell Rd	25600	23400	12800	12600	2007	15	66	10
939	NO	SR 87	177.79	McDowell Rd	179.00	N. Center St.	16700	16300	8900	9500	2007	15	66	10
1629	NO	SR 87	179.00	N. Center St.	179.80	N. Mesa Drive	B	22900	N/A	N/A	N/A	15	66	10
1630	NO	SR 87	179.80	N. Mesa Drive	182.10	N. Gilbert Rd.	B	26100	N/A	N/A	N/A	15	66	10
575	NO	SR 87	182.10	N. Gilbert Rd.	188.83	Shea Blvd	27500	27400	N/A	N/A	2006	15	66	10
576	NO	SR 87	188.83	Shea Blvd	190.84	Fort McDowell Rd	16500	17300	8700	8600	2007	15	66	10
576	NO	SR 87	190.84	Fort McDowell Rd	199.14	Saguaro Lake Rd / Bush Hwy (USFS Rte 206)	7600	8200	4400	3800	2007	15	66	10
577	NO	SR 87	199.14	Saguaro Lake Rd / Bush Hwy (USFS Rte 206)	217.92	Sunflower Rd	9100	8500	4600	3900	2007	15	66	10
578	NO	SR 87	217.92	Sunflower Rd	235.69	SR 188	10700	8100	4400	3600	2007	15	66	10
580	NO	SR 87	235.69	SR 188	239.45	Gisela Rd	10800	8900	4500	4400	2007	15	66	10
579	YES	SR 87	239.45	Gisela Rd	250.97	Round Valley Rd	13100	13300	6600	6700	2007	15	66	10
580	NO	SR 87	250.97	Round Valley Rd	251.85	Main St - Payson	30700	15300	8100	7200	2007	15	66	10
581	NO	SR 87	251.85	Main St - Payson	252.58	SR 260	31300	26100	13000	13100	2007	15	66	10
582	NO	SR 87	252.58	SR 260	254.56	Houston Mesa Rd	28300	23000	11600	11400	2007	N/A	N/A	38

Sub transmission line design

- After the substation location has been identified,
- the next component to study is the sub-transmission line.
- Sub-transmission lines are a necessary part of SSVEC's INFRASTRUCTURE that enables us to provide electricity to homes and businesses - however

Visual Impact

Visual Impact of this Sub-Transmission line is of concern to the community –

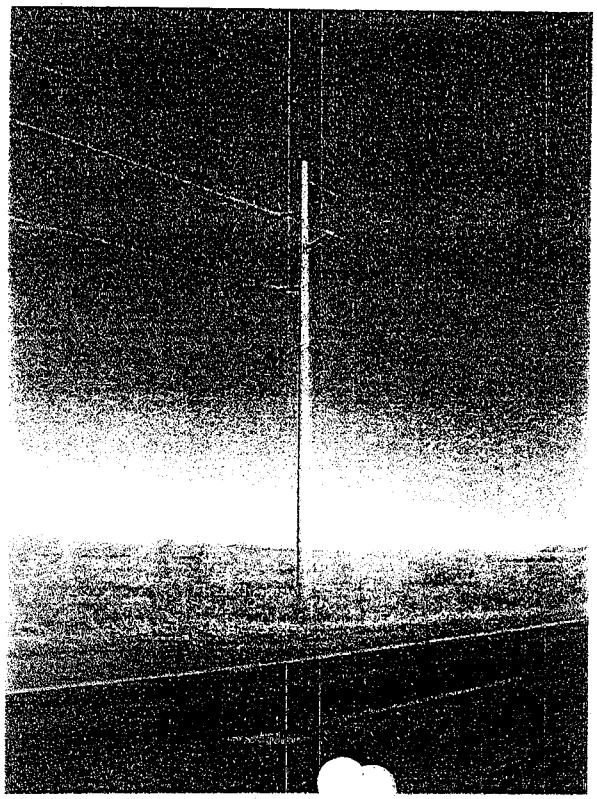
SSVEC IS SENSITIVE TO THIS ISSUE WITH DESIGN PLANNING AND WILL USE COMPONENTS WITH IMPROVED AESTHETIC APPEARANCE.

The first question we hear: What is the pole going to LOOK LIKE?

SSVEC will use a NARROW–PROFILE MONO-POLE design for the sub-transmission line.

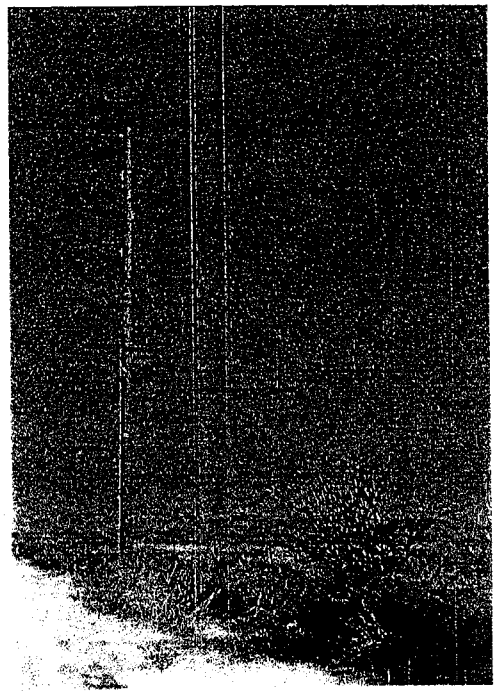
LATER on we will show you locations where this pole will be installed

Narrow – Profile Sub Transmission Pole



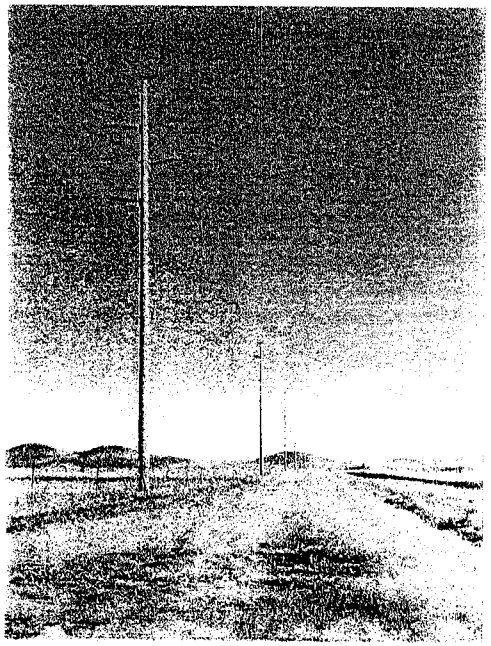
This pole will be used in areas where distribution service to HOMES/BUSINESSES is also necessary –HORIZONTAL ARM

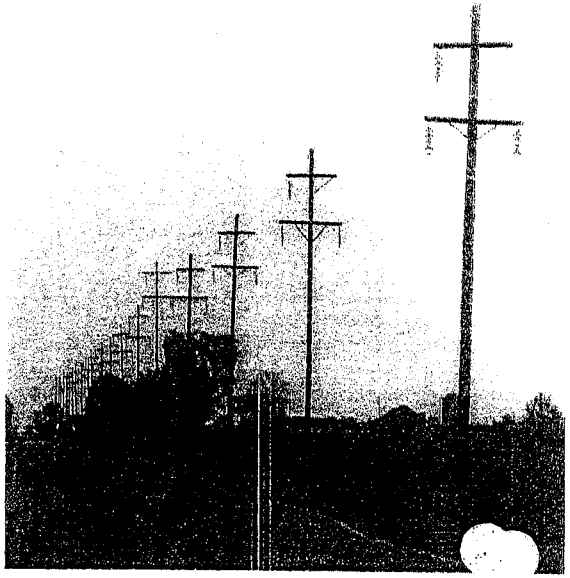
Narrow Profile Sub-Transmission Pole with High Flat Distribution Crossarm



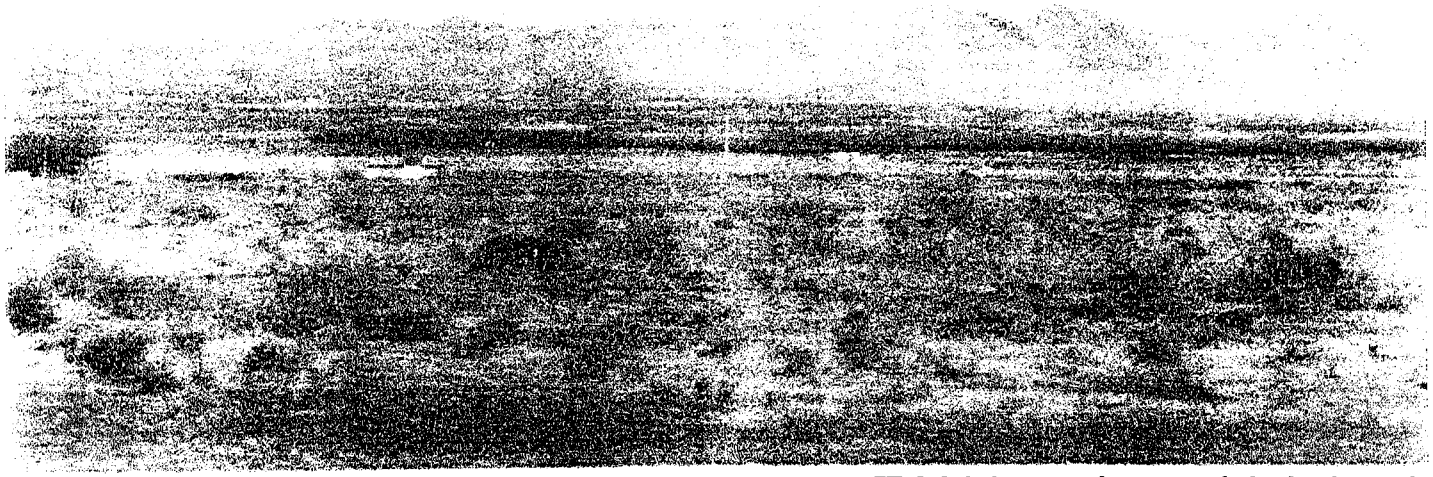
Alternative Pole Materials

- Did you notice neither of those poles are WOOD?
- Material of the pole itself is also considered in design.
- New technology in material allows poles to be made out of CONCRETE, GALVANIZED STEEL, AND FIBERGLASS.
- Longer life spans than wood
- higher resistance to WARPING, BENDING and breakage which decreases impact along the right of way from maintenance traffic.
- Allow LONGER SPANS than wood "STRONGER"
- Environmentally 'GREENER
- Did you notice in the photos that the pole color is grey?
- SSVEC has experimented with pole color testing and found in the desert landscape of SOUTHEAST AZ that GREY poles provide MAXIMUM BLENDING into the background.



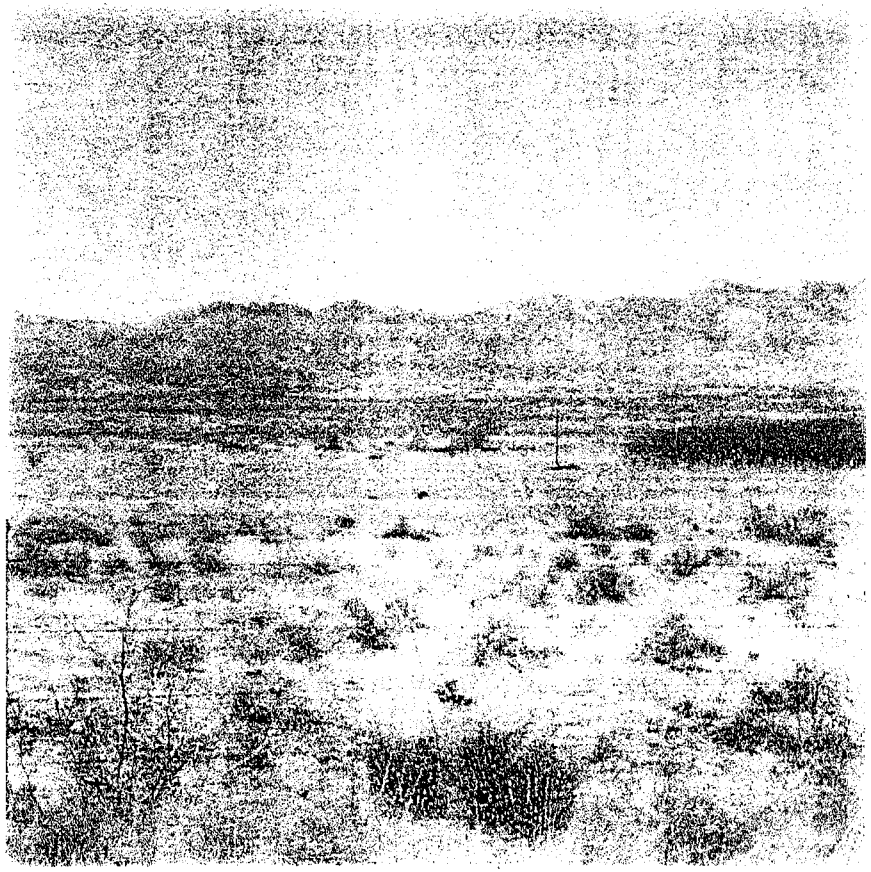


Pole Color Test: Tan vs. Gray



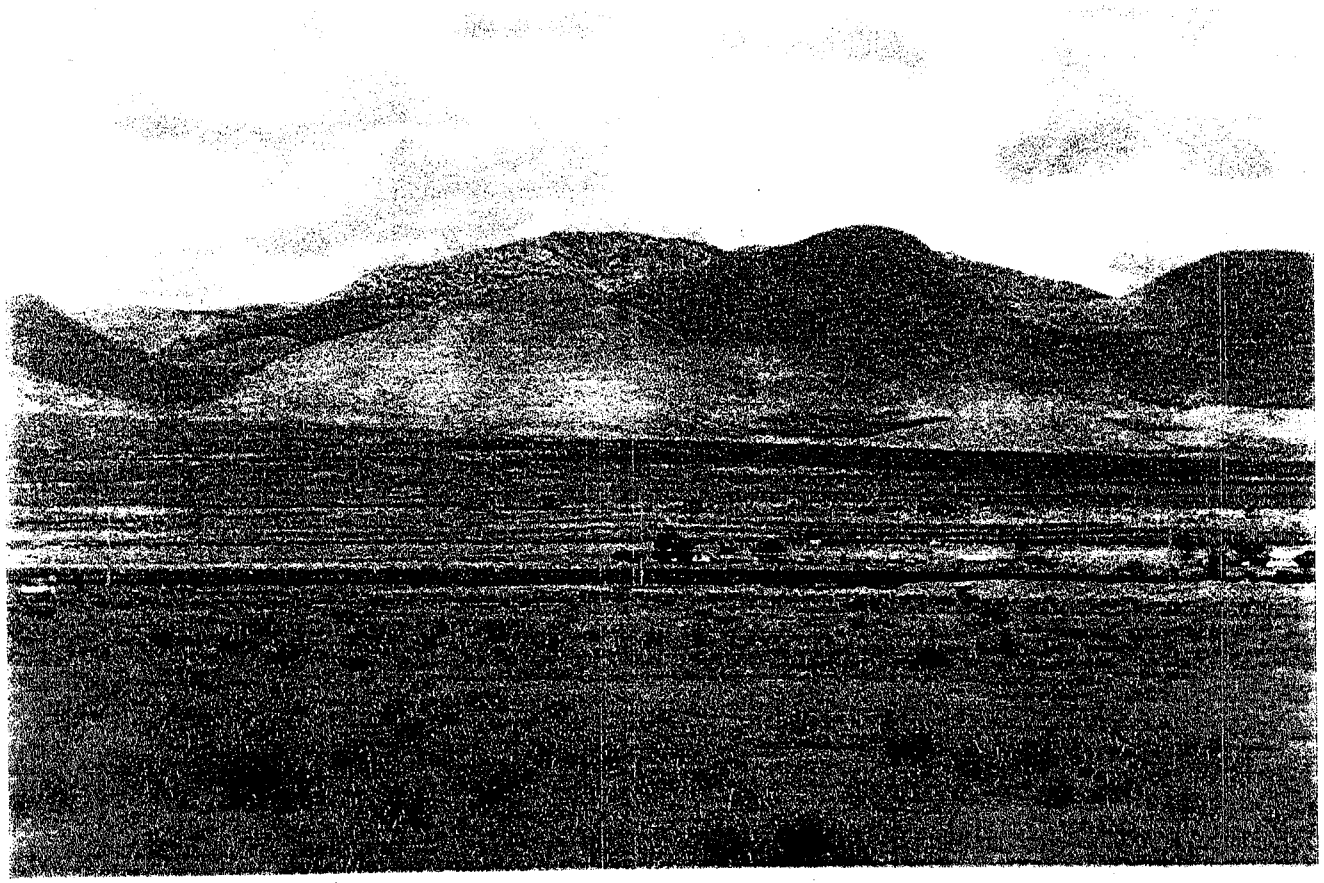
This photo shows a WOOD pole that is TAN in color, which is similar to our native grasses the largest percentage of the year, as you can see, it CONTRASTS very sharply against the background of the landscape. On EACH side of this pole are GREY sub-transmission poles with distribution under build (Camera is less than 1/2m from pole)

Pole Color Test: Rust vs. Gray



This photo shows a STEEL pole that is RUST in color – this is the standard metal used by utility companies. There is a GREY pole to the LEFT of this pole (Camera is 1 mile from POLES)

Grey Pole with Green Background



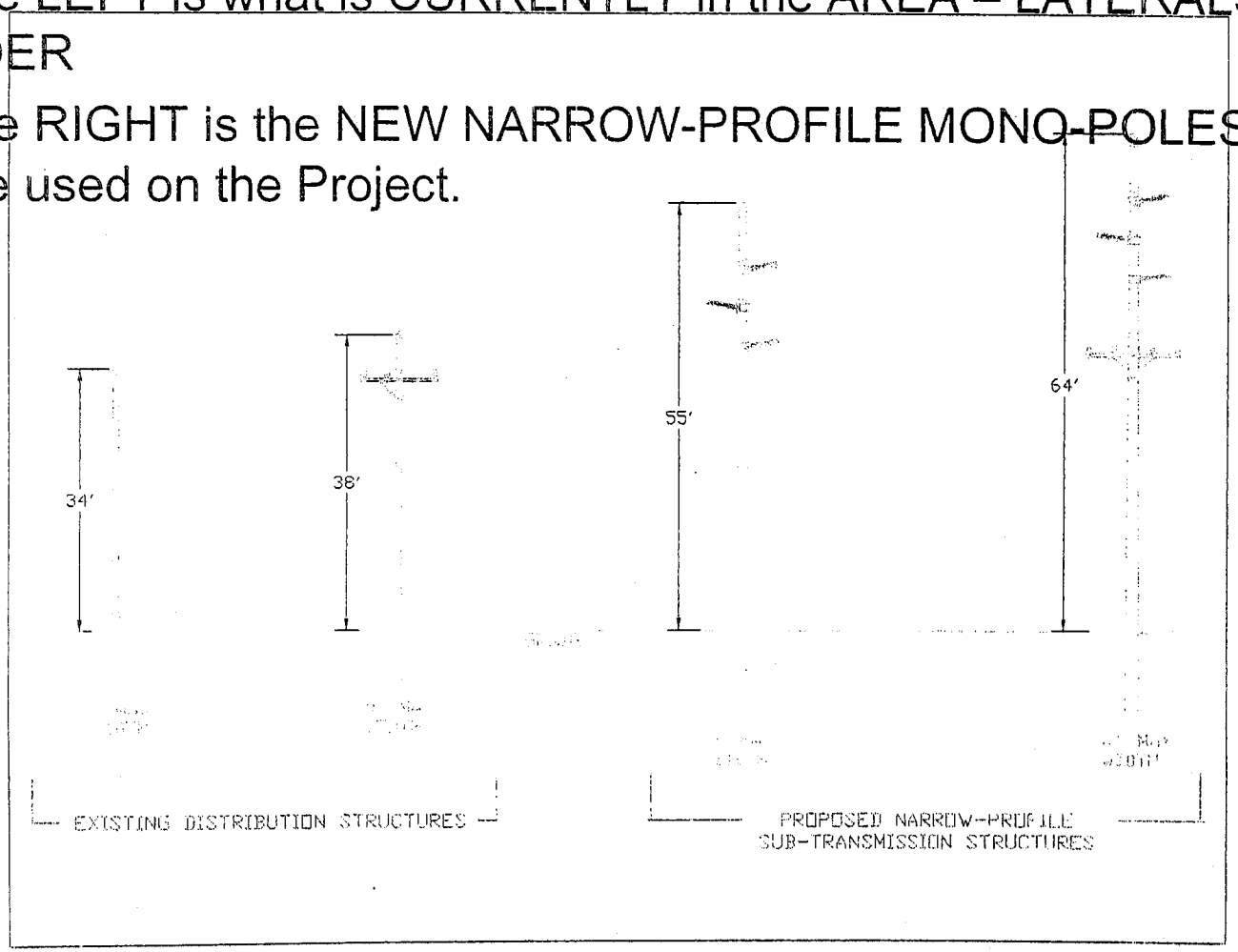
Finally, this PHOTO was taken last week in a "GREENER" setting than the test photos, this only shows the GREY POLES. Camera is 1 mile away with a ZOOM 2X the naked eye.

Pole Comparisons

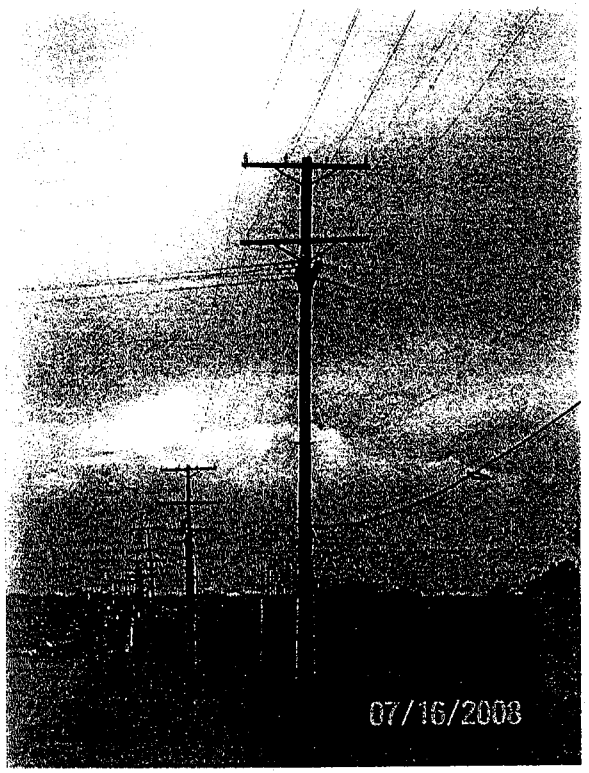
Height of the pole is of great concern to the COMMUNITY, and the NARROW PROFILE design does require a slightly taller pole than other designs – although the visual impact is lower.

On the LEFT is what is CURRENTLY in the AREA – LATERALS / FEEDER

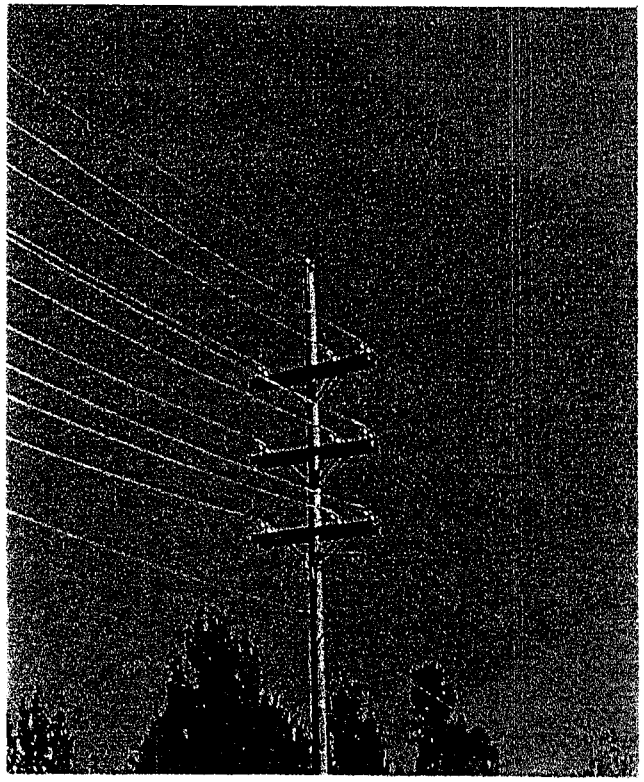
On the RIGHT is the NEW NARROW-PROFILE MONO-POLES that will be used on the Project.



OTHER POLE CONFIGURATION TYPES



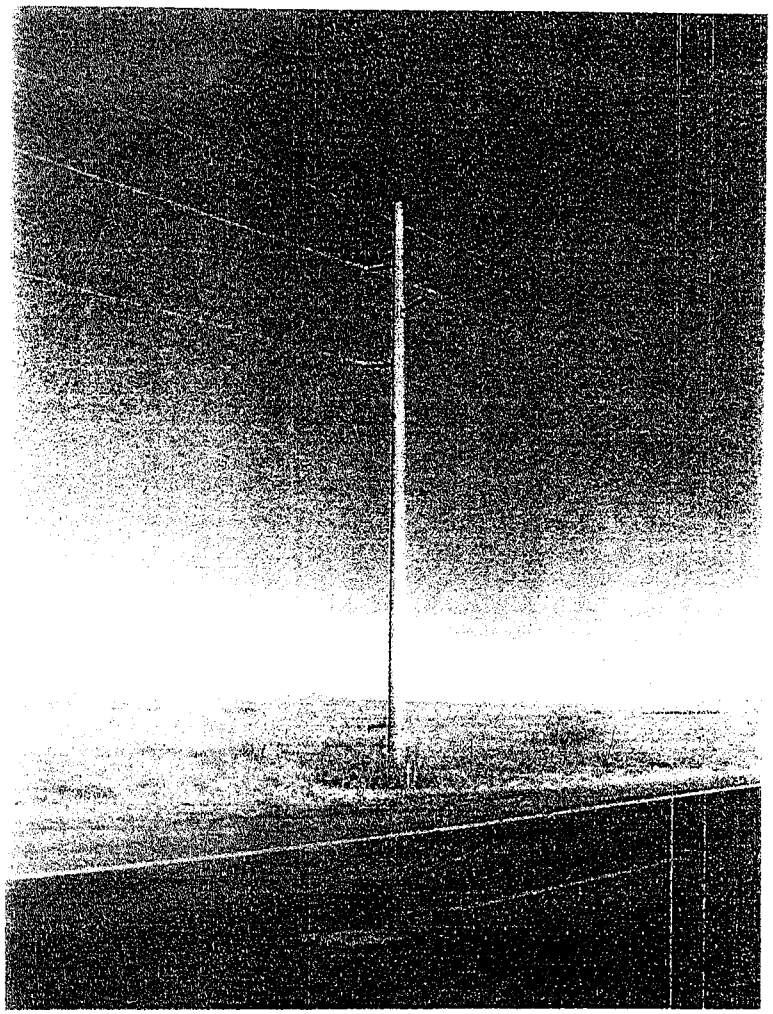
Double Circuit

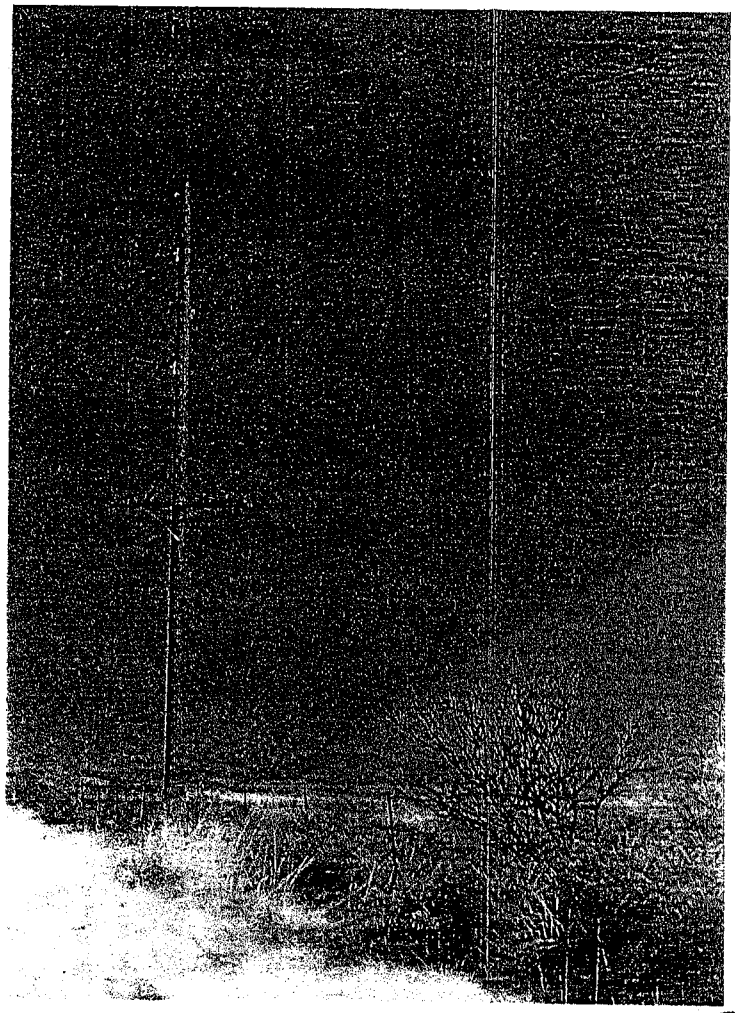


Triple Circuit

- Example POLE CONFIGURATIONS where the HEIGHT may be lower – but the VISUAL IMPACT is higher
- DOUBLE / TRIPLE circuits used where SUBSTATION is TOO FAR from LOAD CENTER
- SSVEC WILL NOT BE USING THESE STRUCTURES ON THIS PROJECT

Selected Pole Configuration





SSVEC

Sun Watts

Sun Watts Rebate Tracking as of AUGUST 6, 2009

City, State	Zip	Type	Manufacturer/Model #	#Watts	Payment Type	Rebate Total	To Acct
Elgin, AZ	85611	Solar	Xantrex GT 3.0	1600	$4.00	$6,400.00	12/13/2005
Sonoita, AZ	85637	Solar	Xantrex GT 3.0	2000	$4.00	$8,000.00	5/21/2007
Patagonia, AZ	85624	Solar	Magnetek Aurora GEPV173MCA/EC-115 Evergreen	1840	$4.00	$7,360.00	9/7/2007
Elgin, AZ	85611	Solar	Grundfos GF110	400	$4.00	$1,600.00	10/17/2007
Elgin, AZ	85611	Solar	BP 175B	350	$4.00	$1,360.00	3/18/2008
Sonoita, AZ	85637	Wind	Southwest Windpower Skystream 3.7	1800	50% of total	$6,987.50	4/17/2008
Sonoita, AZ	85637	Solar	Fronius IG3000	6300	50% of total	$19,500.00	10/1/2008
Elgin, AZ	85637	Wind	Southwest Windpower Skystream 3.7	2400	50% of total	$8,250.00	11/20/2008
Sonoita, AZ	85637	Wind	Southwest Windpower Skystream 3.7	2400	50% of total	$8,250.00	11/21/2008
Sonoita, AZ	85637	Wind	Southwest Windpower Skystream 3.7	2400	50% of total	$8,950.00	12/9/2008
Sonoita, AZ	85637	Solar	Sunny Boy SB 5000US	4680	50% of total	$17,572.00	12/23/2008
Elgin, AZ	85611	Wind	Southwest Windpower Skystream 3.7	2400	50% of total	$9,375.00	3/20/2009
Patagonia, AZ	85624	Solar	Kaco Blue Planet w/12 Kyocera Panels	1530	$4.00	$6,120.00	4/27/2009
Sonoita, AZ	85637	Wind	Southwest Windpower Skystream 3.7	2400	50% of total	$8,375.00	4/28/2009
Elgin, AZ	85611	Solar	Application Received/Design approved	9600			
Sonoita, AZ	85637	Solar	Application Received/Design not yet approved	4800			
			TOTAL CUSTOMER	46900	46.9kW		
			Average Customer	2931	2.9kW		
Elgin School				23000			
Patagonia School				46000			
			SSVEC Total	69000	69kW		

Small Solar Generating Plants

- SSVEC's SunWatts Renewable Energy Program supports this concept system wide
  - Incentive program: SSVEC will pay $4.000 per kilowatt up to half the installed cost of the system.
  - Typical system on SSVEC program is ~2kW
  - Typical home uses between 7-10 kW of energy
  - 16 Customers in Sonoita/Elgin/Patagonia
- SSVEC Program has installed 'Solar Shade' systems at schools in service territory. Currently one 46kW and one 23kW solar system at Elgin School and Patagonia High School in Santa Cruz County.
- These systems do not address capacity issue
- If conventional generator back-up is proposed, gas or diesel supply and storage becomes an issue. Non-Renewable Source
- Utility-grade power purchase agreement for firm power would require redundant back-up and/or spinning reserve

Install a 1-3MW Solar Facility

- A 1-3MW Solar facility at the Nogales Airport would be UniSource's Service decision.
  - The Nogales Airport is over 11-miles from SSVEC's Service Area
- SSVEC has submitted a proposal under the Clean Renewable Energy Bond program for a 750kW Solar Renewable Energy System with a possible location at the Sonoita Substation
- Currently proposed energy storage technologies only provide limited periods of sustainability
  - Battery
  - Flywheel
  - Compressed Air
  - Salt
- SSVEC supports the Cooperative Research Network program of study and exploration of energy storage technologies
- Non-dispatchable renewable energy systems reduce the need for fuel (typically coal or natural gas) but do little to address the capacity issue

Sulphur Springs Valley Electric Cooperative, Inc.

A Touchstone Energy® Cooperative

SUN Watts

Sulphur Springs Valley Electric Cooperative, Inc.
Small Residential/Small Business/Commercial
Single-Phase 120 V or 120/240 V
Photovoltaic System Interconnection Requirements
January 1, 2008

1.0 GENERAL REQUIREMENTS

1.1 The following photovoltaic (PV) system or other renewable system interconnection requirements by Sulphur Springs Valley Electric Cooperative, Inc. (SSVEC) are the minimum requirements by SSVEC to ensure proper interface of small residential, single-phase 120 V or 120/240 V, 15 kW or less, photovoltaic systems with the utility. These minimum requirements are based on the **IEEE Recommended Practice for Utility Interface of Residential and Intermediate Photovoltaic Systems (ANSI/IEEE Std 929)**. In addition to the following minimum requirements, the customer is responsible for complying with all other applicable technical standards, safety codes, **Article 690 of the National Electric Code**, and equipment manufacturers' specifications related to the design, installation, operation, and maintenance of the customer's entire electrical installation, including the PV system, not specifically mentioned in this document. **The PV System Components must be Listed and Tested by a Nationally Recognized Testing Laboratory (NRTL) to UL Standard 1741.**

2.0 AGREEMENT PROCESS REQUIREMENTS

2.1 The customer contacts SSVEC and requests interconnection requirements. SSVEC will forward interconnection requirements (page 1 through 3) and agreement form (page 4, 5 and 6).

2.2 The customer reviews the interconnection requirements and returns the signed and completed agreement form (page 4, 5 and 6) to SSVEC, which verifies that the customer is in agreement with the interconnection requirements. SSVEC will not sign the agreement form authorizing parallel operation with the utility until section 2.6 is complete.

2.3 SSVEC will approve the agreement form, if the customer has submitted the correct information, and the customer has signed the agreement form. SSVEC will then verbally contact the customer, and give the customer permission to proceed with the PV project. The customer should not proceed with the PV project until SSVEC approves the agreement form, and verbally contacts the customer.

2.4 The customer must obtain all permits and inspections required by city or county inspectors regarding the installation of the PV system. The PV system must be installed by a licensed electrical or PV contractor. The disconnect switch must be inspected by a licensed electrician.

2.5 After the PV system has been installed, inspected, and approved by the city or county inspector, the customer should contact SSVEC. SSVEC will inspect the PV system installation to confirm that it complies with the interconnection requirements. SSVEC recommends the licensed electrical or PV contractor be on site when SSVEC inspects the PV system installation to answer any questions that SSVEC may have.

2.6 After SSVEC has inspected the PV system installation, and confirmed that it meets the interconnection requirements, SSVEC will then sign the agreement form, which authorizes the customer to operate the PV system in parallel with the utility. SSVEC will send copies of the completed agreement form to the customer.

3.0 POWER QUALITY REQUIREMENTS

3.1 The power quality at the customer's meter must be within **published national voltage (ANSI/IEEE Std C84.1) and harmonic (ANSI/IEEE Std 519) standards**. The PV system must not exceed SSVEC flicker standards, and must operate in synchronism with the utility at 60 Hz. The PV system must not inject direct current (DC) into the alternating current (AC) system. In addition to these standards, the customer's PV system must not cause noticeable interference with telephone, radio, computer or other communication systems. If the customer's power quality does not meet these standards or if the PV system interferes with the power quality of other SSVEC customers, SSVEC reserves the right to disconnect the PV system from the utility.

4.0 PROTECTION REQUIREMENTS

4.1 The customer must ensure that the PV system automatically disconnects from the utility if SSVEC, or other personnel, open an upstream breaker, fuse, or switch to de-energize the utility power source to safely work on local area power lines or equipment. Without proper protection, the PV system could potentially backfeed the local area loads, and energize the local area power lines. This condition is called "islanding" and is extremely dangerous because SSVEC, or other personnel, will have assumed that they have isolated the utility power source, and could potentially be electrocuted by the customer's PV system backfeeding the utility. This situation is absolutely intolerable and it is the customer's responsibility to ensure that the PV system will automatically disconnect from the utility under these conditions.

4.2 Upstream SSVEC distribution breakers will trip open due to temporary faults (lightning strikes, etc.) and will automatically reclose 1-2 seconds later. Upstream SSVEC transmission breakers will also trip open due to temporary faults and will automatically reclose instantaneously. It is the customer's responsibility to ensure that the PV system has automatically disconnected from the utility before an upstream utility distribution or transmission breaker automatically recloses onto the PV system out of synchronism. SSVEC will not be responsible for any damage caused by an upstream utility breaker automatically reclosing onto the customer's PV system out of synchronism.

4.3 The following minimum protection is required by SSVEC to prevent the PV system from islanding the utility. The PV system must automatically disconnect from the utility 2 seconds (120 cycles) after the voltage deviates outside the voltage range 88-110% of nominal. The PV system must automatically disconnect from the utility 0.1 second (6 cycles) after the frequency deviates outside the frequency range of 59.3-60.5 Hz. After the PV system has disconnected from the utility, it should remain disconnected until voltage and frequency is within the above voltage and frequency ranges for 60 seconds.

4.4 In addition to the minimum protection required by SSVEC, it is the customer's responsibility to ensure that all additional personnel safety and equipment protection devices required by all other applicable technical standards, safety codes, and equipment manufacturers' specifications are properly installed. SSVEC is not responsible for the protection of the customer's PV system.

5.0 DISCONNECT SWITCH REQUIREMENTS

5.1 The customer shall install a SSVEC accessible, outdoor mounted, load break disconnect switch with a visible open that is capable of being padlocked in the open position by SSVEC personnel. The disconnect switch shall be mounted at the service entrance next to the meter, properly grounded, and clearly labeled "**PHOTOVOLTAIC SYSTEM AC DISCONNECT**". The disconnect switch shall be installed on the alternating current (AC) circuit between the utility and AC input to the PV inverter. The purpose of the disconnect switch is for SSVEC, or other personnel, to disconnect the PV system from the utility to eliminate all potential sources of backfeed when it is necessary to safely work on local area power lines or equipment. The customer understands that SSVEC has the right to padlock the disconnect switch in the open position at any time, without notice to the customer. The customer also understands not to tamper with, or remove the padlock if the disconnect switch is padlocked in the open position by SSVEC. The disconnect switch must be installed by a licensed electrician.

6.0 ANNUAL INSPECTION

6.1 SSVEC may conduct one inspection annually, at no cost to the costumer. The customer all provide SSVEC personnel with reasonable access to the PV system to conduct the annual inspection. This inspection will consist, at a minimum, of a visual inspection of required equipment and a test to verify that the equipment will still disconnect properly from the utility when the utility power is disconnected.

SSVEC

SSVEC Solar Proposals

Sulphur Springs Valley Electric Cooperative, Inc.

A touchstone Energy Cooperative

REQUEST FOR QUOTATIONS TO DEVELOP A SOLAR ENERGY GENERATION FACILITY

July 7, 2009

SULPHUR SPRINGS VALLEY ELECTRIC COOPERATIVE, INC.
Request For Quotations To Develop a Solar Energy Generation Facility

1.0 SCOPE

Sulphur Springs Valley Electric Cooperative, Inc. ("SSVEC") is issuing this Request for Quotations ("RFQ") to solicit indicative proposals from potential solar energy developers and design/build contractors for 750 kW of solar-powered generation to be built adjacent to an existing SSVEC substation. SSVEC is receptive to proposals that either provide for a turnkey project with SSVEC as the project owner at completion, or in the alternative a long term purchased power agreement ("PPA") with a developer, under which SSVEC would purchase the output of the facility over its life.

2.0 SCHEDULE

The following schedule and deadlines apply to this solicitation:

Release of RFQ:	July 7, 2009
Indicative Proposals Due:	**July 17, 2009**
Begin Contract Negotiations:	August 2009
Execute Contracts by:	December 2009
Commercial Operation Date	Fall 2010

3.0 PROJECT DESCRIPTION

A. Background & Scope

SSVEC is a non-profit, member-owned distribution cooperative providing electricity to more than 50,000 services over some 4,000 miles of energized line in southeastern Arizona. The cooperative's service territory covers parts of Cochise, Graham, Pima and Santa Cruz Counties and includes the communities of Sierra Vista, Huachuca City, Patagonia, Elfrida, Benson, St. David, Bowie, San Simon, Willcox, Sonoita, and Pearce-Sunsites.

SSVEC is seeking opportunities to collaborate with either a design/build contractor or developer for the purpose of developing a solar electricity generation project in its service territory, at a site adjacent to an existing substation to be specified at a future date. The development of this project is part of SSVEC's efforts to comply with the Arizona Corporation Commission's ("ACC's") Renewable Energy Standard ("RES") outlined in Title 14, Chapter 2, Article 18 of the Arizona Administrative Code. SSVEC is seeking federal grants and financing to assist with the feasibility of this project.

The project that is envisioned is a free field, ground mounted solar energy generation facility capable of delivering up to 750 kW during peak periods. The specific technology is left up to the respondent to propose. The facility would be located adjacent to a new 69 kV/25 kV substation on the SSVEC distribution system. Interconnection to SSVEC's system will be via a 600A underground get-away from a dedicated 25kV grounded Wye distribution bus at a new substation (all of this will be provided by SSVEC). The respondent must provide transformation from inverter output voltage to 25kV, three phase, grounded Wye and provide all DC/AC inversion as well as AC disconnect(s), instrument-rated, substation class metering. SSVEC will install all of the CTs and PTs, but the respondent must provide the CT cans.

While SSVEC is unable to provide specific details about the site at this time, the respondent should assume for purposes of preparing a response that the site is an approximately ten acre tract owned by SSVEC with topology and terrain typical of SSVEC's service territory.

B. Design/Build Alternative

SSVEC is receptive to a design/build turnkey structure where the respondent designs and constructs the facility in collaboration with SSVEC, and then turns over ownership and operation to SSVEC when the project achieves commercial operation. A design/build contractor will be responsible for all equipment, materials, and services required for a complete operating facility. The following lists the major components of the work. This is not intended to be a complete, exhaustive listing, but is provided for convenience of the contractor in quickly developing an understanding of the overall scope of the project work.

- Design: Preparation of facility plans, engineering drawings, and technical specifications.
- Major Plant Equipment: Procuring, receiving, unloading, storing, installation, commissioning and testing of plant equipment.
- Civil-Structural: Site surveys; geotechnical investigation of the site; clearing, grubbing, and site preparation; perimeter security fences and gates; underground utilities and piping; grading and drainage; soil erosion, sediment control, and final stabilization; roads, parking, sidewalks, and paving; landscaping; restoration of site, including lay-down areas, to acceptable condition upon demobilizing from the site; and all foundations.
- Electrical: Controls, metering, relaying; electrical interface between the plant, collector bus with high side breakers, and the substation; plant lighting, plant lightning protection, and grounding.

Any contractor selected as the result of this solicitation will be expected to enter into an agreement with SSVEC that will govern the scope of the work as generally described above, payment obligations, contractor performance obligations, and insurance and security requirements.

C. PPA Alternative

SSVEC is also receptive to a PPA structure, where SSVEC would purchase the output of the project over its life. In the case of the PPA structure, SSVEC expects the developer to own, operate, and maintain the solar energy generation system for a period of at least twenty years. Prospective developers must be willing to enter into specific agreements with various parties which may be involved in the successful execution of this project, including a site use agreement with SSVEC for installation, operation and maintenance activities conducted at the site.

D. Interconnection Requirements

The facility will be required to be constructed to meet the minimum requirements for safe and effective operation in accordance with SSVEC's Interconnection Requirements for Distributed Generation, which can be provided at the respondent's request. These interconnection requirements apply to those installations that will be connected to the SSVEC distribution system (25 kV or less) and do not backfeed onto the transmission system. The proposed project is designed so that it would not backfeed onto the 69 kV transmission system.

These requirements may not cover all details in specific cases. The respondent would be expected to discuss project plans with SSVEC before designing the facility or purchasing and installing equipment.

The minimum required protective relaying and/or safety devices and requirements specified in SSVECs' requirements are for protecting SSVEC facilities and customer equipment from damage or disruptions caused by a fault, malfunction or improper operation of the distributed generating facility. They are also necessary to ensure the safety of utility workers and the public. Minimum protective relaying and interconnection requirements do not include additional relaying, protective or safety devices as may be required by industry and/or government codes and standards, equipment manufacturer requirements and prudent engineering design and practice to fully protect the generating facility or facilities; those are the sole responsibility of the respondent.

4.0 PROJECT SELECTION

Proposals will be judged based on their ability to meet SSVEC's need for economical and reliable renewable energy in the necessary timeframe. Respondents to this solicitation should provide all relevant information necessary to allow SSVEC to conduct a thorough analysis of the proposal. The principal criteria to be used by SSVEC in evaluating proposals include, but are not necessarily limited to, total delivered cost of the renewable energy over the contract term, the reliability of the project, and the financial and operational viability of the respondent.

SSVEC reserves the right to consider any other factors that it deems to be relevant to its needs. SSVEC reserves the right to request additional information from individual respondents or to request all respondents to submit supplemental materials in fulfillment of the content requirements of this RFQ or to meet additional information needs of SSVEC. SSVEC also

reserves the unilateral right to waive any technical or format requirements contained in the RFQ. Furthermore, SSVEC, in its sole discretion, will analyze any financial, operational, or other necessary criteria to determine their comfort and confidence that the respondent has the capability to fulfill their proposal.

Respondents are encouraged to include the following information:

Past Experience. SSVEC will consider past experience in designing, installing, owning, operating, and maintaining solar energy projects of similar size and complexity. If the respondent forms a joint venture or other teaming arrangement, these same considerations will be applied to the parties to the joint venture or teaming arrangement cumulatively. Additional response information may be included such as the extent to which the respondent has experience with solar projects in southern Arizona.

Pricing. Provide a preliminary project cost estimate in sufficient detail to allow SSVEC to validate and verify the various cost components contained in the proposal. Explain the approach for minimizing the price of electricity generated. Respondents are encouraged to guarantee their prices for at least 90 days. Preference will be shown to those proposals that guarantee their pricing for longer periods of time.

Proposed System Conceptual Design & Technical Specifications. Describe the preliminary design/ layout of the PV system, land required, type of technology, efficiency, mounting, tracking method if used, transmission interconnection plan (to an existing 12.5 kV substation), and recommended provisions to minimize system visibility (including light reflection) for the ground-mounted system. Proposals offering some level of "firming" are especially welcome.

Financial Capability. Provide verifiable information demonstrating that the respondent is in sound financial condition and has the ability to secure the necessary financing to meet the project's requirements now and in the future. The respondent's financial capability will be reviewed for stability and adequacy to meet its obligations under the proposal. If the respondent is selected as the winner of the RFQ and plans to secure financing from an outside source, an official letter from the financier confirming the financial arrangement may be required.

Solar Equipment Supply. If the respondent is selected as the winner of the RFQ, the respondent may be asked to provide a letter from its solar equipment supplier and/or manufacturer substantiating the availability of the equipment for use for the project.

5.0 RESPONSE SUBMISSION

SSVEC desires to receive paper or digital copies of proposals by 4:00 PM Eastern Standard Time, on July 17, 2009, at the address below.

GDS Associates, Inc.
1850 Parkway Place, Suite 800
Marietta, GA 30067

Attn: David Brian (david.brian@gdsassociates.com)
Phone: 770-425-8100
Facsimile: 770-426-0303

SSVEC

CREBS

PROPOSAL

EXHIBIT A

Detailed Description of the Qualified Renewable Energy Facility - A reasonably detailed description of the qualified renewable energy facility including reasonably expected costs of components, such as land, site prep, equipment, installation, other dedicated facilities such as transmission, project capacity and projected or expected use of the power produced at the Project.

Sulphur Springs Valley Electric Cooperative, Inc. ("SSVEC") issued a Request for Quotations ("RFQ") to solicit proposals from potential solar energy developers and design/build contractors for up to 750 kW of solar-powered generation to be built adjacent to a future SSVEC substation in Sonoita, Arizona. In its RFQ, SSVEC informed interested parties that it was receptive to proposals that either provided for a turnkey project with SSVEC as the project owner at completion, or in the alternative, a long term purchased power agreement ("PPA") with a developer, under which SSVEC would purchase the output of the facility over its life. SSVEC accepted proposals on July 17, 2009. Following a review of the proposals, SSVEC personnel have determined that a PPA agreement would not be cost-effective and has eliminated PPA proposals from further consideration. It is currently reviewing turnkey proposals from qualified providers. Contract negotiations with acceptable applicants' are expected to begin in August 2009, with the execution of contracts expected to occur in December 2009. SSVEC estimates that the cost of the project will be $6.0 million. The development of this project is part of SSVEC's efforts to comply with the Arizona Corporation Commission's ("ACC's") Renewable Energy Standard ("RES") outlined in Title 14, Chapter 2, Article 18 of the Arizona Administrative Code.

Background: SSVEC, a non-profit member-owned distribution Cooperative, provides electricity to 49,828 customers located in four counties in Southeastern Arizona. Its services are provided by more than 4,000 miles of energized lines. The Cooperative's service territory covers parts of Cochise, Graham, Pima and Santa Cruz Counties and includes the communities of Sierra Vista, Huachuca City, Patagonia, Elfrida, Benson, St. David, Bowie, San Simon, Willcox, Sonoita, and Pearce-Sunsites. SSVEC employs personnel that are highly qualified in their jobs, many who have years of experience working in the utility business. SSVEC was formed in 1938 as part of the Rural Electrification Administration (REA) which was created in 1935 by President Franklin Roosevelt. It is a 501 (c) (12) non-profit organization. Since its inception, SSVEC has worked closely with farms, ranches and small communities providing reliable power supplies. Over the years, these once dark and isolated areas have become thriving centers of commerce, industry, agriculture, culture and quality living.

Location and Site: The project will be located on a 5-acre greenfield site near the town of Sonoita, AZ, located in Santa Cruz County, Arizona. The Project site is readily accessible via Old Sonoita

Road near its intersection with HWY 83 and Papago Springs Road. The Project site would be located adjacent to a new 69 kV/25 kV electric substation on the SSVEC distribution system. The new substation will use approximately 1-acre of the site footprint. Additional acreage can be purchased for the Project's plant site if additional space is required.

Equipment and Installation: SSVEC proposes a free field, ground mounted solar energy generation facility capable of delivering up to 750 kW during peak periods and approximately 1,700,000 kilowatt-hours of energy annually. SSVEC has left the specific technology options (photovoltaic modules, inverters, and tracking system) up to the respondents to its RFQ to propose. SSVEC personnel are currently reviewing turnkey proposals from qualified applicants; an interview process will commence following selection of the most cost-effective proposals. The topology and terrain is flat, with no aerial obstructions. The proposed project will deliver 12,500 volts of alternating electricity once the facility is operational.

Design/build turnkey structure: In its effort to ensure that it undertakes the most cost-effective alternatives in order to meet both current and future needs of its customers, SSVEC has solicited proposals for multiple concepts. It has therefore determined that it will negotiate a turnkey operation, rather than a PPA project.

Using the design/build, turnkey structure, SSVEC proposes to work in collaboration with a selected company who would be responsible for the design and construction of the facility. Upon completion of construction activities, SSVEC would assume ownership and would operate the facility. The selected design/build contractor would be responsible for all equipment, materials, and services required for project completion and facility operation. SSVEC would enter into an agreement with that will govern the scope of the work, including payment obligations, contractor performance obligations, insurance, and security requirements. What follows is a list of the major components of the work:

- Design: Preparation of facility plans, engineering drawings, and technical specifications.
- Major Plant Equipment: Procuring, receiving, unloading, storing, installation, commissioning and testing of plant equipment.
- Civil-Structural: Site surveys; geotechnical investigation of the site; clearing, grubbing, and site preparation; perimeter security fences and gates; underground utilities and piping; grading and drainage; soil erosion, sediment control, and final stabilization; roads, parking, sidewalks, and paving; landscaping; restoration of site, including lay-down areas, to acceptable condition upon demobilizing from the site; and all foundations.
- Electrical: Controls, metering, relaying; electrical interface between the plant, collector bus with high side breakers, and the substation; plant lighting, plant lightning protection, and grounding.

Interconnection Requirements: Interconnection to SSVEC's system will be via a 600A underground get-away from a dedicated 25kV grounded Wye distribution bus at a new substation being built by SSVEC. The RFQ respondents must provide transformation from inverter output voltage to 25kV, three phase, grounded Wye and provide all DC/AC inversion as well as AC disconnect(s), instrument-rated, substation class metering. SSVEC will install all of the CTs and PTs, but the respondent must provide the CT cans.

The Sonoita facility will be constructed to meet the requirements for safe and effective operation in accordance with SSVEC's Interconnection Requirements for Distributed Generation, which requirements apply to installations that will be connected to the SSVEC distribution system (25 kV or less) and do not back-feed onto the transmission system. The proposed project is designed so that it would not back-feed onto the 69 kV transmission system.

The minimum required protective relaying and/or safety devices and requirements specified in SSVECs' requirements are for protecting SSVEC facilities and customer equipment from damage or disruptions caused by a fault, malfunction or improper operation of the distributed generating facility. They are also necessary to ensure the safety of utility workers and the public. Minimum protective relaying and interconnection requirements do not include additional relaying, protective or safety devices as may be required by industry and/or government codes and standards, equipment manufacturer requirements and prudent engineering design and practice to fully protect the generating facility or facilities; those are the sole responsibility of the respondent.

Total Estimated Capital Cost of the Project - The current total estimated cost of the Project is approximately $6 million, with a breakdown as follows:

Sonoita Solar Generation Project
Preliminary Cost Estimate

Category	Cost ($000s)
Solar Photovoltaic Modules	3,300
Inverters	300
Module Mount/Tracking System	400
Site preparation	50
Transformers	100
Monitoring System	50
Additional Land	900
Total Construction Costs	5,100
Owner's Contingency	350
CREBs Issuance Fees	550
Total Project Cost	**6,000**

EXHIBIT C

Plan of Financing

Schedule for Spending CREB Loan Proceeds

SSVEC anticipates a CREB issuance date of January 2010 for the current requested $6,000,000 CREB allocation. SSVEC expects to begin project construction by Q3 2010. The project is expected to have a construction period of 2 to 3 months, placing the commercial online date in the Fall 2010 timeframe. The following schedule provides the anticipated spending of CREB proceeds for the current requested allocation of $6,000,000.

SSVEC – Solar Generation Project **Periodic Drawdown Schedule of Amounts to be Advanced to Borrower For CREB Project**	
DATE ON WHICH PROCEEDS ARE EXPECTED TO BE EXPENDED	AMOUNT OF PROCEEDS TO BE EXPENDED
Aug-09 thru Dec-09	$0
Jan-10	$550,000
Feb-10	$0
Mar-10	$0
Apr-10	$0
May-10	$0
Jun-10	$0
Jul-10	$0
Aug-10	$1,800,000
Sep-10	$1,800,000
Oct-10	$1,800,000
Nov-10	$0
Dec-10	$0
TOTAL	**$6,000,000**

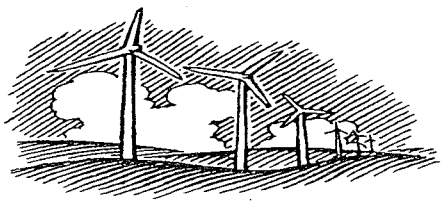
Clean Renewable Energy Bonds ("CREBs")

The Energy Policy Act of 2005 (P.L. 109-58) provides electric cooperatives and public power systems with the ability to issue "Clean Renewable Energy Bonds" ("CREBs"). The CREBs program is further described in Internal Revenue Service ("IRS") Notices 2005-98 and 2006-7 ("Notices"). The Notices will eventually be followed by "temporary and proposed" regulations that invite public comment. The "temporary and proposed" regulations may add detail to the program but will not alter the general terms of the Notice.

CREBs deliver an incentive comparable to the Production Tax Credit ("PTC") that is available to private developers and investor-owned utilities ("IOUs"). A CREB is a special type of bond, known as a "tax credit bond," that offers cooperatives the equivalent of an interest-free loan for financing qualified energy projects for a limited term. CREBs are, in part, modeled on a program called the "Qualified Zone Academy Bond" or "QZAB" program that provides tax credit bonds for school renovation and upgrades in certain qualified school districts.

Qualified Projects

Renewable energy generation projects that qualify for the PTC generally qualify for CREB financing. Specifically, these projects include wind, closed-loop biomass, open-loop biomass (including agricultural livestock waste), geothermal, solar, municipal solid waste (including landfill gas and trash combustion facilities), small irrigation power and hydropower.



Notice 2006-7 clarifies that facilities that are "functionally related and subordinate" to the generation facility itself are also eligible for CREB financing. These facilities may include a radial transmission line to the nearest substation, interconnection upgrades made necessary as a result of the renewable project, offices, storage, or other items. Facilities will not be functionally related and subordinate to a generation facility if they are not of a character and size commensurate with the character and size of the generation facility. Your bond counsel can assist you in identifying the scope of eligible facilities.

Qualified Issuers

Entities qualified to issue CREBs include governmental bodies, Indian tribal governments, mutual or cooperative electric companies and clean energy bond lenders – namely, the National Rural Utilities Cooperative Finance Corporation ("CFC") and Cobank. Notice 2006-7 clarifies that Qualified Issuers include entities that are able to issue tax-exempt bonds "on behalf of" a governmental unit (e.g., a joint action agency).

How CREBs Work

The electric cooperative or cooperative lender ("Issuer") would issue the CREBs and sell them to bondholders. With a conventional bond, the Issuer must pay interest to the bondholder. But with a tax credit bond, the Issuer does not make interest payments. The federal government provides a tax credit to the bondholder in lieu of the Issuer paying interest to the bondholder.

Treasury sets the rate of the credit on a daily basis, at a level that permits the issuance of the CREBs without discount and without interest cost to the Issuer. When the bondholder purchases the bond, the credit rate is locked in for the term of the bond. The credit accrues quarterly and is included in gross income of the bondholder (as if it were an interest payment on the bond). The bondholder takes the amount of the tax credit as a credit against its regular income tax liability and alternative

minimum tax liability. Repayment of principal to the bondholder occurs on a "level annual repayment" basis, meaning equal payments each year of the term of the bond, commencing in the first year of issuance.

The value of the CREB to a bondholder for any year is equal to the credit, less the amount of tax payable on the credit. For example, if the credit amount is $100 and the bondholder is in the 35 percent tax bracket, the credit provides a $65 benefit to the bondholder.

Availability of CREBs

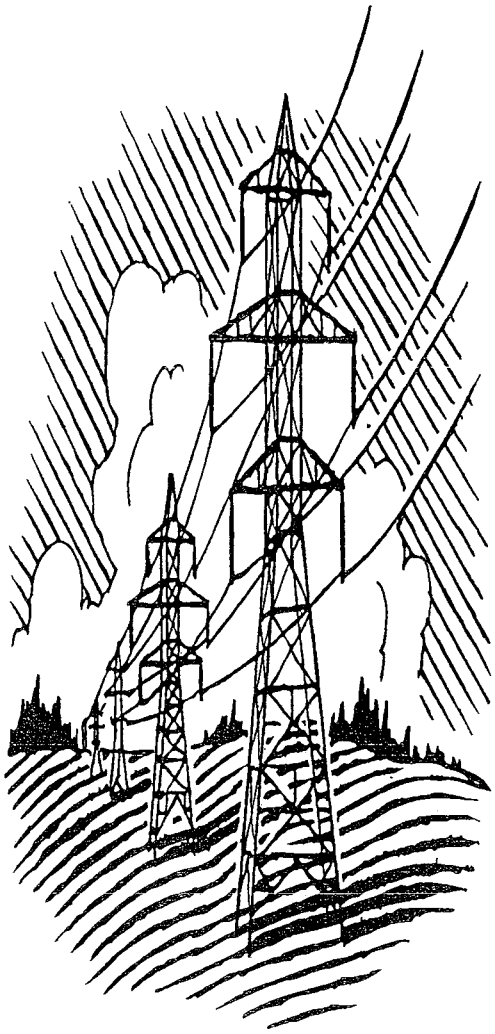
The Clean Renewable Energy Bond program will be available for two years, beginning January 1, 2006, and is subject to a cap of $800 million over two years to be shared between electric cooperative and government projects. The Secretary of Treasury ("the Secretary") will allocate the bonds on a project-by-project basis, prioritizing eligible projects from smallest to largest dollar amount of CREBs requested (with the smallest project first in the queue). The full amount of financing requested will be granted. All projects located at the same site and owned by the same Borrower are treated as a single project. No less than $300 million is reserved for electric cooperatives. The Secretary's timeline for granting the allocations is not provided in the Notices.

Application process

Notice 2005-98 solicits applications to Treasury for CREBs and sets a deadline of April 26, 2006 for applications to be submitted to the IRS. Applications must identify the Issuer and Borrower (the Borrower is the cooperative and the Issuer is either the cooperative or cooperative lender). The application must also describe the project in detail, including a certification by an independent, licensed engineer that the project is eligible and technically viable. Refer to the Notice for additional details of the application.

The Term of CREBs

The maximum term of the bonds is calculated through a formula that is dependent upon interest rates. Technically, the maximum maturity is the term which will result in the present value of the obligation to repay the final principal payment equaling 50 percent of the face amount of the CREB. So, as interest rates increase, the term of the bond decreases. At current interest rates, the maximum term of a CREB is about 15 years. The maximum term of the CREB will be published daily by the Bureau of Public Debt on its web site, http://www.publicdebt.treas.gov.



Credit Rate
The tax credit rate payable to the bondholder (in lieu of interest) will be published daily on the Bureau of Public Debt website mentioned above. Credit rates will be based upon yield on outstanding AA rates corporate bonds of a similar maturity, as estimated by Treasury the day before the CREB is sold. A feature that enhances the marketability of the CREB is "serialization" of the credit rate. In other words, each level annual repayment of principal will be structured as a separate bond paying a separate credit rate to a bondholder.

CREBs were intended by Congress to be issued without interest cost. Given how the credit rate will be set, however, they may sell at a discount depending on the market's perception of the underlying credit of the Borrower or Issuer or due to the small size of the program. Also, the need to begin repaying principal in the first year and transaction costs will result in some additional costs.

Spending the Proceeds of CREBs
CREB issuers must adhere to specific project timeframes for spending CREB proceeds. After issuing the CREBs for a qualified project, the Issuer must spend 95% of the proceeds within five years for that project. See IRS Notice 2005-98 for information on remedial actions that must be taken if the deadline is not met or if proceeds are not spent as intended for a qualified project. Such actions include and are not limited to repaying bondholders with unspent proceeds of the borrowing. Failure to take these actions could cause the bondholders not to receive any tax credits.

Proceeds of CREBs may not be invested above the yield of the CREBs and certain earnings from investment of CREB proceeds must be rebated to the Federal government. Refer to Notice 2005-98 for more information on such arbitrage requirements.

Board Action Needed for Reimbursement
An Issuer may use CREB proceeds to reimburse itself for project costs incurred up to 18 months *prior* to issuing the CREBs. To take advantage of this reimbursement, the actual Borrower (meaning, the cooperative itself, should CFC or Cobank issue the bonds on its behalf) must adopt an official intent to reimburse the expenditure *prior* to the payment of the expenditure. And, the Issuer must adopt an official intent to reimburse the expenditure within 60 days.

Parties Involved in Issuing CREBs
Electric cooperatives may issue the bonds, or have CFC or Cobank issue them on their behalf. Electric cooperatives that choose to issue CREBs independently should also be in contact with bond counsel. NRECA can recommend several bond counsel firms with experience regarding the CREBs.

Partnering with Private Entities
For tax-exempt electric cooperatives, sale to non-members of renewable power from a facility financed by a CREB would be treated in the same manner as any other income -- that is, the 85-15 rule would continue to apply. Examples of sales to non-members include sales of excess renewable capacity or the sale of renewable energy certificates. In any situation, the CREB-financed project must be owned by the cooperative, though it could be operated by another entity. A cooperative may partner with a private entity to finance a project but may only finance the portion it owns with the CREB. In this case, the proper election should be made so that the tax characteristics of the property are attributed to each individual co-owner, since a partnership is not an eligible Issuer under the statute.

A cooperative may lease a CREB-financed project to a private entity provided that the lease meets applicable legal requirements and the cooperative is still deemed to be the owner for tax purposes. A coop could sell a CREB-financed facility to another coop or government body, but if the facility is sold to an entity that can not issue CREBs, such as an

IOU or private developer, the coop would have to use the proceeds of the sale to repay all outstanding CREBs. Bond counsel should be consulted for further information on partnerships, leasing and other arrangements.

Marketing CREBs

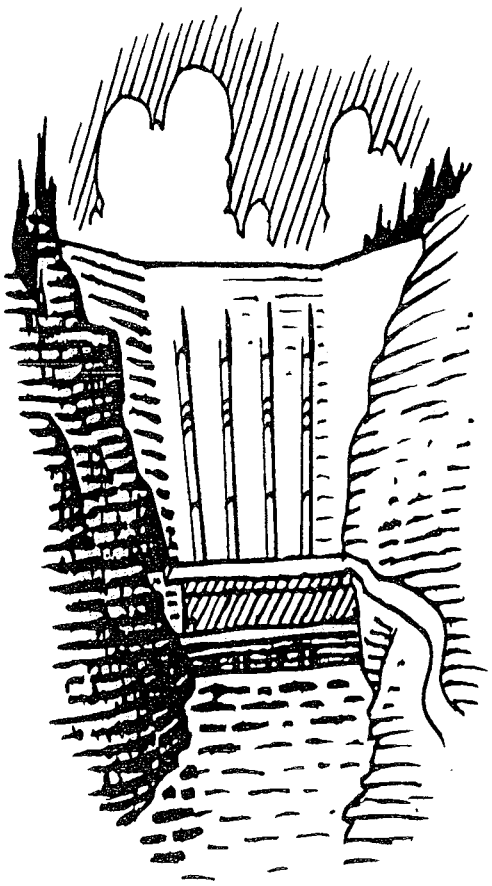
Issuers may pool several projects together to create a bond issue of sufficient size to enhance its marketability, attract interest from the largest number of potential investors and reduce transaction costs. Cooperative lenders could market the bonds to institutional investors, such as pension funds, insurance companies, or Wall Street houses that may offer the bonds to some clients. The bonds could also be sold through mutual funds and to individual investors.

CREBs versus the Production Tax Credit

The Clean Renewable Energy Bond is a different type of financing tool than the PTC that is available to IOUs and private developers. The bond works as a financing tool. In contrast, the benefits from a PTC are received only after the facility is financed and electricity is generated. The value of the CREB relative to the PTC varies according to the project. The PTC provides a 10-year stream of tax credits for all of the above listed renewable generation facilities that qualify for CREBs. The rate provided by the PTC is 1.9 cents per kWh for wind, closed-loop biomass, geothermal and solar. The rate provided by the PTC is reduced to .9 cents per kWh for open-loop biomass (including agricultural livestock waste), municipal solid waste (including landfill gas), hydropower and small irrigation hydropower. The value of the CREB is *not* reduced for such projects, thus the Clean Energy Bond would be relatively more beneficial. A conservative estimate is that a CREB will save the cooperative a minimum of 30 percent versus an RUS loan, depending upon the project.

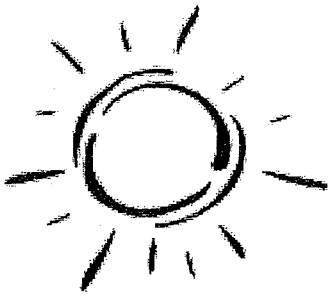
Steps to Take Immediately

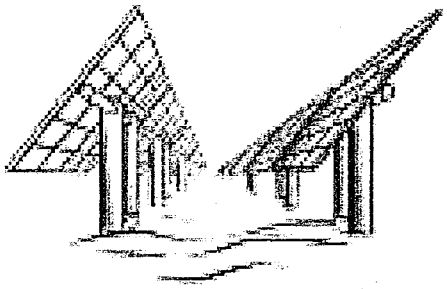
It is important for a cooperative to adopt an official intent to use the proceeds of the CREBs to finance its renewable project. This declaration would be made through a board resolution. The cooperative may reimburse itself for capital expenditures related to the construction of a project once the bonds are issued, but *only* if such a resolution is in place in advance *(see "Reimbursement" above).* Bond counsel can advise you as to the proper wording for the resolution, and NRECA can provide you with a sample resolution that would subject to review by your bond counsel.



Other Resources

There are additional resources helpful to affording renewable generation that may be combined with CREBs. Renewable energy credits ("RECs") are renewable attributes of generation that are separated from the production of electricity and sold to other utilities that must meet renewable portfolio standard requirements, or to entities that want to demonstrate that they are contributing to clean energy production. For more information on RECs, visit the Public Renewables Partnership website at http://www.repartners.org/webcast/4%20RECs%20Lieberman.pdf In addition, the USDA offers grants called "Section 9006 grants" (go to the USDA website at www.rurdev.usda.gov/rbs/farmbill/what_is.html). Finally, state incentives for renewable generation may be available.





Information as of March 3rd, 2006

For More Information

The U.S. Congress Joint Committee on Taxation has published a description of CREBs at the following link: http://www.house.gov/jct/x-60-05.pdf (JCX-60-5, July 28, 2005). Legislative text for Energy Policy Act of 2005 (P.L. 109-58) is available at http://thomas.loc.gov IRS notice 2005-98.is available at http://www.irs.gov/pub/irs-drop/n-05-98.pdf. IRS notice 2006-7 is available at http://www.irs.gov/pub/irs-drop/n-06-07.pdf. Consult the notice for additional detail not provided in this brochure, including additional application requirements, information reporting to the IRS, remedial actions in case of failure to spend bond proceeds as required and arbitrage.

NRECA Contacts

For more information on CREBs, contact Russ Wasson at 703-907-5802, or Susan Pettit at 703-907-5822.

SSVEC

SSVEC DG Proposal

Exhibit B

Supplier's Scope of Work For

Sonoita Distributed Generation Project

SSVEC WO Number#80105

Between

Sulphur Springs Valley Electric Cooperative, Inc.

A Touchstone Energy Cooperative

1348 N. Guilio Cesare Ave
Sierra Vista, Arizona 85635

And

POWER ENGINEERS

Power Engineers, INC.
3940 Glenbrook Drive
P.O. Box 1066
Hailey, ID 83333

June, 2008

Purpose of This Document:
This Exhibit B - Supplier's Scope of Work shall be incorporated in and governed by the terms of that certain Master Professional Services Agreement by and between Sulphur Springs Valley Electric Cooperative, Inc. ("SSVEC") and Power Engineers, Inc. ("Supplier") dated _____, as amended (the "Agreement"). Unless expressly provided for in this Exhibit B, in the event of a conflict between the provisions contained in the Agreement and those contained in this Exhibit B, the provisions contained in the Agreement shall prevail.

Background:
Whereby SSVEC has an Agreement with Supplier, and SSVEC has need for services as defined herein, the Supplier and SSVEC mutually agree to the following.

Project Manager for SSVEC:
The Project Manager for SSVEC on this project is:

David Bryan

office 520-720-6421 cell 520-508-7986

The Project Manager for Supplier on this project is:

Mike Walbert

office 208-788-0357 cell 208-309-1171

Project Accounting Information:

Invoices along with brief monthly report emailed to dbryan@ssvec.com and accountspayable@ssvec.com

SSVEC WO #80105

SSVEC CWP Code 1400.01

SSVEC GL Code 107.24

SSVEC Dept. Number 51

SSVEC Activity Code 666

Project Description:
SSVEC is evaluating a potential distributed generation (DG) project in the Sonoita area – SSVEC feeder number V7. This project will provide system support to a very long radial 25 kV distribution feeder which currently has four line regulators to support voltage in the area. DG is an attractive option for this location.

List of services requested:
Task 1 – Review the SSVEC analysis on the V7 Feeder
Task 2 - Site Visit
Task 3 – Report of Findings and Recommendations
Task 4 – Detailed Analysis and Final Design and Estimate of Probable Cost
Task 5 – Prepare and Execute Procurement Documents
Task 6 – Construction Supervision
Task 7 – Commissioning and Testing
Task 8 – As-Built Drawings

Specific Tasks under this Scope:
Task 1 – Review the SSVEC analysis on the V7 Feeder

SSVEC will provide Supplier with detailed feeder data including MilSoft WinMil model and various load scenarios for evaluation. Details of current line equipment including regulators, capacitors and will also be provided by SSVEC or as requested by Supplier. Additionally SSVEC will provide Supplier with load duration information. The Supplier may be required to seek related information from 3rd parties (e.g. availability of natural gas supply in the area, zoning requirements, etc). SSVEC will provide Supplier with power cost values to be used in the economic evaluation of this DG project.

The Supplier will direct a dialogue with SSVEC staff, coordinated through the assigned SSVEC Project Manager, to define SSVEC's overall goal, options currently under consideration, technical and operational concerns, and other details of the project.

The Supplier will then synthesize these data prior to a site visit (Task 2).

The Supplier will develop written Preliminary Report including the following information:

- ❑ Summary of information gathered and used in the analysis.
- ❑ Summary of preliminary findings including options for:
  - o DG technologies,
  - o DG size,
  - o locations,
  - o rough estimate of costs and cost-savings,
  - o likely interconnection and operations issues
- ❑ Preliminary recommendations (if available at this time)

- ❑ Proposed agenda for site visit. Where possible, details of information needed likely sources (SSVEC staff, outside personnel, physical review of specific sites) shall be provided by the Supplier. SSVEC Project Manager will be responsible for arranging meetings and other local logistics for this visit.

Task 1 - Deliverable(s): Short written Preliminary Report as described above.

Task 1 – Schedule: To begin immediately upon signing of this Exhibit B – SOW. To be completed within 60 calendar days. Report to be submitted not less than one week prior to scheduled Site Visit (see Task 2 below).

Task 2 – Site Visit

Upon submittal of Task 1 Preliminary Report and positive review by SSVEC, Supplier shall arrange for a site visit to the area. An agenda for this visit will be submitted after SSVEC review of the Preliminary Report and will be subject to review and revision by SSVEC. Where possible, details of information needed likely sources (SSVEC staff, outside personnel, physical review of specific sites) shall be provided by the Supplier. SSVEC Project Manager will be responsible for arranging meetings and other local logistics for this visit.

Task 2 - Deliverable(s): Complete site visit.

Task 2 - Schedule: Planning for this Task to begin immediately upon signing of this Exhibit B – SOW. Site visit to be completed within 75 days calendar days but not less than two weeks after submittal of Task 1 Preliminary Report.

Task 3 – Report of Findings and Recommendations

Supplier will provide a written report of findings and recommendations based on further evaluation of information provided in Tasks 1 and 2 above. Additional information search and analysis are likely required of the Supplier during this Task 3 effort.

The Report of Findings and Recommendations is not a complete and definitive design but rather a discussion of recommended option(s). The Supplier should make every effort to identify major considerations for each option presented – thus facilitating SSVEC's ability to evaluate options and make a decision on which option to develop.

At a minimum this report should address:

- ❑ Summary of information reviewed and used in the analysis
- ❑ Summary of all assumptions made in the analysis
- ❑ Option(s) recommended for consideration
- ❑ Discussion of each option to include:
  - o Description of DG technology and fuel source

- Description of the interconnection point and required interconnection equipment
- Estimated total capital and operating cost of the DG unit
- Estimated project economics (Cost/Benefit, NPV, or IRR) with clear statement of assumptions of costs and benefits. This will include estimated run-time for various levels of voltage support and/or demand reduction scenarios
- Summary of technical and operational issues associated with the option
- Statement of likely risks (technology, financial, operational, etc)
- Major equipment lead times and likely commissioning date
- Summary of the Supplier's evaluation of the option

- ❑ Supplier's summary evaluation of all options considered
- ❑ Supplier's recommendation(s)
- ❑ Additional detail on one (or more) recommended option(s). This is the Supplier's recommendation based on the information available up to this point in the project development. The report should contain manufacturer specifications for major components (DG unit, interconnection and relaying/protection equipment, additional line equipment if necessary). This section of the report should also include a Gantt chart or other graphic representation of likely project implementation schedule with a summary of each task.
- ❑ The use of graphics and maps for illustration is encouraged.
- ❑ Where possible, data files should be provided to SSVEC for internal review and analysis

Task 3 - Deliverable(s): Written Report of Findings and Recommendations as described above.

Task 3 - Schedule: Within 90 days of signing of this Exhibit B – SOW.

Task 4 – Detailed Analysis and Final Design and Estimate of Probable Cost

Based on internal evaluation by SSVEC of the Report of Findings and Recommendations, the Supplier may be requested in writing via a formal Notice to Proceed to begin further analysis and design on one or more DG option.

The scope of work (SOW) for this task is dependent on the generation option selected by SSVEC. This SOW will be defined once a generation option is selected. For example there may be design required for the generation interconnection but no detailed design required for a generator package supplied by a manufacturer.

Tasks 5, 6, 7, and 8 are also dependent on the options selected and the SOW will need to be determined once an option is selected.

Task 4 - Deliverable(s): To be determined

Task 4 - Schedule: To be determined

Task 5 – Prepare and Execute Procurement Documents

Task 5 - Deliverable(s): To be determined

Task 5 - Schedule: To be determined

Task 6 – Construction Supervision

Task 6 - Deliverable(s): To be determined

Task 6 - Schedule: To be determined

Task 7 – Commissioning and Testing

Task 7 - Deliverable(s): To be determined

Task 7 - Schedule: To be determined

Task 8 – As-Built Drawings

Task 8 - Deliverable(s): To be determined

Task 8 - Schedule: To be determined

Supplier Resources Allocated to this Project:

The Supplier has reviewed the Project Description and Tasks herein and intends to use the following resources to complete this project:

- Supplier's Project Management personnel:
  - Mike Walbert – Senior Project Manager I
  - Laurie Robinson – Project Manager Assistant I
- Supplier's Generation personnel:
  - David Gardner – Senior Project Manager III
  - Jack Groves – Senior Project Manager II
  - Mike Lidinsky – Senior Project Manager II
- Supplier's SCADA and Analytical Services (SAS) personnel
  - John Kumm – Senior Project Manager I
  - John Squire – Engineer III
  - Rob Schaerer – Engineer II

Hourly Rate for Services:

Supplier agrees to provide the services described herein in accordance with the hourly rate schedule as provided to SSVEC in January 2008 or newer. In no case shall the total amount billed to SSVEC exceed ___$150,000.00___ without prior written agreement from SSVEC (see Master Professional Services Agreement for detail).

Payment for hourly rate for services shall be in accordance to the following schedule:

Task Number	Deliverable	Fee Amount for Task
Tasks 1 thru 3	**Brief Monthly Report of Activities under this task.**	Based on monthly report of hourly services and associated expenses.
Tasks 4 thru 8	**Brief Monthly Report of Activities under this task.**	Based on monthly report of hourly services and associated expenses.

Liquidated Damages:

In accordance with terms of the Master Professional Services Agreement, liquidated damages are hereby established at the rate of _____Not Applicable in the SOW_____if Supplier does not meet schedule of services as presented herein.

Acceptance:

FOR SULPHUR SPRINGS VALLEY ELECTRIC COOPERATIVE, INC. (SSVEC)

Signature: _____

Name:

Title:

Date:

FOR POWER ENGINEERS, INC. (SUPPLIER)

Signature: _____

Name:

Title:

Date:

October 31, 2008

SULPHUR SPRINGS VALLEY ELECTRIC COOPERATIVE

Feeder V7

Sonoita Distributive Generation Study

Revision A

PROJECT NUMBER:
114730

PROJECT CONTACT:
SCOTT RAY
EMAIL:
SCOTT.RAY@POWERENG.COM
PHONE:
503-293-7171

PROJECT CONTACT:
JOHN SQUIRE
EMAIL:
JSQUIRE@POWERENG.COM
PHONE:
503-293-7164

PROJECT CONTACT:
MIKE WALBERT, P.E.
EMAIL:
MWALBERT@POWERENG.COM
PHONE:
208-788-0357

POWER

Sonoita Distributive Generation Study

Prepared by POWER Engineers, Inc. for

Sulphur Springs Valley Electric Cooperative

Feeder V7

For additional information contact:

Scott Ray	(503) 293-7171	scott.ray@powereng.com
John Squire	(503) 293-7164	jsquire@powereng.com
Mike Walbert, P.E.	(208) 788-0357	mwalbert@powereng.com

Rev.	Issue Date	Issued For	Prep By	Chkd By	Appd By	Notes
A	10/31/08	Appvl	SDR	JFS	JM	Issued for client review

"Issued For" Definitions:

- "Prelim" means this document is issued for preliminary review, not for implementation
- "Appvl" means this document is issued for review and approval, not for implementation
- "Impl" means this document is issued for implementation
- "Record" means this document is issued after project completion for project files

Use Alpha (A, B, . .) Rev. identifiers for "Prelim" or "Appvl" issues. Otherwise use numeric (0, 1, . . .)

Table of Contents

Table of Contents ii
Appendices ii
List of Tables iii
Table of Figures iii

1.0 Executive Summary 1

2.0 Introduction 2
2.1 Project Description 2
2.2 Data Review 2

3.0 Analysis 5
3.1 Introduction 5
3.2 Load Flow Analysis Results 6
3.2.1 Results Before Islanding 6
3.2.2 Switch and Generator Locations 8
3.2.3 Results After Islanding 9

4.0 Protection Considerations 11
4.1 Generator 11
4.2 Distribution Line 12

5.0 Communications Considerations 13

6.0 Generator Set Data and Estimate of Probable Cost 13
6.1 Generator Data 13
6.2 Other Data 14
6.2.1 Warranty 14
6.2.2 Operations and Maintenance 14
6.2.3 Noise 14
6.2.4 Permitting 15
6.2.5 Renting Options 15
6.2.6 Natural Gas 15
6.2.7 Recommendations 15
6.2.8 Gen Sets 15

Appendices

Appendix A: Vendor Generator Data Sheets 16

List of Tables

Table 1: Existing Load at PD.3918 in WindMil Model 4
Table 2: Division of 6,900 kVA Peak Load at PD.3918 5
Table 3: WindMil Load Flow Results 8
Table 4: Sonoita to Patagonia Loading (Islanded) 9
Table 5: Feeder V7 Marginal Voltage Sections (Islanded) 10
Table 6: Huachuca West Loading (Islanded) 10
Table 7: Vendor Generator Data 14

Table of Figures

Figure 1: Feeder V7 Peak Loading 3
Figure 2: Feeder V7 Load Duration Curve 4
Figure 3: Map of Locations Analyzed 7

1.0 Executive Summary

Sulphur Springs Valley Electric Cooperative, Inc. (SSVEC) contracted POWER Engineers, Inc. (POWER) to provide technical assistance in regards to adding distributive generation to its V7 Feeder fed from the Huachuca West Substation. The purpose of this study is to provide an engineering analysis for SSVEC in regards to adding distributive generation to its V7 Feeder. Part of this project is to determine a location on the V7 Feeder where the circuit could be opened to allow a 2 MW generator to serve peak load to reduce the loading at the substation and on the 1/0 ACSR mainline of the feeder. A peak substation load of 6,900 kVA was used as the basis for the analysis with an annual growth of 2% for the entire V7 Feeder. The 2 MW generator would be able to serve most of the line between the cities of Sonoita and Patagonia, Arizona for three years beyond the peak year.

2.0 Introduction

2.1 Project Description

The purpose of this study is to provide an engineering analysis for SSVEC in regards to adding distributive generation to its V7 Feeder. The V7 Feeder is fed from the Southwest Transmission Cooperative at 69 kV and is stepped down to 24.9 kV at the Huachuca West Substation to serve consumers in the Rain Valley, Elgin, Sonoita and Patagonia areas of Arizona. In recent years, the feeder has reached its load-serving limit of around 7,000 kVA. In order to better serve its existing consumers, and to accommodate growth in the area, SSVEC plans to construct a new substation and associated transmission line in the Sonoita area.

Until this new substation is constructed, SSVEC plans to install a 2 MW generator (diesel or natural gas) on the V7 Feeder to operate in peak loading conditions. This generator will be installed and run "islanded" from the rest of the feeder. Load flow analysis was used to determine the optimal location to place a switch to open the feeder in order to run the generator islanded. This study also explores other aspects of adding distributive generation to a feeder including protection on the distribution line and for the generator, and communications between the substation and the generator.

Note, voltage flicker and frequency deviation on the feeder due to the generator were not addressed in this study. When a more detailed analysis is performed this should be addressed.

2.2 Data Review

The Huachuca West Substation is a single-feeder facility. The V7 Feeder is a radial feeder consisting of 311 miles of primary line and approximately 50 miles of secondary. The feeder is fed from a 69-24.9kV 5,000/7,000 kVA transformer. In previous studies conducted by SSVEC, it was determined that the substation has reached its maximum capacity and in order to continue to serve its existing and future consumers, a series of improvements would be required. Figure 1 is a graph of peak load growth over the past ten years. January 2007 saw a peak substation load of 6,900 kVA.

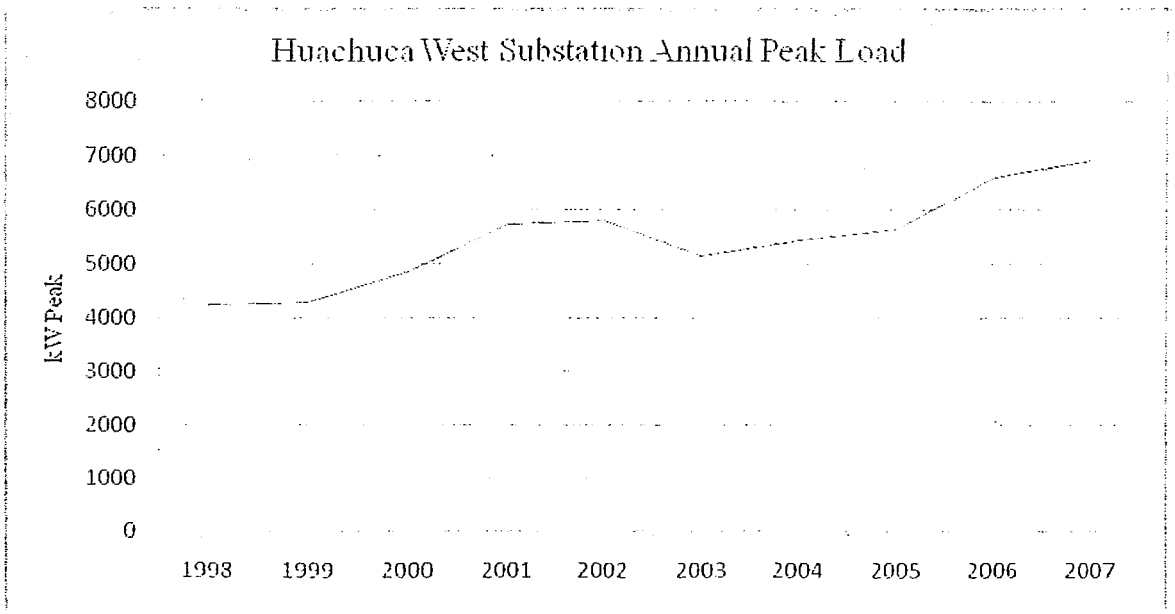


Figure 1: Feeder V7 Peak Loading

One of the solutions to alleviate some of the load from the Huachuca West Substation and the V7 Feeder during these peak times is using distributive generation. In studies conducted by SSVEC, it was determined that a 2 MW generator could be purchased and installed on the system to be run during these peak times. The generator being considered for this application is a portable unit that is skid/trailer mounted; giving SSVEC the flexibility of moving it to other locations within their system once its use on the V7 Feeder is no longer required. At this time, how the generator will be connected to the distribution system is still being taken into consideration. It will either be connected directly at 24.9 kV or will be connected through a generation voltage to 24.9 kV step-up transformer. According to these studies based on load data between November 2006 and November 2007, this generator would only need to be run during peak conditions, which is a very small period of time each year.

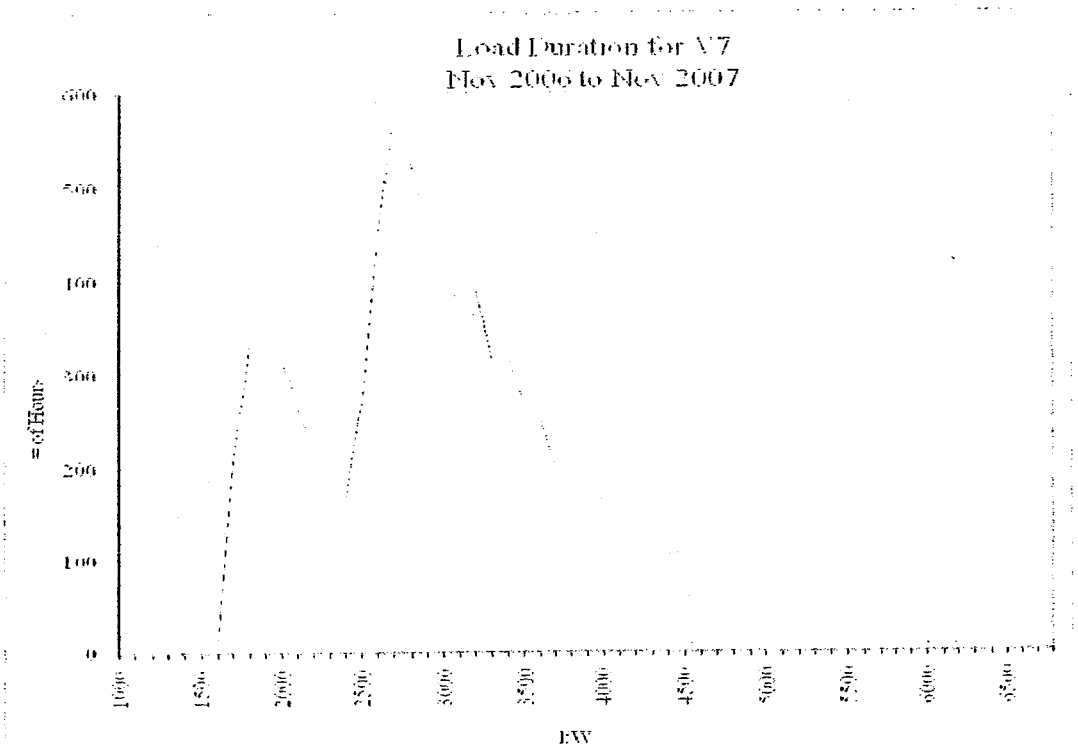


Figure 2: Feeder V7 Load Duration Curve

In order to facilitate this study to determine the optimal location for the generator, POWER received a copy of SSVEC's latest Milsoft WindMil model "HuachucaWest JUL08SYS Jul 07Bill July07Alloc Reduc". SSVEC indicated that the January 2007 peak loading of 6,900 kVA was to be used as the basis for the analysis. The WindMil model contained load data at the Load Control Point PD.3918 as shown in Table 1.

Table 1: Existing Load at PD.3918 in WindMil Model

	kW	kvar	% PF	Calculated kVA	kVA % of Total
A-Phase	2,097	438	97.9	2,141	34.0
B-Phase	1,969	332	98.6	1,997	31.7
C-Phase	2,157	102	99.9	2,159	34.3
Total	6,223	872		6,297	100.0

The by-phase breakdown of the peak load of 6,900 kVA was unknown. It was assumed that the by-phase percentage allocation of the 6,900 kVA would follow the same percentage allocation

that was already being used in the model. The kW and kVAr data in Table 2 was input into the WindMil model and used to distribute the load among the down-line circuit elements.

Table 2: Division of 6,900 kVA Peak Load at PD.3918

	kVA % of Total	kVA	kW	kvar	% PF
A-Phase	34.0	2,346	2,297	480	97.9
B-Phase	31.7	2,187	2,157	364	98.6
C-Phase	34.3	2,367	2,364	112	99.9
Total	100.0	6,900	6,818	955	

Other data and guidance received from SSVEC included:

- A 2% growth is to be used for 3 years to grow the peak load of 6,900 kVA.
- Previous reports by SSVEC that have led up to this study.
- The allocation of load is to be the same as what is already in the WindMil model.
- If necessary, 124 V can be used as the output voltage on regulators.
- The three Capacitor banks have been turned off due to voltage rise concerns on the feeder.

3.0 Analysis

3.1 Introduction

Before any load flow analysis was performed, the general layout of the V7 Feeder was analyzed to determine where the generator could potentially be located. Maps of the area were also taken into consideration to determine what population centers were in the vicinity.

Feeder V7 is a long radial feeder. The feeder originates from the Huachuca West Substation and runs primarily west toward Sonoita. When the feeder reaches Sonoita, it branches off to the north, to the southwest (toward Patagonia) and to the southeast (in the direction of Ft. Huachuca). Due to this configuration at Sonoita, the possible locations of where to locate the generator and where to open the feeder to island the generator are limited. The lines that branch to the north and to the southeast are either short or primarily single-phase. The line southwest to Patagonia feeds the majority of the load past Sonoita. SSVEC has a branch office in Patagonia. Opening the feeder between Sonoita and Patagonia therefore is the focus of this study.

3.2 Load Flow Analysis Results

3.2.1 Results Before Islanding

In previous studies conducted by SSVEC the purchasing of a 2 MW generator was looked into. This 2 MW rating is based on a 0.8 power factor. At unity power factor, this generator could serve 2.5 MW (2.5 MVA), but in order to provide var support for the portion of the feeder it will be serving, the actual real power output would be 2 MW. The 2 MW output at 0.8 power factor was used as the maximum loading to determine where on the feeder to place an open point to run the generator islanded.

Load flow analysis was performed on the V7 Feeder utilizing the base allocation of the 6,900 kVA of peak load and then growing the entire feeder load by 2% for three successive years. To determine where the feeder can be opened in regards to loading on the feeder, the primary quantity examined was kW by-phase. The by-phase kW flow was examined for six line sections. Using their WindMil designations, these six sections are:

- PL.45024
- PL.44871
- PL.44818
- PL.45483
- PL.44284
- PL.45240

The first five of these locations were chosen as they occur at two locations in Sonoita where the feeder branches off. The sixth location, PL.45240 was chosen, as it is a line segment between Sonoita and Patagonia. Figure 3 shows these locations in relation to the rest of the V7 Feeder.

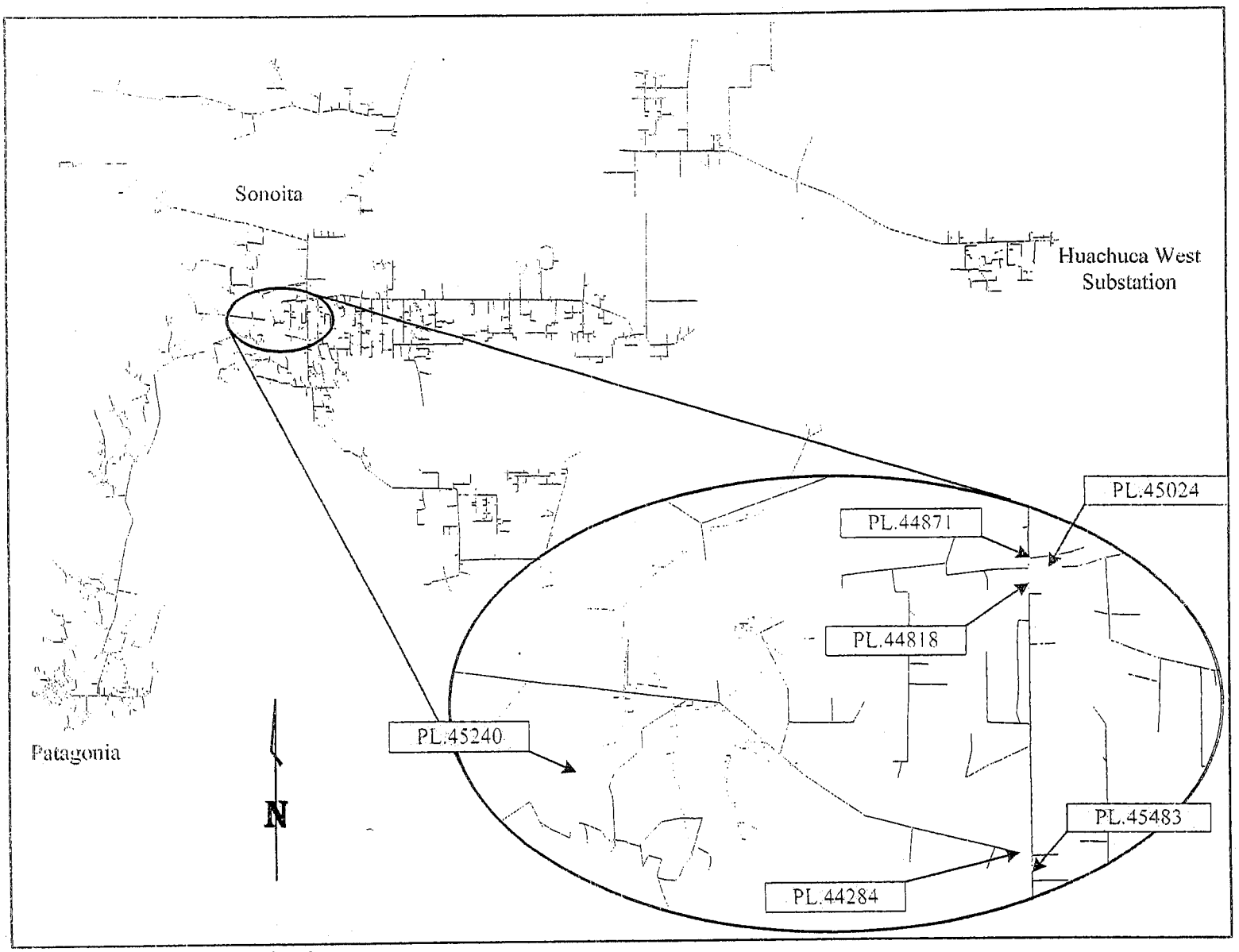


Figure 3: Map of Locations Analyzed

The results of the load flows for these six locations can be seen in Table 3. This table contains data for all six locations for the base year and three successive years utilizing a 2% load growth each year on the entire feeder.

Table 3: WindMil Load Flow Results

Element Name	A-Phase (kW)	B-Phase (kW)	C-Phase (kW)	Total (kW)
PL.45024				
Base Year	1,285	1,415	1,507	4,207
Year 1	1,308	1,442	1,539	4,289
Year 2	1,336	1,472	1,569	4,377
Year 3	1,364	1,504	1,604	4,472
PL.44871				
Base Year	138	259	675	1,072
Year 1	141	264	691	1,096
Year 2	144	269	705	1,118
Year 3	147	275	719	1,141
PL.44818				
Base Year	1,141	1,119	830	3,090
Year 1	1,162	1,140	847	3,149
Year 2	1,187	1,164	863	3,214
Year 3	1,211	1,189	884	3,284
PL.45483				
Base Year	299	647	102	1,048
Year 1	304	659	104	1,067
Year 2	311	671	106	1,088
Year 3	317	687	108	1,112
PL.44284				
Base Year	758	461	725	1,944
Year 1	772	470	739	1,981
Year 2	789	481	753	2,023
Year 3	805	489	772	2,066
PL.45240				
Base Year	742	441	693	1,876
Year 1	756	449	707	1,912
Year 2	772	459	720	1,951
Year 3	787	468	738	1,993

3.2.2 Switch and Generator Locations

Based on these results, and if this generator is only going to be utilized for three years beyond the base year, the optimal location to open the feeder is at the beginning of the line section designated as PL.45240. According to the analysis by the third year, the kW and load current flowing through this section will be just under the 2 MW capacity of the generator. This line section is approximately 4.15 miles from where the mainline branches toward Patagonia from Sonoita.

Due to the rural nature of the area, there are only two population centers fed by this section of line, Sonoita and Patagonia. Considering this, the location of where to connect the generator is limited to these two general areas. If the generator were to be connected to the line at the open point, it would be approximately 4 miles outside of Sonoita along Arizona Highway 82. Although this location is more isolated to locate the generator, it would allow personnel to open the circuit and start the generator at the same time. The downside with this location would be that it is more isolated and if the generator were to go down, crews would probably be required to travel from Patagonia to the generator site.

The other option would be to locate the generator in Patagonia, where SSVEC has a branch office. With the office in Patagonia, this location would make it easier for crews to get to in case the generator was to go down. The downside of this location is that it would be on the opposite side of the feeder from the open point on the feeder and would require coordinating opening the switch and starting the generator.

3.2.3 Results After Islanding

After the line to Patagonia is disconnected and with the generator as the power source, the voltages on this islanded section of line are maintained at or above 118 volts on a 120 volts basis whether the line is being fed from the Sonoita or Patagonia ends. The loading on this section at the generator for the base year and the three successive years, with a 2% load increase per year is as shown in Table 4.

Table 4: Sonoita to Patagonia Loading (Islanded)

Element Name	A-Phase (kW)	B-Phase (kW)	C-Phase (kW)	Total (kW)
Load at Generator				
Base Year	740	439	692	1,871
Year 1	755	448	706	1,909
Year 2	771	457	720	1,948
Year 3	786	466	734	1,986

After the line to Patagonia is disconnected the rest of the feeder fed from Huachuca West Substation maintains voltages greater than 118 volts on a 120 volts base with exception to those line sections directly preceding the voltage regulators on the system. Table 5 shows the lowest reported voltages in these areas and the voltage regulator associated with these line sections.

Table 5: Feeder V7 Marginal Voltage Sections (Islanded)

Line Section	Associated Regulator		Base Year Voltage		Year 1 Voltage		Year 2 Voltage		Year 3 Voltage	
	WindMil ID	Location	Volts	Ph.	Volts	Ph.	Volts	Ph.	Volts	Ph.
PL.44281	RG.69	Rain Valley	116.8	B	116.3	B	116.0	B	115.5	B
PL.44277							117.9	B	117.5	B
PL.70076	RG.64	Canelo					118.0	B	117.8	B
PL.70077							117.9	B	117.7	B
PL.44597							117.9	B	117.7	B
PL.45314							117.9	B	117.7	B
PL.45313							117.9	B	117.7	B
PL.45315							117.9	B	117.7	B
PL.44598							117.9	B	117.7	B
PL.46265							117.8	B	117.6	B
PL.53935								B	117.9	B
PL.70075								B	117.8	B
PL.53934								B	117.9	B

The primary reason for these low voltages is due to the substation load becoming unbalanced after the line to Patagonia is opened. After the line is opened, B-phase becomes the more predominantly loaded phase. Table 6 shows the loading at the Huachuca West Substation with the line to Patagonia opened.

Table 6: Huachuca West Loading (Islanded)

Element Name	A-Phase (kW)	B-Phase (kW)	C-Phase (kW)	Total (kW)
Load on Secondary of Substation Transformer				
Base Year	1,263	1,586	1,419	4,268
Year 1	1,297	1,630	1,445	4,372
Year 2	1,326	1,666	1,479	4,471
Year 3	1,355	1,702	1,508	4,565

In the previous studies conducted by SSVEC, the goal for the generator was to reduce the load on the 1/0 ACSR mainline to below 5 MW, and reduce the overall substation loading during the peak loading times. This would be accomplished by installing the generator and running the system islanded.

4.0 Protection Considerations

4.1 Generator

Because the generator will be used as a primary power source and not as a distributed resource in parallel with the rest of the distribution system, the protection for this generator should follow recommended IEEE practice as laid out in IEEE Standard C37.102 "IEEE Guide for AC Generator Protection." Based on this standard, at a minimum the following protection elements should be used include (referenced by their ANSI Device Number):

- 21 - Distance relay used as a backup for a system generator zone phase fault. This would require a time delay for coordination. Either this element or a 51V or 51C element should be used for this type of protection.
- 24 – Volts per hertz protection for the generator to prevent thermal damage to the generator caused by the over excitation of the generator.
- 27 – Undervoltage protection against undesirable effects such as a reduction instability and excessive import of reactive power from the feeder.
- 32 – Reverse power protection of the prime mover of the generator that may be damaged during a motoring condition.
- 40 – Loss-of-Field protection which may be caused by accidental tripping of a field breaker, field open circuit, field short circuit or voltage regulation failure.
- 46 – Stator unbalanced current protection or negative-sequence protection to protect against unbalanced system conditions or unbalanced faults.
- 51V or C – Voltage-restrained or voltage controlled time-overcurrent relay. Backup for system and generator zone phase faults. Either this element or a 21 element should be used for this type of protection.
- 59 – Overvoltage protection, which provides similar protection as the 24 element to protect the generator against overexcitation or overspeeding.
- 64S - 100% stator ground fault protection with subharmonic voltage injection.
- 81 – Frequency relay. Both underfrequency and overfrequency protection may be required.
- 87G - Differential protection. Primary phase fault protection for the generator. This can be considered optional depending on the size of the generator and whether CTs can be installed.

- 87T – Differential protection. Primary protection for a GSU transformer. This element will not be required if the generator is connected directly to the distribution system at 24.9 kV. Depending on the size of transformer use, this may not be required.

Since SSVEC already uses Schweitzer Engineering Laboratories (SEL) relays for protection within its distribution substations, the SEL 300G relay would be suitable for this application. This relay utilizes these functions and may provide a compact solution that will fit in with the trailer mounted generator scheme.

4.2 Distribution Line

For the generator to serve the section of feeder between Sonoita and Patagonia, the feeder needs to be opened. A recloser should be placed just upstream of the generator interconnection point. A recloser of the same types already in use on the V7 Feeder could be used for this function.

The fault currents on this section of line will differ depending on if this section is being fed from the Huachuca West Substation or from the generator. According to the fault analysis conducted in WindMil on the V7 Feeder, and using the source impedances provided with the model from SSVEC, the three-phase fault currents at the chosen open point (line section PL.45240) is 361 amperes. Using a subtransient reactance of 15% on the generator base of 2.5 MVA the generator will contribute 386 amperes of fault current if it is connected directly to the feeder at 24.9 kV. If the generator is connected to the feeder through a generator voltage to 24,900 volt GSU transformer using an IEEE typical impedance of 6.5% on a transformer base of 3 MVA, the three-phase fault current on the feeder will be 284 amperes.

Normally the fault currents contributed by the generator would be less than with the feeder fully connected due to the smaller capacity of the generator. However, with the V7 Feeder being of a long length, the accumulated impedance to the open point is significant. The distance back to the substation from the open point is approximately 26 miles. In this distance, the accumulated positive sequence impedance is $24.91+j31.17\ \Omega$ and the accumulated zero sequence impedance is $31.17+j39.44\ \Omega$, which accounts for the low fault currents.

If the generator is to be connected directly to the distribution system at 24.9 kV, it appears the existing feeder protection may be adequate for when the generator is in service. If the generator is to go through a GSU transformer then the protection may need to be re-evaluated on this part of the feeder due to the lower fault currents.

5.0 Communications Considerations

In order for SSVEC to monitor the generator's operating state as well as its power output, a communications processor would be required. A NovaTech Orion5r communication processor located at the generator trailer would be sufficient. SSVEC already uses this processor in other applications at its substations. This processor has 16 ports as well as 4 hardwired inputs and 4 hardwired outputs which should be able to accommodate the required IEDs for this application. The Orion5r would poll the SEL 300G as well as other IEDs installed at the generator site and would in turn then be polled by the SSVEC master station. Also to be used in this set up would be an SEL-2401. The SEL-2401 is a GPS clock that would be providing time information to all devices at the generator and is used by SSVEC at other sites. A PML 6200 would be used to meter the generator at the generator trailer. The Orion5r would communicate with the substation via radio through the SSVEC Master network.

6.0 Generator Set Data and Estimate of Probable Cost

6.1 Generator Data

The generator set data was based on the following:

- Diesel Fuel
- Portable
- Weather enclosure
- 24 hr fuel tank
- 2400/4160 voltage
- Skid mounted on a trailer
- Sound attenuation
- Automatic transfer switch
- To be connected to an existing distribution feeder

POWER contacted three suppliers that provide comparable generator sets that could be used in this application. The estimated cost for all three vendors is very competitive and estimated to be in the $675,000 to $775,000 range. Table 7 below provides a brief overview of the three models reviewed.

Table 7: Vendor Generator Data

Vendor	Model	kW/kVA	Generator	Emissions	Cooling	Fuel Consumption @ 100% load
Caterpillar	2000 ekW	2000/2500	3 phase 60 Hz brushless	EPA Tier 2	Water cooled	138.9 gal/hr
Cummins	DQKAB	2000/2500	3 phase 60 Hz brushless	EPA Tier 2	Water cooled	137.9 gal/hr
Kohler	2000REOZM	2000/2500	3 phase 60 Hz brushless	EPA Tier 2	Water cooled	134.5 gal/hr

6.2 Other Data

6.2.1 Warranty

Each vendor offers a standard limited one-year warranty with optional two, five and ten year extended warranties available.

6.2.2 Operations and Maintenance

Estimated cost for O&M is $700 per hour of operation. The units are considered self contained and can be placed in standby mode with an automatic transfer switch engaging the unit when needed. The gen set comes with system protection to prevent catastrophic failures. As with any reciprocating engine, regular preventative maintenance is required and each manufacturer has similar service interval recommendations. Running inspections are recommended during operation.

6.2.3 Noise

It is important that noise generated from the gen set is considered when locating the unit. Typical sound levels can be as high as 80 db with the sound attenuation package. Normal conversation is 58 db and freeway noise is 70 db. Locating a unit near any residential or commercial neighborhoods can be difficult.

6.2.4 Permitting

A portable gen set can be problematic with permitting. The Arizona Department of Environmental Quality (ADEQ) will most likely require that an air permit application be submitted each time the gen set is relocated. This may cause scheduling difficulties and extra costs. The gen sets reviewed meet the EPA Tier 2 criteria, which mean that the units are low emitters, and satisfy most stringent air permitting requirements. However, a stationary gen set is a better solution in obtaining an air permit because only one application process is required. It is advisable that discussions should be conducted with Sulphur Springs Valley Electric Cooperative and the ADEQ before proceeding.

6.2.5 Renting Options

There are many options to renting units for short periods of time and many levels of cost. The actual cost of renting depends on the configuration and services provided. Services that need to be identified are set up, operation oversight and fuel costs. POWER contacted a local Cummins supplier in Phoenix that is very willing to discuss renting options further. POWER can provide this contact information if interested. Typically, purchasing the unit should be considered if it will be used more than one year.

6.2.6 Natural Gas

Each gen set reviewed is also available in a natural gas model. Natural gas operating gen sets are easier to maintain and operate cleaner than diesel units. Typically, there are no visible emissions from the stack. Natural gas is typically less expensive to operate. Natural gas units should be considered if the unit will be stationary and fuel supply is nearby.

6.2.7 Recommendations

The generator set vendors are very competitive and each provides high quality and reliable products.

6.2.8 Gen Sets

Vendor information for each model reviewed can be found in Appendix A.

Appendix A:

Vendor Generator Data Sheets

DIESEL GENERATOR SET

CATERPILLAR®

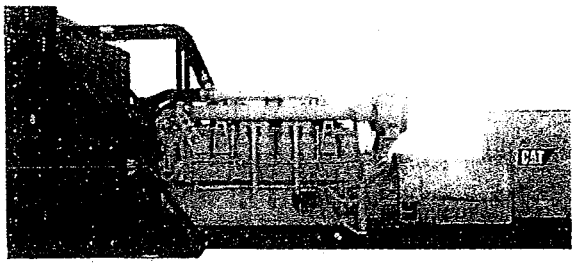


Image shown may not reflect actual package.

STANDBY
2000 ekW 2500 kVA
60 Hz 1800 rpm 480 Volts

Caterpillar is leading the power generation marketplace with Power Solutions engineered to deliver unmatched flexibility, expandability, reliability, and cost-effectiveness.

FEATURES

FUEL/EMISSIONS STRATEGY
- EPA Tier 2

DESIGN CRITERIA
- The generator set accepts 100% rated load in one step per NFPA 110 and meets ISO 8528-5 transient response.

UL 2200
- UL 2200 listed packages available. Certain restrictions may apply. Consult with your Caterpillar Dealer.

FULL RANGE OF ATTACHMENTS
- Wide range of bolt-on system expansion attachments, factory designed and tested

SINGLE-SOURCE SUPPLIER
- Fully prototype tested with certified torsional vibration analysis available

WORLDWIDE PRODUCT SUPPORT
- Caterpillar® dealers provide extensive post sale support including maintenance and repair agreements
- Caterpillar dealers have over 1,600 dealer branch stores operating in 200 countries
- The Cat® S•O•S℠ program cost effectively detects internal engine component condition, even the presence of unwanted fluids and combustion by-products

CAT 3516C TA DIESEL ENGINE
- Reliable, rugged, durable design
- Field-proven in thousands of applications worldwide
- Four-stroke-cycle diesel engine combines consistent performance and excellent fuel economy with minimum weight

CAT SR4B GENERATOR
- Matched to the performance and output characteristics of Caterpillar engines
- Segregated low voltage AC/DC accessory box provides single point access to accessory connections
- UL 1446 Recognized Class H Insulation

CAT EMCP 3 SERIES CONTROL PANELS
- Simple user friendly interface and navigation
- Scalable system to meet a wide range of customer needs
- Integrated Control System and Communications Gateway

STANDBY 2000 ekW 2500 kVA

60 Hz 1800 rpm 480 Volts

CATERPILLAR®

FACTORY INSTALLED STANDARD & OPTIONAL EQUIPMENT

System	Standard	Optional
Air Inlet	• Single element canister type air cleaner • Service indicator	• Dual element & heavy duty air cleaners (with pre-cleaners) • Air inlet adapters & shutoff
Cooling	• Radiator with guard (43°C) • Coolant drain line with valve • Fan and belt guards • Caterpillar Extended Life Coolant • Low coolant level & high temperature alarm or shutdown	• Radiator duct flange • Jacket water heater
Exhaust	• Dry exhaust manifold • Flanged faced outlets	• Mufflers and Silencers • Stainless steel exhaust flex fittings • Elbows, flanges, expanders & Y adapters
Fuel	• Secondary fuel filters • Fuel priming pump • Flexible fuel lines • Fuel cooler* *Not included with packages without radiators	• Water separator • Duplex fuel filter
Generator SR4B	• Class H insulation • Class F temperature (105°C prime/130°C standby) • Winding temperature detectors(select models)	• Oversize & premium generators • Anti-condensation space heaters • Bearing temperature detector • Stator temperature detector
Power Termination	• Bus bar (NEMA and IEC meachanicallug holes) -right side standard • Top and bottom cable entry	• Circuit breakers, UL listed, 3 pole with shunt trip, 80% or 100% rated, choice of trip units, manual or electrically operated (low voltage only) • Circuit breakers, IEC compliant, 3 or 4 pole with shunt trip (low voltage only), choice of trip units, manual or electrically operated • Shroud cover for bottom cable entry • Power terminations can be located on the left and/or rear as an option. Also, multiple circuit breakers can be ordered (up to 3)
Governor	• ADEM™ 3	• Load share module
Control Panels	• User Interface panel (UIP) - rear mount (standard) • EMCP3.1 Genset Controller • Speed adjust (on panel) • AC&DC customer wiring area (right side) • CAT digital voltage regulator (CDVR) with KVAR/PF control, 3-phase sensing • Emergency Stop Pushbutton	• EMCP 3.3 • Option for right or left mount UIP • Local & remote annunciator modules • Load share module • Discrete I/O module • Generator temperature monitoring & protection • Voltage Adjust (on panel)
Lube	• Lubricating oil and filter • Oil drain line with valves • Fumes disposal • Gear type lube oil pump	• Oil level regulator • Deep sump oil pan • Electric & air prelube pumps • Manual prelube with sump pump • Duplex oil filter
Mounting	• Structual steel tube • Anti-vibration mounts (shipped loose)	• Isolator removal
Starting/Charging	• 24 volt starting motor(s) • Batteries with rack and cables • Battery disconnect switch	• Battery chargers (10&20AMP) •45 amp charging alternator • Oversize batteries • Ether starting aid • Heavy duty starting motors • Barring device (manual) • Air starting motor with control & silencer
General	• Right-hand service • Paint - Caterpillar Yellow except rails and radiators are gloss black • SAE standard rotation • Flywheel and flywheel housing - SAE No. 00	• CSA certification • EU Certificate of Conformance
Note	Standard and optional equipment may vary for UL 2200 Listed Packages. UL 2200 Listed packages may have oversized generators with a different temperature rise and motor starting characteristics.	

STANDBY 2000 ekW 2500 kVA

60 Hz 1800 rpm 480 Volts

CATERPILLAR®

SPECIFICATIONS

CAT GENERATOR

Frame.....825
Excitation..... Permanent Magnet
Pitch.....0.6667
Number of poles.....4
Number of bearings..... 1
Number of leads.....6
Insulation..... UL 1446 Recognized Class H with tropicalization and antiabrasion
IP Rating.....Drip Proof IP22
Alignment.....Pilot Shaft
Overspeed capability..... 125%
Wave form..... 2%
Paralleling kit/Droop transformer..... Standard
Voltage regulator.3 Phase sensing with selectible volts/Hz
Voltage regulation .....Less than +/- 1/2% (steady state)
Less than +/- 1/2% (w/3% speed change)
Telephone influence factor.....Less than 50
Harmonic distortion..... Less than 5%

CAT DIESEL ENGINE

3516C ATAAC V-16, 4 Stroke, water-cooled diesel
Bore..... 170.00 mm (6.69 in)
Stroke..... 190.00 mm (7.48 in)
Displacement.....69.00 L (4210.64 in³)
Compression Ratio..... 14.7:1
Aspiration.....TA
Fuel System..... Electronic unit injection
Governor Type..... ADEM3

CAT EMCP3 CONTROL PANELS

EMCP 3.1 (standard)
EMCP 3.2 & 3.3 (Optional)
24 Volt DC control
Generator insturments designed to meet UL/CSA/CE
Integral generator terminal box
Single location for customer connection
MODBUS isolated data link (RS0485 half-duplex) supports serial communication at data rate up to 33.6 kbaud
Auto start/stop control
True RMS metering, 3-phase
• Digital indication for:
-RPM
-Operating hours
-Oil pressure
-Coolant temperature
- System DC volts
--L-L volts, L-N volts, phase amps, Hz
-Ekw, kVA, kVAR, kW-hr, %kW, PF
• Shutdowns with indicating lights for:
-Low oil pressure
-High coolant temperature
- Low coolant level
- Overspeed
-Overspeed
-Emergency stop
- Failure to start (over crank)
• Programmable protective relay functions:
- Under and over voltage
- Under and over frequency
- Reverse power
- Overcurrent (phase & total)
-

STANDBY 2000 ekW 2500 kVA

60 Hz 1800 rpm 480 Volts

CATERPILLAR

TECHNICAL DATA

Open Generator Set - - 1800 rpm/60 Hz/480 Volts	DM8263	
EPA Tier 2		
Generator Set Package Performance		
Genset Power rating @ 0.8 pf	2500 kVA	
Genset Power rating with fan	2000 ekW	
Coolant to aftercooler		
Coolant to aftercooler temp max	50 ° C	122 ° F
Fuel Consumption		
100% load with fan	525.7 L/hr	138.9 Gal/hr
75% load with fan	408.2 L/hr	107.8 Gal/hr
50% load with fan	294.2 L/hr	77.7 Gal/hr
Cooling System[1]		
Air flow restriction (system)	0.12 kPa	0.48 in. water
Air flow (max @ rated speed for radiator arrangement)	2480 m³/min	87580 cfm
Engine Coolant capacity with radiator/exp. tank	475.0 L	125.5 gal
Engine coolant capacity	233.0 L	61.6 gal
Radiator coolant capacity	242.0 L	63.9 gal
Inlet Air		
Combustion air inlet flow rate	180.3 m³/min	6367.2 cfm
Exhaust System		
Exhaust stack gas temperature	405.4 ° C	761.7 ° F
Exhaust gas flow rate	428.6 m³/min	15135.9 cfm
Exhaust flange size (internal diameter)	203.2 mm	8.0 in
Exhaust system backpressure (maximum allowable)	6.7 kPa	26.9 in. water
Heat Rejection		
Heat rejection to coolant (total)	765 kW	43505 Btu/min
Heat rejection to exhaust (total)	1804 kW	102593 Btu/min
Heat rejection to aftercooler	666 kW	37875 Btu/min
Heat rejection to atmosphere from engine	137 kW	7791 Btu/min
Heat rejection to atmosphere from generator	74.7 kW	4248.2 Btu/min
Alternator[2]		
Motor starting capability @ 30% voltage dip	4647 skVA	
Frame	825	
Temperature Rise	130 ° C	234 ° F
Lube System		
Sump refill with filter	401.3 L	106.0 gal
Emissions (Nominal)[3]		
NOx g/hp-hr	5.39 g/hp-hr	
CO g/hp-hr	.29 g/hp-hr	
HC g/hp-hr	.11 g/hp-hr	
PM g/hp-hr	.026 g/hp-hr	

[1] For ambient and altitude capabilities consult your Caterpillar dealer. Air flow restriction (system) is added to existing restriction from factory.

[2] UL 2200 Listed packages may have oversized generators with a different temperature rise and motor starting characteristics. Generator temperature rise is based on a 40 degree C ambient per NEMA MG1-32.

[3] Emissions data measurement procedures are consistent with those described in EPA CFR 40 Part 89, Subpart D & E and ISO8178-1 for measuring HC, CO, PM, NOx. Data shown is based on steady state operating conditions of 77°F, 28.42 in HG and number 2 diesel fuel with 35° API and LHV of 18,390 btu/lb. The nominal emissions data shown is subject to instrumentation, measurement, facility and engine to engine variations. Emissions data is based on 100% load and thus cannot be used to compare to EPA regulations which use values based on a weighted cycle.

STANDBY 2000 ekW 2500 kVA

60 Hz 1800 rpm 480 Volts

CATERPILLAR®

RATING DEFINITIONS AND CONDITIONS

Meets or Exceeds International Specifications: AS1359, CSA, IEC60034, ISO 3046, ISO 8528, NEMA MG 1-33, UL508A, 98/37/EC

Standby - Output available with varying load for the duration of the interruption of the normal source power. Average power output is 70% of the standby power rating. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year. Standby power in accordance with ISO 8528. Fuel stop power in accordance with ISO 3046. Standby ambients shown indicate ambient temperature at 100% load which results in a coolant top tank temperature just below the shutdown temperature.

Ratings are based on SAE J1349 standard conditions. These ratings also apply at ISO 3046 standard conditions.

Fuel rates are based on fuel oil of 35° API [16° C (60° F)] gravity having an LHV of 42 780 kJ/kg (18,390 Btu/lb) when used at 29° C (85° F) and weighing 838.9 g/liter (7.001 lbs/U.S. gal.). Additional ratings may be available for specific customer requirements, contact your Caterpillar representative for details. For information regarding Low Sulfur fuel and Biodiesel capability, please consult your Caterpillar dealer.

STANDBY 2000 ekW 2500 kVA

60 Hz 1800 rpm 480 Volts

CATERPILLAR®

DIMENSIONS

Package Dimensions		
Length	6424.6 mm	252.94 in
Width	2378.1 mm	93.63 in
Height	2966.3 mm	116.78 in
Weight	17 307 kg	38,155 lb

NOTE: For reference only - do not use for installation design. Please contact your local dealer for exact weight and dimensions. (General Dimension Drawing #2846051).

Performance No.: DM8263

Feature Code: 516DE5A

Gen. Arr. Number: 2628106

Source: U.S. Sourced

March 04 2008

11953836

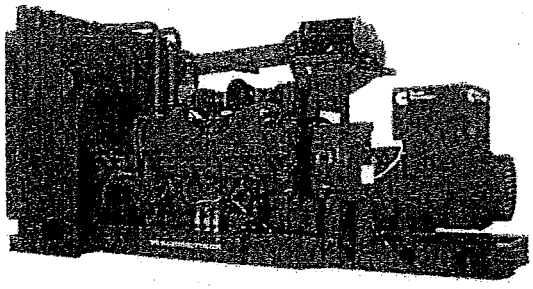
www.CAT-ElectricPower.com

© 2008 Caterpillar
All rights reserved.

Materials and specifications are subject to change without notice. The International System of Units (SI) is used in this publication.

CAT, CATERPILLAR, SAFETY.CAT.COM their respective logos, "Caterpillar Yellow," and the POWER EDGE trade dress, as well as corporate and product identity used herein, are trademarks of Caterpillar and may not be used without permission.

Diesel generator set QSK60 series engine EPA emissions



> Specification sheet
1600 kW - 2000 kW 60 Hz

Our energy working for you.™

Cummins® Power Generation

Description

Cummins Power Generation commercial generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary and prime power applications.

ISO 9001	This generator set is designed in facilities certified to ISO9001 and manufactured in facilities certified to ISO9001 or ISO9002.
PTS	The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins Power Generation products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems.
CSA	All low voltage models are CSA certified to product class 4215-01.
UL	The generator set is available Listed to UL 2200, Stationary Engine Generator Assemblies. The PowerCommand control is Listed to UL 508 - Category NITW7 for U.S. and Canadian usage. Circuit breaker assemblies are UL 489 Listed for 100% continuous operation and also UL 869A Listed Service Equipment.
U.S. EPA	Engine certified to U.S. EPA Nonroad Source Emissions Standards, 40 CFR 89, Tier 2.

Features

Cummins® heavy-duty engine - Rugged 4-cycle, industrial diesel delivers reliable power, low emissions and fast response to load changes.

Alternator - Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

Permanent magnet generator (PMG) - Offers enhanced motor starting and fault clearing short-circuit capability.

Control system - The PowerCommand® electronic control is standard equipment and provides total genset system integration including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, AmpSentry™ protection, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance.

Cooling system - Standard integral set-mounted radiator system, designed and tested for rated ambient temperatures, simplifies facility design requirements for rejected heat.

NFPA - The genset accepts full rated load in a single step in accordance with NFPA 110 for Level 1 systems.

Warranty and service - Backed by a comprehensive warranty and worldwide distributor network.

	Standby rating		Prime rating		Continuous rating		Data sheets	
Model	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz	50 Hz
DQKAA	1750 (2188)		1600 (2000)				D-3335	
DQKAB	2000 (2500)		1825 (2281)				D-3336	

©2006 | Cummins Power Generation Inc. | All rights reserved | Specifications subject to change without notice | Cummins Power Generation and Cummins are registered trademarks of Cummins Inc. PowerCommand, AmpSentry and "Our energy working for you." are trademarks of Cummins Power Generation. Other company, product or service names may be trademarks or service marks of others.
S-1519d (2/06)

Generator set specifications

Governor regulation class	ISO8528 Part 1 Class G3
Voltage regulation, no load to full load	± 0.5%
Random voltage variation	± 0.5%
Frequency regulation	Isochronous
Random frequency variation	± 0.25%
Radio frequency emissions compliance	IEC 801.2 through IEC 801.5; MIL STD 461C, Part 9

Engine specifications

Design	4 cycle, V-block, turbocharged and low temperature air aftercooled
Bore	158.8 mm (6.25 in)
Stroke	190.0 mm (7.48 in)
Displacement	60.2 litres (3673 in^3)
Cylinder block	Cast iron, 60°V 16 cylinder
Battery capacity	2200 amps minimum at ambient temperature of -18 °C to 0 °C (0 °F to 32 °F)
Battery charging alternator	40 amps
Starting voltage	24 volt, negative ground
Fuel system	Cummins modular common rail
Fuel filter	Dual element, 10 micron filtration, spin-on fuel filters with 15 micron water separator
Air cleaner type	Dry replaceable element oil filters
Lube oil filter type(s)	Four spin-on, combination full flow filter and bypass filters
Standard cooling system	High ambient radiator

Alternator specifications

Design	Brushless, 4 pole, revolving field
Stator	2/3 pitch
Rotor	Single bearing, flexible disc
Insulation system	Class H on low and medium voltage, Class F on high voltage
Standard temperature rise	150 °C standby
Exciter type	PMG (permanent magnet generator)
Phase rotation	A (U), B (V), C (W)
Alternator cooling	Direct drive centrifugal blower fan
AC waveform total harmonic distortion	< 5% no load to full linear load, < 3% for any single harmonic
Telephone influence factor (TIF)	< 50 per NEMA MG1-22.43
Telephone harmonic factor (THF)	< 3

Available voltages

60 Hz line-neutral/line-line				50 Hz line-neutral/line-line			
• 219/380	• 277/480	• 2400/4160	• 7620/13200	• 220/380	• 240/415	• 1905/3300	• 3810/6600
• 254/440	• 347/600	• 7200/12470	• 7970/13800	• 230/400	• 254/440	• 3640/6300	• 6350/11000

* Note: Consult factory for other voltages.

Generator set options and accessories

Engine
- ☐ 208/240/480 V coolant heater for ambient above 4.5 °C (40 °F)
- ☐ 208/240/480 V coolant heater for ambient below 4.5 °C (40 °F)

Control panel
- ☐ 120/240 V, 100 W control anti-condensation space heater
- ☐ Paralleling configurations
- ☐ Remote fault signal package
- ☐ Run relay package

Alternator
- ☐ 80 °C rise alternator
- ☐ 105 °C rise alternator
- ☐ 125 °C rise alternator
- ☐ 120/240 V, 300 W anti-condensation heater
- ☐ Temperature sensor - RTDs, 2/phase
- ☐ Temperature sensor – alternator bearing RTD
- ☐ Differential current transformers

Exhaust system
- ☐ Industrial grade exhaust silencer
- ☐ Residential grade exhaust silencer
- ☐ Critical grade exhaust silencer

Cooling system
- ☐ Remote radiator cooling

Generator set
- ☐ AC entrance box
- ☐ Batteries
- ☐ Battery rack w/hold-down - floor standing
- ☐ Circuit breaker - set mounted
- ☐ Disconnect switch - set mounted
- ☐ PowerCommand Network
- ☐ Remote annunciator panel
- ☐ Spring isolators
- ☐ 2 year warranty
- ☐ 5 year warranty
- ☐ 10 year major components

* Note: Some options may not be available on all models - consult factory for availability.

Our energy working for you.™

©2008 | Cummins Power Generation Inc. | All rights reserved | Specifications subject to change without notice | Cummins Power Generation and Cummins are registered trademarks of Cummins Inc. PowerCommand, AmpSentry and "Our energy working for you." are trademarks of Cummins Power Generation. Other company, product or service names may be trademarks or service marks of others.
S-1514d (2/08)

Power Generation

Control system

Operator panel features

Analog AC metering panel - Provides color-coded display of generator set output voltage, current, frequency, power factor and kW. All phases of voltage and current are simultaneously displayed. Easy to see output status from a distance.

Graphical data display - Allows operator to view all engine and alternator data; perform operator adjustments for speed, voltage and time delays; view fault history; and set up and adjust the generator set (set up requires password access). A portion of the display is allocated to display system status including alarm and shutdown conditions. Display is controlled by sealed membrane switches. Up to 9 lines of data can be displayed with approximately 26 characters per line.

LED status lamps - The status lamps indicate remote start command (green), not in auto (red-flashing), warning (amber) and shutdown (red).

Mode selector switch - Off/manual/auto and run/stop switches allow remote automatic starting or manual starting from the operator panel. Panel includes an LED lamp to indicate manual mode operation.

Exerciser switch - Automated exercise function in the control allows an operator to initiate an exercise period and have it automatically completed by the control.

Fault reset switch - Allows the operator to reset the control after a warning or shutdown condition. LED lamp with switch indicates that a fault is present on the system.

Panel lamps and switch - Operator panel can be illuminated by a series of high-intensity LED lamps controlled by a membrane switch on the panel. Panel lamps include a time delay to automatically switch off after a preset time period.

Emergency stop switch - Provides positive and immediate shutdown of the generator set on operation.

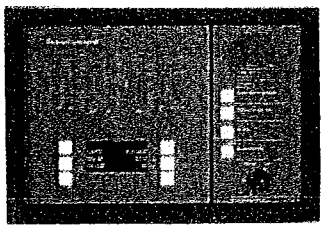
Construction - Operator panel is a sealed design with membrane switches for most functions. Mechanical switches are oil-tight design. Plug interfaces are provided to the generator set control system. Display panel labeling is configurable for language.

Standard control functions

- Integrated Isochronous governing and fuel control system.
- Integrated 3-phase sensing voltage regulation system with automatic single and three phase fault regulation.
- Integrated AC protective functions include over/under voltage, short-circuit, overcurrent (warning and shutdown) and overload.
- Integrated engine management system including configurable cycle-cranking functions and configurable start sequence.
- Comprehensive warning and shutdown protection including customer configurable warning and shutdown conditions.
- Comprehensive data displays including 3-phase AC voltage, current, power factor, kW and kVA; engine oil pressure, coolant temperature, DC volts and other service functions; operating history (load and fault conditions) and system setup information.

Options

- ☐ Integrated digital paralleling controls including options for semi-automatic and automatic (isolated bus) applications.
- ☐ LonMark compliant network interface.
- ☐ Control anti-condensation heater.
- ☐ Key-type mode select switch.
- ☐ Relay outputs for genset running, common warning and common shutdown.
- ☐ Exhaust temperature alarm.
- ☐ Alternator temperature alarm(s).
- ☐ Centinel™ lube oil burn system.
- ☐ Power transfer control function to allow generator set to control remote power circuit breakers for open, fast closed or soft (ramping) power transfer from a utility source to the genset (2 minute maximum fail-to-disconnect timer).



Our energy working for you.™

©2008 | Cummins Power Generation Inc. | All rights reserved | Specifications subject to change without notice | Cummins Power Generation and Cummins are registered trademarks of Cummins Inc. PowerCommand, AmpSentry and "Our energy working for you." are trademarks of Cummins Power Generation. Other company, product or service names may be trademarks or service marks of others.
S-1514d (2/08)

Power Generation

Ratings definitions

Emergency standby power (ESP):

Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Limited-time running power (LTP):

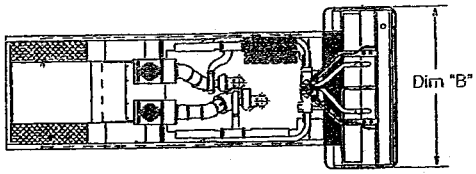
Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.

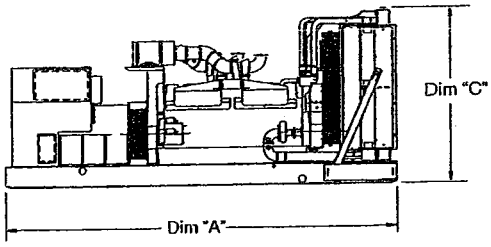
Prime power (PRP):

Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Base load (continuous) power (COP):

Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.





This outline drawing is for reference only. See respective model data sheet for specific model outline drawing number.

Do not use for installation design

Model	Dim "A" mm (in.)	Dim "B" mm (in.)	Dim "C" mm (in.)	Set Weight* dry kg (lbs)	Set Weight* wet kg (lbs)
DQKAA	6175 (243)	2534 (100)	3043 (120)	15231 (33569)	15396 (33932)
DQKAB	6175 (243)	2534 (100)	3043 (120)	17382 (38309)	17908 (39470)

* Note: Weights represent a set with standard features. See outline drawings for weights of other configurations.

Cummins Power Generation
1400 73rd Avenue N.E.
Minneapolis, MN 55432 USA
Telephone: 763 574 5000
Fax: 763 574 5298

Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

Our energy working for you.™

©2008 | Cummins Power Generation Inc. | All rights reserved | Specifications subject to change without notice | Cummins Power Generation and Cummins are registered trademarks of Cummins Inc. PowerCommand, AmpSentry and "Our energy working for you." are trademarks of Cummins Power Generation. Other company, product or service names may be trademarks or service marks of others.
S-1514d (2/08)

Power Generation

Power Generation

Exhaust Emission Data Sheet
2000DQKAB
60 Hz Diesel Generator Set

Engine Information:

Model:	Cummins Inc. QSK60-G6 NR2	Bore:	6.25 in. (158 mm)
Type:	4 Cycle, 60°V, 16 Cylinder Diesel	Stroke:	7.48 in. (189 mm)
Aspiration:	Turbocharged and Low Temperature aftercooled	Displacement:	3673 cu. in. (60.1 liters)
Compression Ratio:	14.5:1		
Emission Control Device:	Aftercooled		

PERFORMANCE DATA	1/4 Standby	1/2 Standby	3/4 Standby	Full Standby	Full Prime	
BHP @ 1800 RPM (60 Hz)	730	1460	2189	2919	2639	
Fuel Consumption (gal/Hr)	43.9	76.4	105.8	137.9	124.7	
Exhaust Gas Flow (CFM)	6510	10220	12000	14920	13780	
Exhaust Gas Temperature (°F)	772	838	873	893	884	
EXHAUST EMISSION DATA						
HC (Total Unburned Hydrocarbons)	0.38	0.32	0.23	0.23	0.25	
NOx (Oxides of Nitrogen as NO2)	3.18	3.04	4.60	5.11	5.02	
CO (carbon Monoxide)	0.65	0.40	0.19	0.21	0.16	
PM (Particular Matter)	0.20	0.12	0.03	0.04	0.03	
SO2 (Sulfur Dioxide)	0.13	0.12	0.10	0.10	0.10	
Smoke (Bosch)	0.65	0.52	0.19	0.24	0.15	

All Values are Grams/HP-Hour, Smoke is Bosch #

TEST CONDITIONS

Data was recorded during steady-state rated engine speed (± 25 RPM) with full load (±2%). Pressures, temperatures, and emission rates were stabilized.

Fuel Specification:	46.5 Cetane Number, 0.035 Wt.% Sulfur; Reference ISO8178-5, 40CFR86.1313-98 Type 2-D and ASTM D975 No. 2-D.
Fuel Temperature:	99 ± 9 °F (at fuel pump inlet)
Intake Air Temperature:	77 ± 9 °F
Barometric Pressure:	29.6 ± 1 in. Hg
Humidity:	NOx measurement corrected to 75 grains H2O/lb dry air
Reference Standard:	ISO 8178

The NOx, HC, CO and PM emission data tabulated here were taken from a single engine under the test conditions shown above. Data for the other components are estimated. These data are subjected to instrumentation and engine-to-engine variability. Field emission test data are not guaranteed to these levels. Actual field test results may vary due to test site conditions, installation, fuel specification, test procedures and instrumentation. Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may results in elevated emission levels.

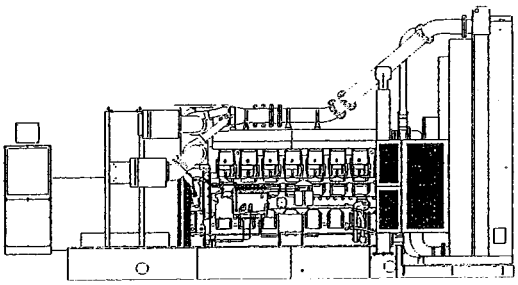
Model: 2000REOZM

KOHLER.POWER SYSTEMS 380-4160 V Diesel

ISO 9001 KOHLER POWER SYSTEMS NATIONALLY REGISTERED

Ratings Range

		60 Hz	50 Hz
Standby:	kW	1590-2000	1496-1760
	kVA	1988-2500	1870-2200
Prime:	kW	1440-1820	1376-1600
	kVA	1800-2275	1720-2000



Standard Features

- Kohler Co. provides one-source responsibility for the generating system and accessories.
- The generator set and its components are prototype-tested, factory-built, and production-tested.
- The 60 Hz generator set offers a UL 2200 listing.
- At 60 Hz, the generator set accepts rated load in one step.
- The 60 Hz generator set meets NFPA 110, Level 1, when equipped with the necessary accessories and installed per NFPA standards.
- The generator set complies with ISO 8528-5, Class G3, requirements for transient performance.
- A one-year limited warranty covers all systems and components. Two-, five-, and ten-year extended warranties are also available.
- Alternator features:
  - The pilot-excited, permanent-magnet (PM) alternator provides superior short-circuit capability.
  - The brushless, rotating-field alternator has broadrange reconnectability.
- Other features:
  - The low coolant level shutdown prevents overheating (standard on radiator models only).
  - The generator set is direct-mounted to the skid.

Generator Set Ratings

				150°C Rise Standby Rating		130°C Rise Standby Rating		125°C Rise Prime Rating		105°C Rise Prime Rating	
Alternator	Voltage	Ph	Hz	kW/kVA	Amps	kW/kVA	Amps	kW/kVA	Amps	kW/kVA	Amps
7M4054	220/380	3	60	1590/1988	3020	1590/1988	3020	1440/1800	2735	1440/1800	2735
	240/416	3	60	1840/2300	3192	1840/2300	3192	1800/2250	3123	1680/2100	2915
	277/480	3	60	2000/2500	3007	2000/2500	3007	1820/2275	2736	1820/2275	2736
	220/380	3	50	1584/1980	3008	1528/1910	2902	1496/1870	2841	1400/1750	2659
	230/400	3	50	1624/2030	2930	1536/1920	2771	1536/1920	2771	1424/1780	2569
	240/416	3	50	1608/2010	2790	1496/1870	2595	1496/1870	2595	1376/1720	2357
7M4056	220/380	3	60	1850/2313	3513	1790/2238	3400	1750/2188	3324	1650/2063	3134
	240/416	3	60	2000/2500	3470	1950/2438	3383	1820/2275	3157	1780/2225	3088
	277/480	3	60	2000/2500	3007	2000/2500	3007	1820/2275	2736	1820/2275	2736
	220/380	3	50	1760/2200	3343	1760/2200	3343	1600/2000	3039	1600/2000	3039
	230/400	3	50	1760/2200	3175	1760/2200	3175	1600/2000	2887	1600/2000	2887
	240/416	3	50	1760/2200	3053	1736/2170	3012	1600/2000	2776	1568/1960	2720
7M4058	220/380	3	60	2000/2500	3798	1950/2438	3703	1820/2275	3457	1790/2238	3400
	240/416	3	60	2000/2500	3470	2000/2500	3470	1820/2275	3157	1820/2275	3157
	277/480	3	60	2000/2500	3007	2000/2500	3007	1820/2275	2736	1820/2275	2736
	220/380	3	50	1760/2200	3343	1744/2180	3312	1600/2000	3039	1600/2000	3039
	230/400	3	50	1760/2200	3175	1760/2200	3175	1600/2000	2887	1600/2000	2887
	240/416	3	50	1760/2200	3053	1760/2200	3053	1600/2000	2776	1600/2000	2776
7M4176	220/380	3	60	2000/2500	3798	2000/2500	3798	1820/2275	3457	1820/2275	3457
7M4292	347/600	3	60	2000/2500	2406	2000/2500	2406	1820/2275	2189	1820/2275	2189
7M4374	2400/4160	3	60	2000/2500	347	2000/2500	347	1820/2275	316	1820/2275	316
	1905/3300	3	50	1744/2180	381	1600/2000	350	1600/2000	350	1448/1810	317

RATINGS: All three-phase units are rated at 0.8 power factor. *Standby Ratings:* Standby ratings apply to installations served by a reliable utility source. The standby rating is applicable to varying loads for the duration of a power outage. There is no overload capability for this rating. Ratings are in accordance with ISO-3046/1, BS 5514, AS 2789, and DIN 6271. *Prime Power Ratings:* Prime power ratings apply to installations where utility power is unavailable or unreliable. At varying load, the number of generator set operating hours is unlimited. A 10% overload capacity is available for one hour in twelve. Ratings are in accordance with ISO-8528/1, overload power in accordance with ISO-3046/1, BS 5514, AS 2789, and DIN 6271. For limited running time and base load ratings, consult the factory. Obtain the technical information bulletin (TIB-101) on ratings guidelines for the complete ratings definitions. The generator set manufacturer reserves the right to change the design or specifications without notice and without any obligation or liability whatsoever. GENERAL GUIDELINES FOR DERATION: *Altitude:* Derate 2.5% per 300 m (984 ft.) elevation above 1500 m (4921 ft.). *Temperature:* Derate 11.5% per 10°C (18°F) temperature above 40°C (104°F) up to a maximum temperature of 55°C (131°F).

Alternator Specifications

Specifications	Alternator
Type	4-Pole, Rotating-Field
Exciter type	Brushless, Permanent-Magnet Pilot Exciter
Voltage regulator	Solid State, Volts/Hz
Insulation:	NEMA MG1
Material	Class H, Synthetic, Nonhygroscopic
Temperature rise	130°C, 150°C Standby
Bearing: quantity, type	1, Sealed
Coupling	Flexible Disc
Amortisseur windings	Full
Rotor balancing	125% 60 Hz
Voltage regulation, no-load to full-load (with <0.5% drift due to temp. variation)	3-Phase Sensing, ±0.25%
One-step load acceptance	100% of Rating
Unbalanced load capability	100% of Rated Standby Current
Peak motor starting kVA:	(35% dip for voltages below)
380 V 7M4176 (4 bus bar)	5400 (60Hz)
480 V, 380 V 7M4054 (4 bus bar)	7000 (60Hz), 4800 (50 Hz)
480 V, 380 V 7M4056 (4 bus bar)	7200 (60Hz), 5200 (50 Hz)
480 V, 380 V 7M4058 (4 bus bar)	11000 (60Hz), 6600 (50 Hz)
600 V 7M4292 (4 bus bar)	4250 (60Hz)
4160 V, 3300 V 7M4374 (6 lead)	6200 (60Hz), 3750 (50 Hz)

- NEMA MG1, IEEE, and ANSI standards compliance for temperature rise and motor starting.
- Sustained short-circuit current of up to 300% of the rated current for up to 10 seconds.
- Sustained short-circuit current enabling downstream circuit breakers to trip without collapsing the alternator field.
- Self-ventilated and dripproof construction.
- Superior voltage waveform from two-thirds pitch windings and skewed stator.
- Digital solid-state, volts-per-hertz voltage regulator with ±0.25% no-load to full-load regulation.
- Brushless alternator with brushless pilot exciter for excellent load response.

Application Data

Engine

Engine Specifications	60 Hz	50 Hz
Engine model	D2000 65.4A60	D2000 65.4A50
Engine type	4-Cycle, Turbocharged, Air-to-Air Charge Cooled	
Cylinder arrangement	16 V	
Displacement, L (cu. in.)	65.4 (3989)	
Bore and stroke, mm (in.)	170 x 180 (6.69 x 7.09)	
Compression ratio	14.0:1	
Piston speed, m/min. (ft./min.)	648 (2126)	540 (1772)
Main bearings: quantity, type	7, Precision Half-Shell	
Rated rpm	1800	1500
Max. power at rated rpm, kWm (BHP)	2150 (2882)	1939 (2599)
Cylinder head material	Cast Iron	
Crankshaft material	Forged Steel	
Governor type	Electronic	
Frequency regulation, no-load to full-load	Isochronous	
Frequency regulation, steady state	±0.25%	
Frequency	Fixed	
Air cleaner type, all models	Dry	

Exhaust

Exhaust System	60 Hz	50 Hz
Exhaust manifold type	Dry	
Exhaust flow at rated kW, m^3/min. (cfm)	479 (16913)	434 (15325)
Exhaust temperature at rated kW, dry exhaust, °C (°F)	519 (966)	536 (997)
Maximum allowable back pressure, kPa (in. Hg)	5.9 (1.7)	
Exhaust outlet size at engine hookup, mm (in.)	See ADV drawing	

Engine Electrical

Engine Electrical System	60 Hz	50 Hz
Battery charging alternator:		
Ground (negative/positive)	Negative	
Volts (DC)	24	
Ampere rating	30	
Starter motor rated voltage (DC)	Dual, 24	
Battery, recommended cold cranking amps (CCA):		
Quantity, CCA rating each	Four, 1150	
Battery voltage (DC)	12	

Fuel

Fuel System	60 Hz	50 Hz
Fuel supply line, min. ID, mm (in.)	25 (1.0)	
Fuel return line, min. ID, mm (in.)	19 (0.75)	
Max. lift, engine-driven fuel pump, m (ft.)	1 (3)	
Max. fuel flow, Lph (gph)	660 (174)	560 (148)
Max. fuel pump restriction, kPa (in. Hg)	10 (3.0)	
Fuel filter: quantity, type	4, Secondary	
Recommended fuel	#2 Diesel	

Lubrication

Lubricating System	60 Hz	50 Hz
Type	Full Pressure	
Oil pan capacity, L (qt.)	200 (211)	
Oil pan capacity with filter, L (qt.)	250 (264)	
Oil filter: quantity, type	4, Cartridge	
Oil cooler	Water-Cooled	

Application Data

Cooling

Radiator System	60 Hz	50 Hz
Ambient temperature °C (°F)	40 (105)	
Engine jacket water capacity, L (gal.)	170 (44.9)	
Radiator system capacity, including engine, L (gal.)	413 (109)	
Engine jacket water flow, Lpm (gpm)	1850 (489)	1650 (436)
Heat rejected to cooling water at rated kW, dry exhaust, kW (Btu/min.)	686 (38999)	623 (35401)
Heat rejected to charge cooling air at rated kW, dry exhaust, kW (Btu/min.)	633 (36000)	575 (32677)
Water pump type	Centrifugal	
Fan diameter, including blades, mm (in.)	1895 (75)	
Fan kWm (HP)	44 (59)	
Max. restriction of cooling air, intake and discharge side of radiator, kPa (in. H_2O)	0.125 (0.5)	

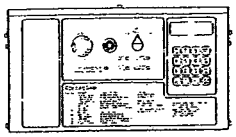
Operation Requirements

Air Requirements	60 Hz	50 Hz
Radiator-cooled cooling air, m^3/min. (scfm)†	2500 (88275)	
Combustion air, m^3/min. (cfm)	181 (6391)	164 (5791)
Heat rejected to ambient air:		
Engine, kW (Btu/min.)	158 (9000)	144 (8169)
Alternator, kW (Btu/min.)	97 (5516)	

† Air density = 1.20 kg/m^3 (0.075 lbm/ft^3)

Fuel Consumption	60 Hz	50 Hz
Diesel, Lph (gph) at % load	**Standby Rating**	
100%	509 (134.5)	462 (122.1)
75%	381 (100.6)	338 (89.2)
50%	261 (69.0)	231 (61.0)
25%	147 (38.9)	128 (33.9)
Diesel, Lph (gph) at % load	**Prime Rating**	
100%	461 (121.9)	415 (109.7)
75%	348 (92.0)	309 (81.5)
50%	243 (64.2)	214 (56.5)
25%	142 (37.4)	122 (32.2)

Controllers



Decision-Maker™ 550 Controller
Audiovisual annunciation with NFPA 110 Level 1 capability.
Programmable microprocessor logic and digital display features.
Alternator safeguard circuit protection.
12- or 24-volt engine electrical system capability.
Remote start, remote annunciation, and remote communication options.
Refer to G6-46 for additional controller features and accessories.

KOHLER CO., Kohler, Wisconsin 53044 USA
Phone 920-565-3381, Fax 920-459-1646
For the nearest sales and service outlet in the
US and Canada, phone 1-800-544-2444
KohlerPower.com

Kohler Power Systems
Asia Pacific Headquarters
7 Jurong Pier Road
Singapore 619159
Phone (65) 6264-6422, Fax (65) 6264-6455

Additional Standard Features

- Alternator Protection
- Alternator Strip Heater (standard on 3300 volt and above)
- Electronic, Isochronous Governor
- Oil Drain Extension
- Operation and Installation Literature

Available Accessories

Open Unit

- ☐ Exhaust Silencer, Hospital (kit: PA-361627)
- ☐ Exhaust Silencer, Critical (kit: PA-361625)
- ☐ Flexible Exhaust Connector, Stainless Steel

Cooling System

- ☐ Block Heater
  [recommended for ambient temperatures below 20°C (68°F)]
- ☐ Radiator Duct Flange

Fuel System

- ☐ Flexible Fuel Lines
- ☐ Fuel Pressure Gauge
- ☐ Subbase Fuel Tank with Day Tank

Electrical System

- ☐ Battery
- ☐ Battery Charger, Equalize/Float Type
- ☐ Battery Heater
- ☐ Battery Rack and Cables

Engine and Alternator

- ☐ Air Cleaner, Heavy Duty
- ☐ Air Cleaner Restriction Indicator
- ☐ Alternator Strip Heater (available up to 600 volt)
- ☐ Bus Bar Kits (standard on 7M alternators, 380-600 volt only)
- ☐ Crankcase Emissions Canister
- ☐ Fuel/Water Separator
- ☐ Line Circuit Breaker (NEMA type 1 enclosure)
- ☐ Line Circuit Breaker with Shunt Trip (NEMA type 1 enclosure)
- ☐ Oil Temperature Gauge
- ☐ Rated Power Factor Testing
- ☐ Spring Isolators

Paralleling System

- ☐ Load-Sharing Module
- ☐ Voltage Adjustment Control (manual)

Maintenance

- ☐ General Maintenance Literature Kit
- ☐ Maintenance Kit (includes air, oil, and fuel filters)
- ☐ NFPA 110 Literature
- ☐ Overhaul Literature Kit
- ☐ Production Literature Kit

Controller

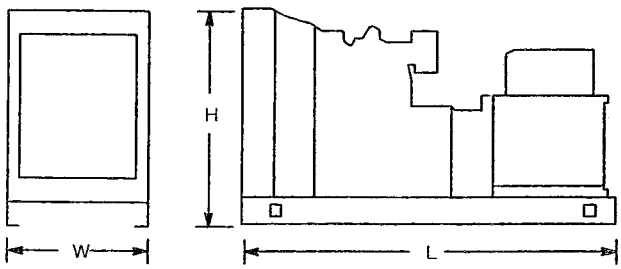
- ☐ Common Failure Relay Kit
- ☐ Communication Products and PC Software
- ☐ Customer Connection Kit
- ☐ Dry Contact Kit (isolated alarm)
- ☐ Remote Annunciator Panel
- ☐ Remote Audiovisual Alarm Panel
- ☐ Remote Emergency Stop Kit
- ☐ Remote Mounting Cable
- ☐ Run Relay Kit

Miscellaneous Accessories

- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____

Dimensions and Weights

Overall Size, L x W x H, max., mm (in.):	6005 x 2212 x 3244 (236.4 x 87.1 x 127.7)
Weight (radiator model), wet, max., kg (lb.):	15876 (35000)



Note: This drawing is provided for reference only and should not be used for planning the installation. Contact your local distributor for more detailed information.

DISTRIBUTED BY:

© 2003, 2004, 2005, 2006, 2007, 2008 by Kohler Co. All rights reserved.

A Proposal

for

Apache Powder

and

10mW Interactive Distributed Generation® Services

to serve

Sulphur Springs Valley Electric Cooperative, Inc.®

A Touchstone Energy Cooperative

PowerSecure

Interactive Distributed Generation®

Confidential and Proprietary

PowerSecure ♦ 1609 Heritage Commerce Ct. ♦ Wake Forest, NC ♦ 27587
1-866 DG SKILL (347-5455)

Power Secure
Interactive Distributed Generation®

1609 Heritage Commerce Ct.
Wake Forest, NC 27587
1-866-DG SKILL (347-5455)
Tel: 919-556-3056
Fax: 919-556-3596
www.powersecure.com

Confidential & Proprietary

September 13, 2006

Ron Orozco, PE
Engineering Manager
Sulphur Springs Valley Electric Cooperative, Inc.
311 E. Wilcox Drive
Sierra Vista, AZ 85635

RE: PowerSecure 2250kW Interactive Distributed Generation® Services
SSVEC/Apache Powder
Benson, AZ

Dear Ron;

We are pleased to submit this proposal to provide SSVEC with PowerSecure Interactive Distributed Generation® (IDG®) Services. We will provide a 2250kW Standby; 2000kW Prime; 480Y/277V – 12.47kVY IDG® System to serve the Standby, Load Curtailment and Load Management needs of SSVEC and your Apache Powder customer. This letter and the attached **Exhibits** will serve as our formal **Agreement.**

PowerSecure and our local contractor will provide this IDG® System on a turnkey basis including:

- ✓ Engineering/Design
- ✓ Generation Equipment
- ✓ *NexGear*® Advanced Paralleling Switchgear
- ✓ IDG® System Installation
- ✓ Equipment and Installation Warranties
- ✓ In-service Training
- ✓ *Annual* NexGear® Switchgear Maintenance Services
- ✓ Optional Environmental Permitting Assistance

A **Scope of Services** can be found in **Exhibit A. Exhibit B** includes our **Quotation** and **Standard Terms and Conditions** for this project. We would expect this project to be completed within 42 weeks from authorization to proceed. This schedule could be excelerated to 24 weeks if we received a notice to proceed by October 15, 2006.

Our payment terms will be as follows:

Upon	% of Contract
Agreement Signing	30%
Receipt of IDG® System Submittal	20%
Equipment Shipping Date to Site	25%
Substantial Completion of Installation	15%
Final Commissioning/Start-up	10%
Total	100%

Please let us know if you have any questions. If you are in agreement with this letter and the attached Exhibits, please sign in the space allotted below and return a copy to me at your earliest convenience.

Thank you again for this opportunity. We look forward to hearing from you.

Sincerely,

Mark S, Martyak, PE
Executive Vice President

cc: SH, Steve Hodgin, PR

Accepted:

_____ _____

SSVEC Date

SCOPE OF POWERSECURE SERVICES

I. General

A. PowerSecure (PS) will provide 2250kW Standby; 2000kW Prime; 480Y/277-12.47kVY Interactive Distributed Generation® (IDG®) System to serve SSVEC and your Apache Powder Customer.

B. PS will provide a recloser, power transformer, instrument transformers, secondary power/control wiring and auxiliary equipment necessary for interconnection of the IDG® System at the customer's site per this proposal.

C. We understand that SSVEC will provide the following scope:

1. Two (2) In-Line Poles
2. Installation of PS-furnished Recloser, PT's and CTS
3. Fused Cut-outs
4. Primary Service Drop to PS-provided power transformer
5. All fuel including initial fill

D. PS will deliver the IDG® System project, as described in this Exhibit on a complete turnkey basis including:

1. Engineering/Design
2. Generation Equipment
3. *NexGear®* Advanced Paralleling Switchgear
4. IDG® System Installation
5. Equipment and Installation Warranties
6. In-service Training
7. Annual NexGear® Maintenance Services
8. **Optional** Environmental Permitting Assistance

D. PS will deliver the project in the following estimated timeframe:

Milestone	**Completion (*Week No*)**	
	Base Schedule	Alt. Schedule
Agreement Signing	0	0
Receipt of IDG® System Submittal	4	4
Equipment Shipping Date to Site	38	16
Substantial Completion of Installation	40	20
Final Commissioning/Start-up	42	24

E. Refer to the enclosed drawings which illustrate the proposed IDG® System.

II. Engineering/Design Services

A. PS will provide all engineering and design services necessary to complete construction documents for this project in accordance with the State of AZ.

B. PS will prepare construction documents signed and sealed by a Registered Professional Engineer of Record in AZ.

III. Generation System

A. The Generation System will include:

1. Engine Generator Set rated at 480Y/277 volts; 2250kW (Standby); 2000kW (Prime), .8pf; 2812.5kVA.
2. Permanent Magnet Generator
3. Electronic Engine Governor
4. Charging Alternator 24V
5. Lead Acid Batteries, Rack and Battery Charger
6. Engine Cooling System
7. Exhaust System with Silencer
8. Double Wall (UL142), 3000 Gallon Sub-base Tank with Level Sensors.
9. Weather Resistant Enclosure
10. Lubricating Oil and Antifreeze – Initial fill
11. Sound Attenuation to 85 db at 23 ft including:

B. Add Alternate #1 – Bi Fuel Injection System

1. PS will provide a Bi-Fuel Injection System enabling the diesel engine generator to operate from 30 to 100% diesel fuel and 0% to 70% natural gas.
2. SSVEC would be responsible for providing a natural gas service line to the IDG®System Enclosure capable of providing 14,000 CFH @ 2 to 5 psi.

C. Add Alternate #2 – Pre Owned Selected Catalytic Reducer (SCR)

1. PS would provide a Pre Owned, Reconditioned Selected Catalytic Reducer to reduce NOx by a minimum of 95%.
2. This Add Alternate is strictly dependent upon the continued availability of this existing SCR in PowerSecure's inventory.

IV. NexGear® Advanced Paralleling Switchgear

A. We will provide a *NexGear®* Advanced Paralleling Switchgear (APS) to provide the following Modes of Operation:

1. **Load Management Mode**: Long-term Synchronized/Parallel Operation with SSVEC.

2. **Curtailment:** Short-term Synchronized Operation with SSVEC followed by a Make-Before-Break Separation from SSVEC.

3. **Standby Mode:** Automatic, Dead Bus, Block Load Transfer of a maximum of 2000kW during SSVEC outages.

B. Each APS will include all necessary functions to prevent connection or parallel operation of the IDG® System with SSVEC, unless the service voltage and frequency are of normal magnitude.

V. IDG® System Installation

A. PS will combine our in-house IDG® Project Management staff with a reputable local licensed electrical contractor or utilize our in house licensed electrical construction group to provide a fully coordinated high quality installation.

B. The PS Project Manager will serve as the single point interface with SSVEC and AP during construction/start-up and will be present on-site for all critical activities and key construction milestones.

VI. Equipment and Installation Warranties

A. The entire system will be Warranted for One Year.

B. We are also offering an Optional Extended 5 Year Warranty for your consideration.

VII. In-Service Training

A. PS will provide onsite in-service training on the operation and maintenance of the IDG® System.

VIII. Optional Emissions/Environmental Permitting Assistance

A. PowerSecure, will aid SSVEC and AP in the application of all environmental related permits that are required by the various federal and state agencies.

B. PowerSecure will prepare all application documents for the above-mentioned permits and will allow/request Environmental Management of SSVEC and AP to review all documents prior to submission such to avoid conflicts or impacts to the environmental strategy of SSVEC and AP Neither construction nor operation will be started until proper authority has been granted and evidence of that authority has been provided to appropriate officials within SSVEC and AP.

Power Secure

Exhibit B
Interactive Distributed Generation® Services
SSVEC/Apache Powder
Benson, AZ

Sulphur Springs Valley Electric Cooperative, Inc.

Confidential and Proprietary

I. TURNKEY INSTALLATION OF A POWERSECURE IDG® AS DESCRIBED IN EXHIBIT A INCLUDES:

- Engineering
- Generator/Enclosure
- *NexGear®* Switchgear
- Installation
- IDG® System One-Year Warranty
- In Service Training

Subtotal Turnkey Installation*	**$867,800**
Add Alternate #1 – Bi-Fuel	**$42,600**
Add Alternate #2 – SCR	**$106,000**

II. ANNUAL NexGear® Switchgear Maintenance SERVICES	**$3,200**
III. OPTIONAL EXTENDED (Five Year) WARRANTY	**$25,600**

Notes*

- Does Not Include Sales Tax
- Refer to Standard Terms and Conditions
- Quote Good For 60 Days

POWERSECURE - CONTRACT TERMS AND CONDITIONS

1. **Description of Services**

1.1 Subject to the conditions set forth in this Contract, POWERSECURE agrees to furnish labor, supervision, equipment, materials, and transportation necessary to provide the services described in the attached POWERSECURE proposal (the "Work").

1.2 POWERSECURE shall be entitled to rely on the accuracy of any information provided by Customer, which is hereby warranted by Customer to be accurate and correct. In the event of any unforeseen costs incurred due to the inaccuracy of any such information, the compensation payable to POWERSECURE shall be equitably adjusted to compensate for any such additional costs.

1.3 POWERSECURE shall exercise reasonable efforts to complete the Work in accordance with the estimated schedule specified in POWERSECURE's proposal, but is not responsible for costs incurred by customer due to late delivery or completion of the Work.

2. **Services Fee and Terms of Payment**

2.1 Customer shall pay POWERSECURE the contract price specified in POWERSECURE's proposal (the "Contract Price") within 30 days from the date of completion of the Work, unless otherwise provided in POWERSECURE's proposal. If Customer fails to pay Contract Price by the due date, Customer shall liable to POWERSECURE for any attorney fees incurred in collection of any amount due and shall pay interest to POWERSECURE on the amount past due in the amount of 1.5% per month.

2.2 Any work beyond the scope of Work described herein requested of and performed by POWERSECURE ("Additional Work") shall be billed to Customer at POWERSECURE's then current standard rates, unless otherwise agreed to in writing by the parties.

2.3 The prices for the Work and any Additional Work are exclusive of federal, state, municipal or other sales or use tax. If POWERSECURE is required by applicable law to pay or collect any such taxes on account of Work provided in fulfilling this contract, then such amount of tax and any penalties and interest thereon shall be reimbursed to POWERSECURE. Unless a Sales Tax Certificate is provided to POWERSECURE, the invoice will include a line item for sales tax.

3. **Customer's Obligations**

3.1 Customer shall be responsible to provide necessary access to and around the work site to enable POWERSECURE to perform the Services proposed herein. POWERSECURE shall have the right to suspend Work and recover additional costs in the event that there is inadequate access to the work site, or in the event that continuing with the Work might jeopardize the safety of any person or property.

3.2 Customer shall provide any necessary plans, specifications, drawings, or information that may be necessary or useful in the performance of the Work and any Additional Work at no cost to POWERSECURE.

4. **Permits and Regulatory Requirements**

If compliance with any laws, regulations, or ordinances of any government authority or agency, require any changes in the Work or services proposed herein, or should any permits, licenses, or approvals be required, Customer assumes the risk and responsibility for such compliance or change, or for securing such permits, licenses, and approvals from the proper authorities, and for paying any associated costs or fees, unless specifically stated otherwise within this proposal.

5. **Limitation of Liability**

The remedies set forth in this Contract are Customer's sole and exclusive remedies. Neither POWERSECURE nor its employees, its subcontractors or suppliers shall be liable for any indirect, special, incidental, exemplary, or consequential loss or damage of any nature arising out of or in connection with their performance or non-performance hereunder. In no event shall POWERSECURE's liability arising out of or in connection with the performance or non-performance of the Work or any Additional Work exceed the total of the Contract Price as set forth in POWERSECURE's proposal. The provisions of this Section 5 shall apply whether such liability arises in contract, tort (including negligence), strict liability, or otherwise.

6. **Insurance**

POWERSECURE represents and warrants that it has met all requirements under North Carolina law with regard to workers' compensation and automobile liability coverage.

7. **Force Majeure**

In no event shall POWERSECURE be responsible for any damages arising out of any failure to perform or delay due to any cause beyond POWERSECURE's reasonable control. In such event, POWERSECURE shall be entitled to an extension of time as necessary to overcome the cause of the failure to perform or delay.

8. **Use of Subcontractors**

POWERSECURE shall be permitted to use subcontractors to perform the work specified herein. Notwithstanding the use of subcontractors, POWERSECURE shall continue to be responsible for the quality of the work and any Additional Services under the provisions of Section 4.

9. **Non-Waiver**

The failure of either party to insist upon the performance of any term or condition of this Contract or to exercise any right hereunder on one or more occasions, shall not constitute a waiver or relinquishment of its right to demand future performance of such term or condition, or to exercise such right in the future.

10. **Governing Law**

The laws of the State of North Carolina shall govern this Contract, except that the North Carolina conflict-of-laws provisions shall not be invoked in order to apply the laws of another state or jurisdiction.

11. **Warranty**

POWERSECURE only warrants that the installation services performed by POWERSECURE or subcontractors as part of the Work shall be free from defects in material and workmanship for a period of 1 year from the completion of the Work or any Additional Work. In the event that Customer notifies POWERSECURE of any defect in materials or workmanship that is covered by this warranty within such twelve (12) month period, POWERSECURE shall correct the defect at its own expense. POWERSECURE shall not be responsible for any problems or defects attributable to improper operation, maintenance, or use of the Work or any Additional Work, or attributable to any cause beyond POWERSECURE's reasonable control. THE WARRANTIES SET FORTH ABOVE ARE EXCLUSIVE, AND NO OTHER WARRANTIES OR REMEDIES OF ANY KIND, WHETHER STATUTORY, WRITTEN, ORAL, EXPRESS, OR IMPLIED, INCLUDING WITHOUT LIMITATION WARRANTIES OF INFRINGMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTIES ARISING FROM COURSE OF DEALING OR USAGE OF TRADE, SHALL APPLY. TO THE MAXIMUM EXTENT PERMITTED, POWERSECURE HEREBY ASSIGNS TO CUSTOMER ALL EXPRESS AND IMPLIED WARRANTIES FROM THE MANUFACTURER OF ANY PARTS AND EQUIPMENT INSTALLED BY POWERSECURE AS A PART OF THE WORK (see Manufacturer's warranties for details). POWERSECURE MAKES NO ADDITIONAL WARRANTY FOR ANY PARTS OR EQUIPMENT SUPPLIED HEREUNDER. NO REPRESENTATIONS ARE MADE BY POWERSECURE WITH RESPECT TO THE QUALITY, WORKMANSHIP OR SUITABILITY OF ANY EQUIPMENT OR PARTS PROVIDED UNDER THIS CONTRACT. Except as provided in Section 8, POWERSECURE shall not be responsible for any work done by others or for any loss, damage, cost or expense arising out of or resulting from such work, unless authorized by POWERSECURE in advance.

12. **Entire Agreement**

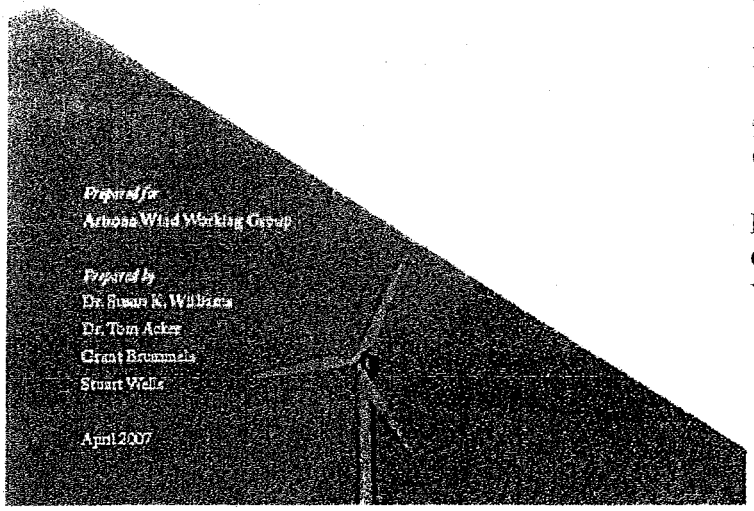
This Contract embodies the entire agreement between POWERSECURE and Customer. Any purchase order or acknowledgement issued by Customer is issued only for administrative purposes and any additional or conflicting terms and conditions appearing therein shall be void and of no effect. The parties shall not be bound by or liable for any statement, writing, representation, promise, inducement, or understanding not set forth above. In the event of any conflict between a proposal letter and the terms of this Contract, this Contract shall control. No changes, modifications, or amendments to any terms and conditions in this Contract are valid or binding unless agreed to by the parties in writing by their authorized representatives.

SSVEC _____ *Date* _____

SSVEC

Renewable Research

Arizona Wind Energy Assessment – April 2007



Arizona Wind Energy Assessment Executive Summary

Developable Windy Land and Economic Benefits:

Apache County
Cochise County
Coconino County
Graham County
Mohave County
Navajo County

Developable Windy Land:

Greenlee County
Yavapai County

Above are links to the Arizona Wind Energy Assessment reports for eight Arizona counties. For six of the counties, Apache, Cochise, Coconino, Graham, Mohave, and Navajo, the report contains both an analysis of the developable windy land and an economic benefits analysis. For Greenlee and Yavapai only the developable wind energy analysis is provided.

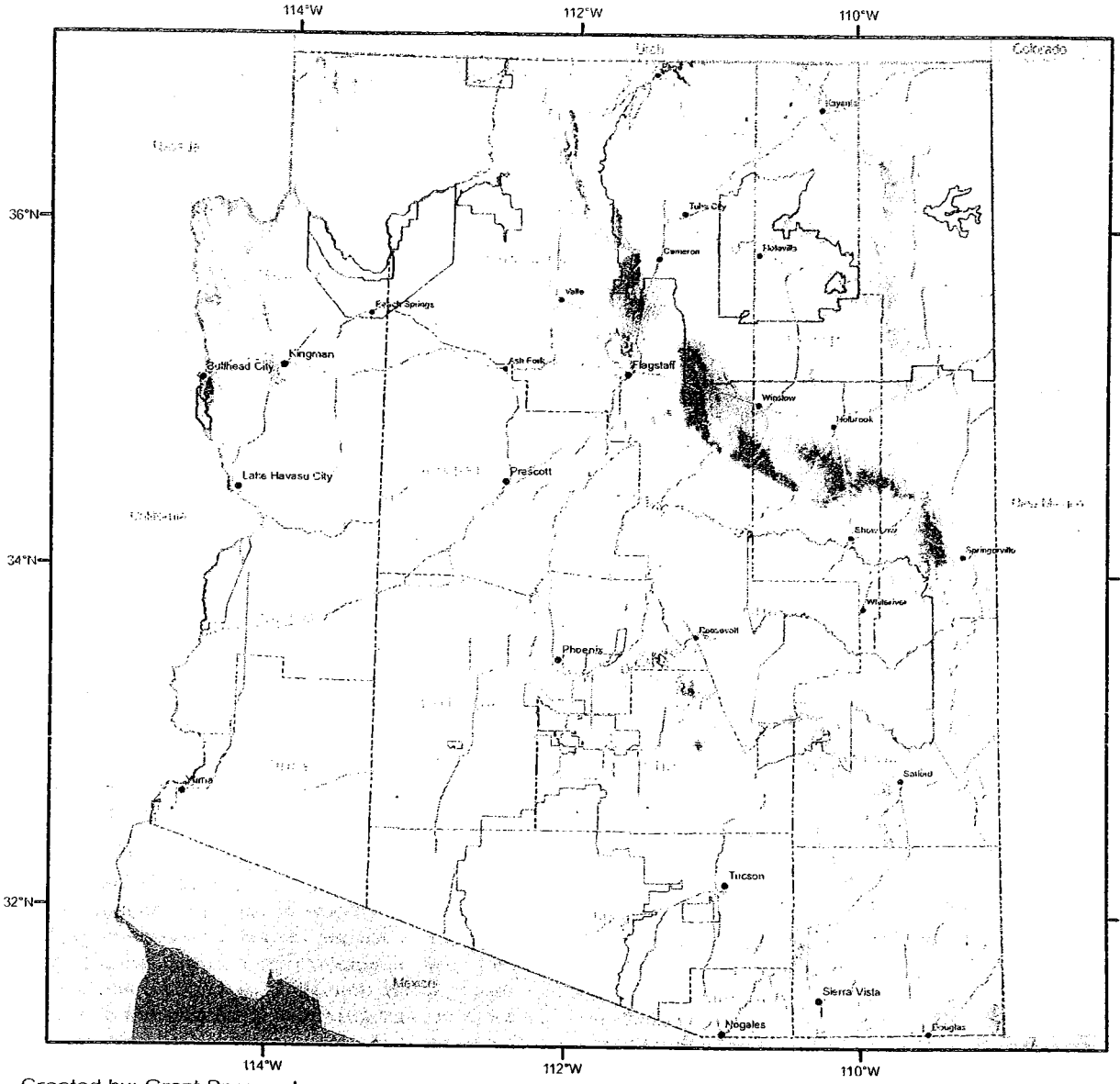
The amount of *developable windy land* in each county was determined in the first analysis. Based on the TrueWind map acquired by NAU in 2003 which is the best available representation of the Arizona wind resource, the windy land for each county was determined. An extensive geographic information system analysis was then used to exclude any land not appropriate for wind development. This included land use exclusions (i.e., National Park Service land), environmental exclusions (i.e., wetlands) and any land with slopes greater than 20% (expensive to develop). More details on the exclusions are described in the reports. The remaining land, *developable windy land*, is the windy land that may be accessible for wind energy development.

Some of this developable windy land is appropriate for development in the near term based upon site specific project economics, land access, and transmission access/availability. These reports made no attempt to apply these additional development criteria because they are project specific and subject to relatively rapid change, but rather assessed the developable wind resource that the state may access over a long term planning horizon (years to decades). In a long-term view, as our traditional energy resources become more costly and the wind turbine technology continues to improve, greater portions of the developable windy land will be appropriate for development based upon these project specific metrics (economics, land and transmission access). The developable windy land information thus is an estimate of the maximum one would expect could be developed in the long term.

The second analysis estimated the economic benefits that would occur *within* the county if a wind energy project were developed in that county. The benefits are quantified by the number of jobs, wages and salaries, and general economic output within the county as a result of the construction and operation of the wind energy project. The economic benefits reported are valid for wind energy projects in these counties that may occur in the near term (present day through the next several years). The magnitudes of the wind energy project sizes analyzed are typical of what one may expect to be built in Arizona in the near term.

State of Arizona

Average Annual Wind Resource 164 ft (50m)



Created by: Grant Brummels
Date of Creation: 7/6/2005
For more information contact:
Dr. Earl Duque
Earl.Duque@nau.edu

Projection:
UTM, Zone 12, WGS84
Spatial Resolution of
Wind Resource Data: 200m

Sustainable
Energy Solutions
www.ses.nau.edu

NORTHERN
ARIZONA
UNIVERSITY

Wind Power Classification

Wind Power Class	Wind Power Density (W/m^2)	Wind Speed (mph)
1 Poor	0 - 200	0.0 - 12.3
2 Marginal	200 - 300	12.3 - 14.1
3 Fair	300 - 400	14.1 - 15.7
4 Good	400 - 500	15.7 - 16.8
5 Excellent	500 - 600	16.8 - 17.9
6 Outstanding	600 - 800	17.9 - 19.7
7 Superb	> 800	> 19.7

Legend

- County Boundary
- Indian Reservation
- Rivers and Water Bodies
- Major Roads

N
W E
S

0 12.5 25 50 75 100
Miles

NORTHERN ARIZONA UNIVERSITY

Sustainable Energy Solutions

Arizona Wind Energy Assesment

Cochise County

Developable Windy Land and Economic Benefits

Prepared for

Arizona Wind Working Group

Prepared by

Dr. Susan K. Williams

Dr. Tom Acker

Grant Brummels

Stuart Wells

April 2007

Acknowledgements

We would like to thank Dr. Michael Milligan and Dr. Suzanne Tegen at NREL for review and comments on this report. We would also like to thank Mr. Marshal Goldberg of MRG Associates who provided county multipliers and also reviewed and commented on this report. The report has benefited greatly from their expertise.

This work was funded by US Department of Energy, Wind Powering America Program through the Arizona Wind Working Group.

The College of Business Administration at Northern Arizona University provided matching funds for the publication of this report.

Abstract

This report contains two wind energy analyses for the southern-Arizona's Cochise County. In the first analysis, the developable wind energy capacity was estimated using a geographic information system. Specifically, the amount of windy land by wind class in each county was determined. Development exclusions were then applied and the developable windy land was determined. The wind energy potential in Cochise County was estimated to be 275 MW. The majority of developable windy land, 80%, was Class 3.

The second analysis determined the economic impact of constructing a wind energy project in Coconino County. Utilizing National Renewable Energy Laboratory's Job and Economic Development Impact (NREL's JEDI) model in conjunction with Monte Carlo simulation, economic benefits categorized by jobs, earnings, and economic output were estimated for three different sized wind energy projects, 10.5 MW, 60 MW and 180 MW.

For a 10.5 MW wind energy project

- *Jobs during construction*: median was 5 jobs
- *Jobs during operations and maintenance phase (O&M phase)*: median was 2 jobs
- *Earnings during construction*: the median was $0.13 million
- *Earnings during O&M phase*: median was $0.08 million annually
- *Output (economic activity) during construction*: median was $0.56 million
- *Output during O&M phase*: median was $0.17 million annually

For a 60 MW wind energy project

- *Jobs during construction*: median was 27 jobs
- *Jobs during operations and maintenance phase (O&M phase)*: median was 11 jobs
- *Earnings during construction*: the median was $0.76 million
- *Earnings during O&M phase*: median was $0.43 million annually
- *Output (economic activity) during construction*: median was $3.21 million
- *Output during O&M phase*: median was $0.98 million annually

For a 180 MW wind energy project

- *Jobs during construction*: median was 80 jobs
- *Jobs during operations and maintenance phase (O&M phase)*: median was 33 jobs
- *Earnings during construction*: the median was $2.27 million
- *Earnings during O&M phase*: median was $1.29 million annually
- *Output (economic activity) during construction*: median was $9.59 million
- *Output during O&M phase*: median was $2.92 million annually

Table of Contents

Acknowledgements i
Abstract ii
List of Figures iv
List of Tables iv
List of Appendices iv
Introduction 1
- State of Arizona 2
- Cochise County 2

Windy Land Analysis using GIS 4
- Methodology 4
- Input Data for Windy Land Analysis 4
- Results of Windy Land Analysis 6

Economic Impact Analysis 11
- Methodology 11
  - JEDI Model 11
  - Why Monte Carlo simulation? 12
- Input Data for Economic Impact Analysis 13
  - County Multipliers 13
  - Wind Energy Project Size 13
  - Construction Cost and Operations & Maintenance Cost 13
  - Property tax calculation 14
  - Local Share 15
  - Simulation Parameters 15
- Results of Economic Impact Analysis 17
  - *Jobs* 17
  - *Earnings* 18
  - *Output* 19

Conclusions 21
Appendix A Tables of JEDI/Monte Carlo Simulation Results 22
References 25

List of Figures

Figure 1 Cochise County in northern Arizona 1
Figure 2 Map of Windy Land for Cochise County, AZ 7
Figure 3 Map of Development Exclusions in Cochise County 8
Figure 4 Windy Land by Wind Class for Cochise County 9
Figure 5 Map of Developable Windy Land for Cochise County 10
Figure 6 Wind Energy Project Impact on JOBS during Construction Phase 17
Figure 7 Wind Energy Project Impact on JOBS during O&M Phase 18
Figure 8 Wind Energy Project Impact on EARNINGS during Construction 18
Figure 9 Wind Energy Project Impact on EARNINGS during O&M Phase 19
Figure 10 Wind Energy Project Impact on OUTPUT during Construction Phase 19
Figure 11 Wind Energy Project Impact on OUTPUT during O&M Phase 20

List of Tables

Table 1 Cochise County Demographics 3
Table 2 Cochise County Industry Sectors 3
Table 3 Land Ownership in Cochise County 3
Table 4 Wind Development Exclusions 5
Table 5 Cochise County Exclusion Categories that Remove Windy Land 9
Table 6 Windy Land and Developable Windy Land in Cochise County 9
Table 7 Input Parameter Estimates 14
Table 8 Arizona Property Tax Calculation 14
Table 9 Local Shares Values 16

List of Appendices

Appendix A- 1 Wind Energy Project Impact on JOBS 22
Appendix A- 2 Wind Energy Project Impact on EARNINGS 23
Appendix A- 3 Wind Energy Project Impact on OUTPUT 24

Introduction

The wind energy development potential and economic benefits were determined for a southern Arizona county, Cochise (see Figure 1). Using Geographic Information System (GIS) techniques on wind map data an estimate was made of the amount of developable windy land and potential installed capacity. Secondly, an analysis was made of the economic impacts of constructing and operating wind energy projects utilizing the Job and Economic Development Impact[a] (JEDI) model developed for National Renewable Energy Laboratory (NREL). Wind energy projects of three representative sizes were considered: 10.5 MW, 60 MW, and 180 MW. The JEDI model was used in conjunction with Monte Carlo simulation to estimate economic impacts at the county level. Direct, indirect and induced economic effects were estimated and categorized by jobs, earnings, and output (economic activity).

The wind maps and information in this report are *not* appropriate for siting wind energy projects. It is useful for discussing policy and locations that might be appropriate for further study. In order to site a wind energy project, an anemometer should be installed on the property and two years of data collected. More Arizona wind maps are available at www.ses.nau.edu.

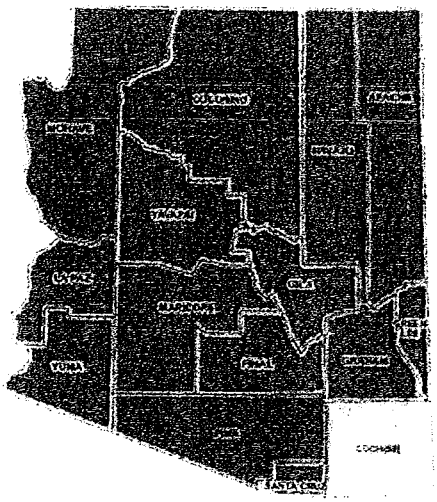


Figure 1 Cochise County in northern Arizona

---

[a] The JEDI model was designed by Marshall Goldberg, of MRG & Associates, under contract with NREL. The model is posted on the Wind Powering America website: http://www.eere.energy.gov/windandhydro/windpoweringamerica/filter_detail.cfm/pid=707 in June 2005.

State of Arizona

According to the US Census Bureau Quick Facts[1] the population in the state of Arizona increased 40% from 1990 to 2000. During this period US population increased 13.1%. Due to this rapid population and economic growth, electricity demand increased at the rate of 2.6% per year[2].

In 2001, the average electricity retail price for Arizona residents and businesses was 7.2 cents/kwh. This is the 16th highest average electricity price in the nation behind the six New England states, New York, New Jersey, Pennsylvania, California, Alaska, Hawaii, Texas, Florida, and Nevada. In addition to Arizona's increasing population, the hot climate and resulting need for air conditioning in the summer affect the increasing demand and price of electricity. Arizona has a larger than average residential demand largely due to the demand for air conditioning. The residential sector purchases 41% of the electricity as compared to 36% nationally[2].

Arizona primarily relies on coal and nuclear fuels for electrical generation. In 2000, approximately 45% of electricity was coal-generated and 35% was nuclear with only 10% generated from natural gas and another 10% by hydroelectric. However, the balance will be shifting to natural gas in the future as there are 16,000 MW of planned generation units by 2007, of which 15,000 MW are planned to be natural gas[2].

Cochise County

Cochise County, in southeastern Arizona, is 6,219 square miles with a 2001 population of 121,040. The area is known for mining and agriculture. Historic Tombstone may be its most widely recognized town though Bisbee is the county seat and Sierra Vista is the largest community with a population of 40,415 in 2003[3]. Demographic information is given in Table 1[4] and industry sector information is given in Table 2[5]. The largest land ownership category in Cochise County, approximately 40% is individual and corporate ownership (see Table 3)[3].

Table 1 Cochise County Demographics

Demographic	Cochise
Population, 2005 estimate	126,106
Population, percent change, April 1, 2000 to July 1, 2005	7.1%
Population, percent change, 1990 to 2000	20.6%
High school graduates, percent of persons age 25+, 2000	79.5%
Bachelor's degree or higher, pct of persons age 25+, 2000	18.8%
Per capita money income, 1999	$15,988
Median household income, 2003	$34,755
Persons below poverty, percent, 2003	16.3%
Private nonfarm establishments, 2003	2,256
Private nonfarm employment, 2003	25,122
Private nonfarm employment, percent change 2000-2003	10.8%
Retail sales, 2002 ($1000)	917,299
Retail sales per capita, 2002	$7,641
Land area, 2000 (square miles)	6,169
Persons per square mile, 2000	19.1
Metropolitan or Micropolitan Statistical Area	Sierra Vista-Douglas

Table 2 Cochise County Industry Sectors

Industry Sectors in Cochise County	Percent	Employed
Agriculture, forestry, fishing and hunting, and mining	3.3	1418
Construction	7.4	3,164
Manufacturing	3.9	1649
Wholesale trade	1.4	615
Retail trade	14.7	6,264
Transportation and warehousing, and utilities	4.9	2,108
Information	2.4	1024
Finance, insurance, real estate, and rental and leasing	4	1695
Professional, scientific, management, administrative, and waste management services	7.9	3359
Educational, health and social services	20.3	8,640
Arts, entertainment, recreation, accommodation and food services	9.9	4,226
Other services (except public administration)	5.6	2389
Public administration	14.3	6,075

Table 3 Land Ownership in Cochise County

Land owner	Cochise
Private	40%
State of AZ	35%
US Forest Service & BLM	22%
Other public lands	3%
	100%

Windy Land Analysis using GIS

Methodology

For the purpose of this analysis, *windy land* is defined as land with a wind resource greater than or equal to class three as predicted by the Arizona Wind Map (the wind map will be discussed in the section on Input Data). That is, predicted average annual wind speeds are large enough that wind energy may be produced economically. However, not all windy land may be developed for wind power. There are many *development exclusions* that must be considered. For instance, land that is owned by the National Park Service must be excluded 100% from consideration for development. *Developable windy land*, therefore, is the windy land that remains after all development exclusions have been applied. Finally, *excluded windy land* is windy land (class 3 and above) that falls within a development exclusion.

Consistent with the methodology applied by NREL, there are three general *exclusion* categories of land unsuitable for development[6]:

- environmental exclusions
- land use exclusions
- additional windy land factors

These development exclusions are summarized in Table 4. Any windy land with 1 or more exclusion is excluded windy land and is not appropriate to be used for wind energy projects. After removing excluded windy land, the remaining land is developable and an estimate of the potential installed capacity by wind class for each county was made by assuming a conservative 5 MW of installed capacity per square kilometer.

Input Data for Windy Land Analysis

TrueWind Solutions, in collaboration with NREL, developed a high-resolution wind map and GIS data for the state of Arizona in 2003. The data for this wind map was created using a numerical weather model coupled with climactic data and a wind flow model. The wind map provides 200-meter resolution data sufficient for identifying the most promising areas for wind development in the state. The data from this map was used to analyze the wind resource of Cochise County.

A *data layer* is a geographic data set that can be represented visually using GIS software. Several data layers were required for the exclusion analysis. The data layers, their exclusion category (environmental, land use, other factors), source and brief description are listed in Table 4.

Table 4 Wind Development Exclusions

Broad Exclusion Category	Exclusion	Exclusion† Percentage	Exclusion Description	GIS Layer Source
Environmental Exclusions	**National Park Service**	100%	United States National Park Service Land	ALRIS ‡
	Fish and Wildlife Service	100%	United States Fish and Wildlife service	ALRIS
	Congressionally Specially Designated Areas	100%	Special Areas, like wilderness or wild, and scenic rivers, congressionally designated as such	USFS
	Inventoried Roadless Areas	100%	These are roadless areas of the country on federal land that have been congressionally designated as such	USFS
	State and Other Environmental Land (State GAP Data)	100%	Land Stewardship Layer (includes Nature Conservancy Land available)	USGS AZ ReGAP
	Other: Wildlife, Wilderness and Recreation Areas on Federal land of any designation (predominately USFS and BLM lands)	100%	Land Stewardship Layer (includes Nature Conservancy Land available)	USGS AZ ReGAP§
	Remaining USFS & DOD Land	50%	United States Forest Service and Department of Defense lands that remain after all other windy land exclusions are removed	ALRIS
Land Use Exclusions	**Urban/Developed Areas**	100%	Urban or Developed land as described by USGS ReGAP data	USGS AZ ReGAP
	Airports	100%	Airports	National Atlas of the United States, USGS, ESRI
	Wetlands	100%	Wetland ecosystems as described by USGS ReGAP data	USGS AZ ReGAP
	Water bodies (includes seasonal and dry lakes)	100%	Areas covered by water all year or part of the year. Does not include Rivers and Streams	USGS AZ ReGAP
	Non-ridge Crest Forests	50%	Areas of forest cover that are not considered ridge crests by TPI analysis	ReGAP + TPI **
Additional Windy Land Factors	**Slopes > 20%**	100%	These are landscapes with slopes greater than 20%	Grant Brummels

† Windy land exclusions were excluded 100%, with the exception of "non-ridge crest forests" and "remaining USFS and DOD Land," which were excluded 50%. Additionally, all 100% exclusions were buffered 3km, except for wetlands (100m), open water (no buffer), and slopes > 20% (no buffer).† Non-ridge crest forests have had all 100% exclusions removed. Remaining USFS and DOD land has had all non-ridge crest forests and 100% exclusions removed.

‡ ALRIS—Arizona Land Resource Information System

§ ReGAP—Regional Gap Analysis Program, 30m satellite data

** Jenness, J. 2005. Topographic Position Index (tip_jen.avx) extension for ArcView 3.x. Jenness Enterprises. Available at: http://www.jennessent.com/arview/tpi.htm. TPI was applied to a 90m Digital Elevation Model.

Results of Windy Land Analysis

The windy land in Cochise County is shown in Figure 2. Using GIS, the square kilometers of land was then totaled by wind class. Approximately 2.2% of the land is considered windy land. Of the windy land, the majority is class 3.

The development exclusions for Cochise County are mapped in Figure 3. As displayed, the land areas highlighted in blue show the areas that cannot be developed for wind energy regardless of how windy since this land was classified as a development exclusions. In Cochise County, 3.0% of the total county land area is classified as development exclusions.

Exclusions are significant in Cochise County – 90% of windy land is excluded from consideration for development. See Figure 4 to compare the wind class breakdown of the amount of windy land with the wind class breakdown of the amount of developable windy land. When exclusions are considered, much of the excluded windy land is higher than class 3. As a result, the proportional amounts of class 4 and above decrease with a corresponding increase in the proportional amount of class 3.

Some land is excluded under multiple categories. For instance, land may have a slope greater than 20% and also be an Inventoried Roadless Area. The largest exclusion affecting windy land is Slopes>20% and excludes 67% of windy land. Other exclusion categories that remove windy land are given in Table 5. The percentages will not add to 100% because trivial categories have not been included and because some land is excluded by multiple categories.

Table 6 provides a summary of the results of the windy land analysis for Cochise County. Organized by wind class, the total area of windy land, area of developable windy land, and potential developable capacity are shown. These tables also show that the total developable capacity in Cochise County, including class 3 or better windy lands, is 276 MW. When restricting this estimate to windy lands of class 4 or better, the developable capacity for these counties is 56 MW. Finally, the developable windy land is shown in Figure 5.

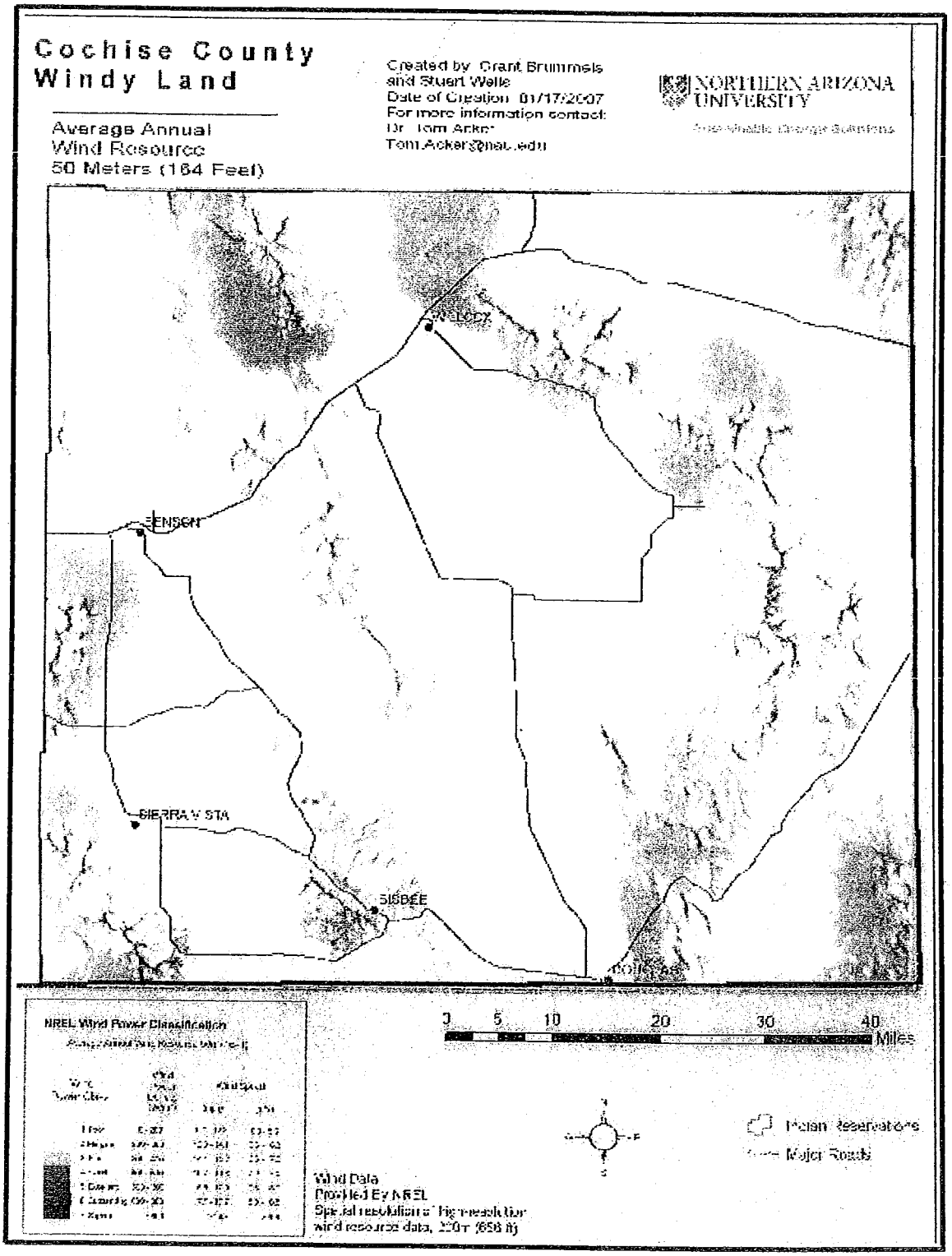


Figure 2 Map of Windy Land for Cochise County, AZ

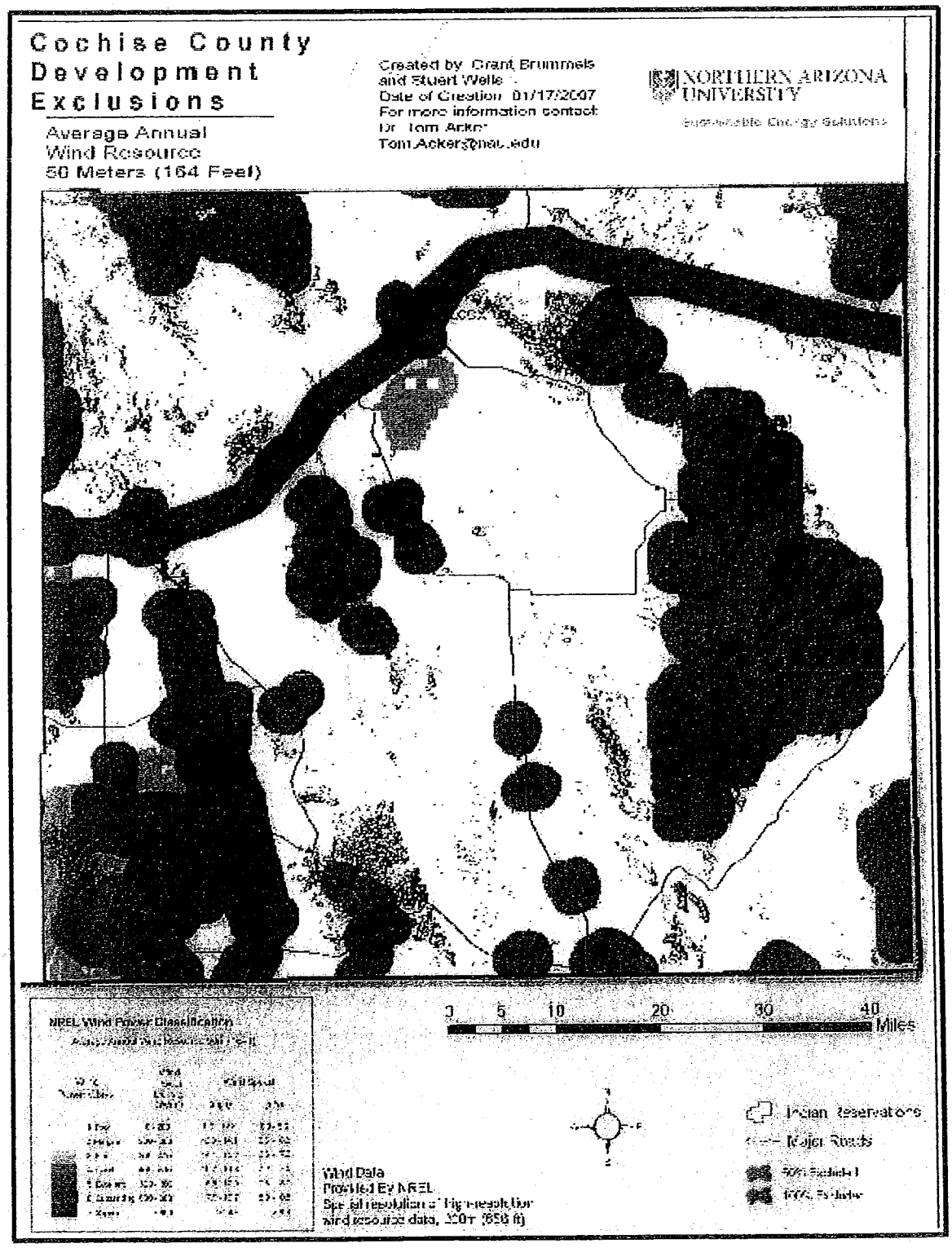


Figure 3 Map of Development Exclusions in Cochise County

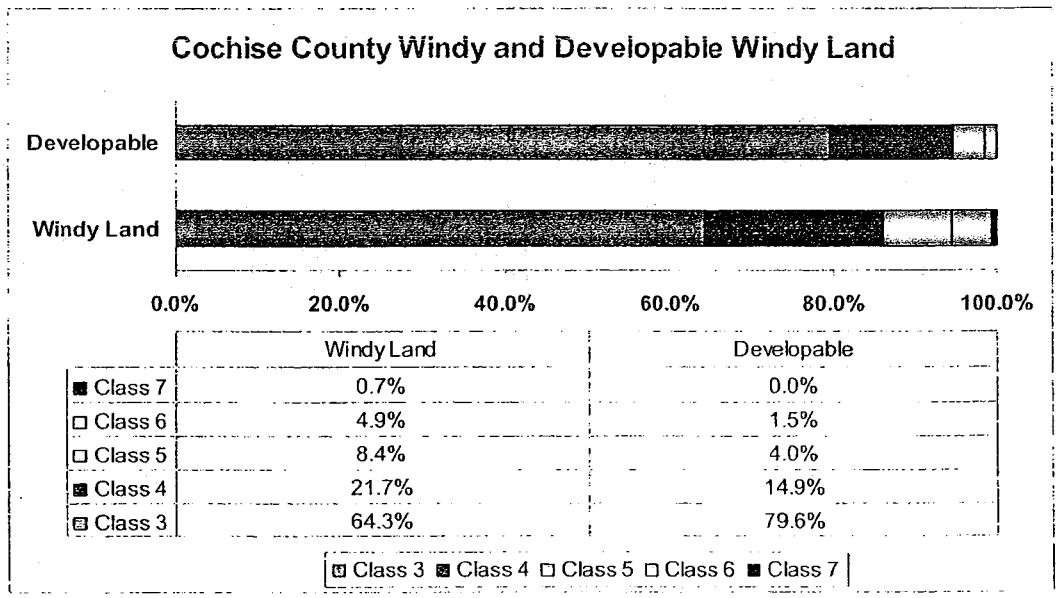


Figure 4 Windy Land by Wind Class for Cochise County

Table 5 Cochise County Exclusion Categories that Remove Windy Land

Exclusion Category	Windy Land Excluded
Slopes > 20%	67.1%
Inventoried Roadless Areas	45.2%
Environmental Lands	32.9%
Specially Designated Areas	18.5%

Table 6 Windy Land and Developable Windy Land in Cochise County

Cochise County Wind Class Area Analysis						
Wind Class	Power (w/m^2)	Total Area (km^2)	Windy Land as Percent of Total Land Area	Developable Windy Land (km^2)#	Developable Windy Land as Percent of Total Land Area	Developable Installed Capacity (MW)*
3	300-400	354	1.38%	44	0.17%	220
4	400-500	119	0.47%	8	0.03%	41
5	500-600	46	0.18%	2	0.01%	11
6	600-800	27	0.10%	1	0.00%	4
7	>800	4	0.02%	0	0.00%	0
		16,212	Cochise County Total			276

*Assuming 5 MW per sq. km.

#Exclusions determined using GIS analysis

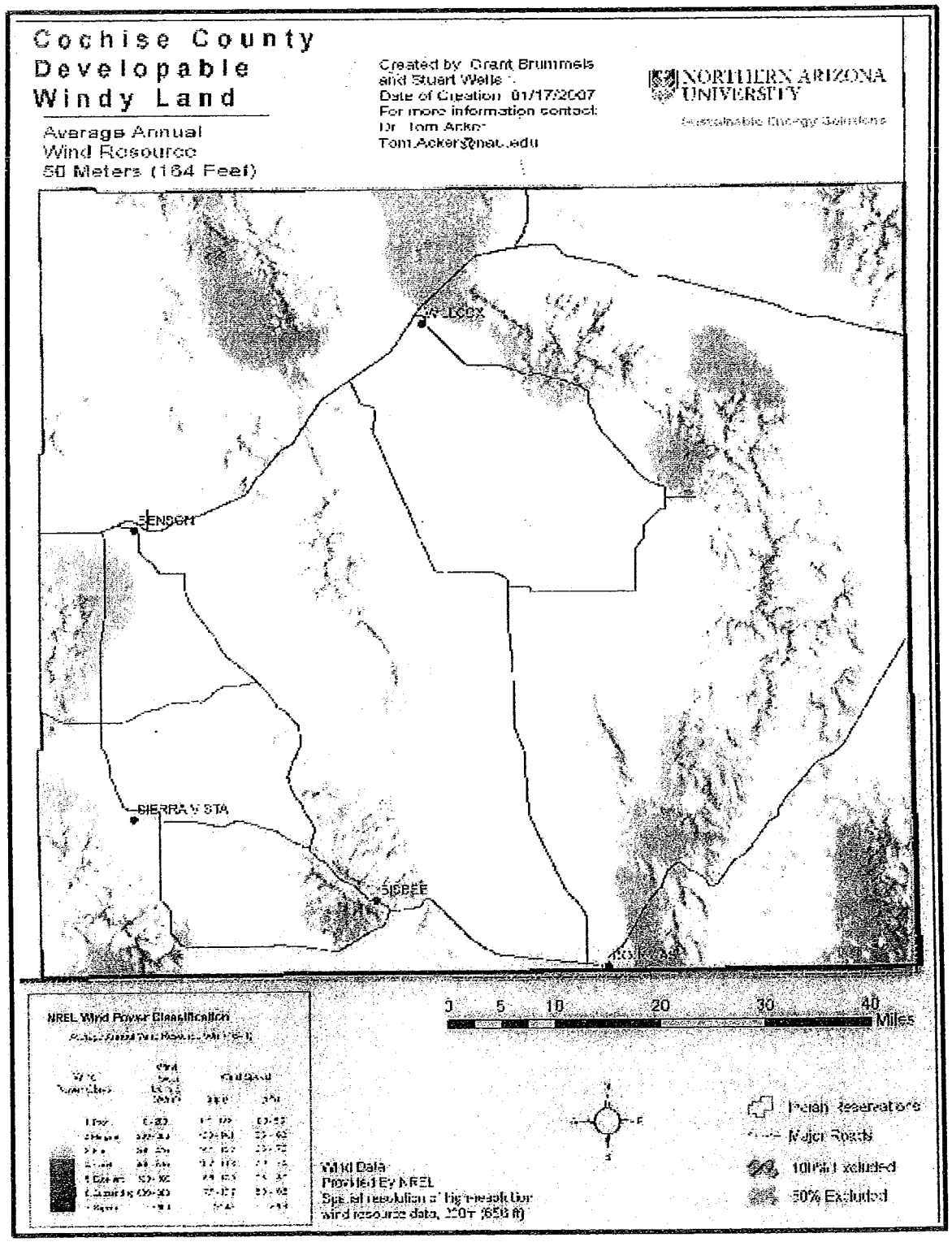


Figure 5 Map of Developable Windy Land for Cochise County

Economic Impact Analysis

In this study, economic input/output (I/O) analysis in conjunction with Monte Carlo simulation was used to estimate the economic impact for wind energy projects. The JEDI model performs I/O analysis with an Excel add-in, *@Risk*[7], used to perform the Monte Carlo simulation.

In I/O analysis, a project expenditure may have up to three impacts on the local economy:

- **Direct effects** – on-site effect created by expenditure (i.e., on-site jobs of contractors and crews, jobs at the turbine).
- **Indirect effects** – increase in economic activity that occurs when a contractor, vendor or manufacturer receives payment for goods or services and in turn is able to pay others who support their business.
- **Induced effects** – change in wealth and income that is induced by the spending of those persons directly and indirectly employed by the project (i.e., spending on food, clothes, utilities, transportation, insurance, medical, etc.).

The results of I/O analysis estimate these effects (direct, indirect, and induced) on the jobs, earnings, and economic output.

Methodology

JEDI Model

JEDI is a spreadsheet economic input/output model that accepts wind project data and estimates the direct, indirect, and induced effects of the expenditure to build and operate a wind energy project. The model separates a wind energy project into two distinct phases: construction phase and operations and maintenance (O&M) phase. The construction phase is approximately a year while the O&M phase is from the time the project is brought on-line until it is decommissioned. JEDI estimates the jobs, earnings, and economic activity for the one-time impact of the construction phase and the annual impact of the O&M phase.

JEDI was designed for users that have a variety of experience-levels in I/O analysis or with wind energy projects. To obtain results from JEDI, a user can input as little as the year of installation, the size of the project, and the state for which the economic impacts will be estimated. The remaining input has default values designed for a state-level analysis. As the user gains additional experience or information about the project, additional details can be entered into the model[8].

Why Monte Carlo simulation?

Monte Carlo simulation is a statistical simulation technique which allows input parameters that are uncertain to be randomly varied over a specified range of values. Multiple trials of the Monte Carlo model allow the user to observe and average the results of the output.[9] @Risk by Palisade Corporation[8], an add-in to Microsoft Office Excel, was utilized for Monte Carlo simulation.[10] Using Monte Carlo simulation in conjunction with the I/O analysis provided two advantages over an analysis with JEDI only:

1) Increased input flexibility – cost estimates may be entered as a range of values instead of a single estimate.

2) Increased output information –a range of output values was obtained instead of a single value.

The data required by the JEDI model to estimate the economic impact of constructing and operating a wind energy project can be difficult to accurately estimate. Some input parameters are specific to the site and design. However, estimates for economic impacts are often desired before a site and design have been selected. In addition some of this data is proprietary and industry norms must be relied on to estimate the parameters.

The approach in other work[11,12] has been to use a single estimate representing the most likely value or industry average. For each of the outputs, the JEDI model then produced a single value. By using Monte Carlo simulation any input parameters can be approximated by a range of input values. For each of these input parameters, three estimates were determined: (1) the most likely estimate, (2) the minimum estimate, and (3) the maximum estimate.

Running a simulation with these input parameters as random variables provides an expected value and a variance of the output variables. Therefore, the output is a range of values instead of a single number. This provides a measure of certainty or risk: the smaller the range, the more certainty in the results. When using the JEDI model, the economic impact is estimated using six measures: jobs during construction phase, jobs during O&M phase, earnings during construction phase, earnings during O&M phase, output during construction phase, and output during O&M phase.

Finally, the input parameter(s) which have the most influence on the output can be determined using Monte Carlo simulation. Effort can then be focused on accurately estimating those input parameters that have the most significant effect on the outputs.

Input Data for Economic Impact Analysis

Sources of information are documented. However, many modeling decisions are also based on information gained from discussion with wind energy professionals and experts. These discussions have occurred over time in many venues including the Arizona Wind Working Group and the AWEA Windpower meetings.

County Multipliers

In order to utilize JEDI for county-level analysis, appropriate multipliers for Coconino County were obtained from Marshal Goldberg via NREL. Specifically, the direct, indirect and induced multipliers for employment, earnings and output (per million dollars change in final demand) and personal consumption expenditures (i.e., average consumer expenditures on goods for the counties) were obtained[13]. Using the state-level multipliers that are provided with JEDI would overstate the economic benefits so it was important to obtain county-level multipliers for this analysis.

Wind Energy Project Size

Three wind energy project sizes were selected for the economic impact analysis. The sizes that were selected are based on discussions with wind energy experts and professionals, examination of the results of the windy land analysis and surveying the projects that came on-line in 2003-2004 in the southwest. For all analysis, 1.5 MW wind turbines were assumed.

The smallest project size considered was 10.5 MW and the largest was 180 MW. The mid-sized project was assumed to be 60 MW, which is the size of the wind project planned for another Arizona county, Coconino County (Sunshine Wind Park near Winslow, Arizona) and the size of two wind energy projects built in the southwest in 2003-2004, Caprock Wind Ranch in New Mexico and the Oasis Wind Power Project in southern California. In the southwest during 2003-04, three wind energy projects were built that were in the size range of 160-200 MW (New Mexico Wind Energy Center, Colorado Green Lamar, Brazos Wind Ranch in Texas) [14]. To date, no utility-scale wind energy projects have been built in Arizona.

Construction Cost and Operations & Maintenance Cost

Construction cost and O&M cost depend on site and design specific data. Since the site and design were not known, these costs were estimated by a range of values. The estimates used for construction cost and operations and maintenance (O&M) cost are given in Table 7. Estimates for these costs are based on several sources including conversation with a wind developer[11,12,15,16].

Table 7 Input Parameter Estimates

Input Parameter	Minimum	Most Likely	Maximum
Construction Cost ($/kw)	$1,000	$1,200	$1,500
Annual Operating Cost ($/kw)	$9.50	$12.50	$25.00
Property Tax Rate	9.6%	11.6%	15.0%

Both construction cost and O&M cost were uncertain input parameters and were therefore simulated. The triangular distribution was used to generate these costs. The triangular distribution is often used in practice because it is uni-modal and may be non-symmetrical. In addition, there are fixed endpoints for the range of values. Finally, the triangular distribution is a good distribution to use in the absence of data. In the absence of data, experts can be surveyed and industry data consulted for averages. Experts can be asked for their subjective estimates of the minimum, most likely, and maximum values.[17]

Property tax calculation

To calculate the property tax in Arizona the construction cost which includes the cost of the equipment (wind turbines), building and installation costs, must first be determined. Typically, the *full-cost value* is 80% of the construction cost. Property taxes are based on the *assessed value* which is 25% of the full-cost value. The *property tax* is the tax rate multiplied by the assessed value, see Table 8

Table 8 Arizona Property Tax Calculation

Full Cost Value = 80% * Construction Cost
Assessed Value = 25% of Full Cost Value
Tax = Tax Rate * Assessed value

The tax rate varies significantly depending on the location within the state. Examining the tax tables, it was determined that the range of tax rates vary from a minimum of 9.6% to a maximum 15%. Tax rates were estimated from information obtained in conversations with the Cochise County Tax Assessor's office[3,18]. The property tax rate was simulated using a triangular distribution.

Local Share

Local share is the percentage of expenditures spent in the state or local region where the wind energy project is constructed. For this work, it represents the percentage of expenditures spent in the county. Currently, the JEDI model provides default values for local share percentages that are estimated at the state-level (See Table 9). The JEDI model default values are not appropriate for a county-level analysis as the results will be considerably overstated.

We developed local share percentages that apply to Cochise County by consulting with a wind developer and an economist. Constanti (2004) also provides guidance for setting the local share percentages for rural counties in Montana. Finally, we examined Cochise County demographics (Table 1, Table 2) focusing particularly on population and employment. Minimum and maximum local share percentages were established and are also shown in Table 9[11]. The local share percentages were simulated using a uniform distribution which implies that all values between the minimum and maximum (default) are equally likely.

Simulation Parameters

For each county and wind project size, a simulation was run. For each simulation, the number of trials was determined by observing the convergence of the distribution statistics for the output variables (construction phase: jobs, earnings, output; O&M phase: jobs, earnings, output). When the measured statistics changed no more than 1%, the output distribution was considered 'stable' and the simulation was considered to have converged. The number of trials in each simulation varied between 900 and 1100. The output distribution statistics that were measured are the average percent change of the percentiles, the mean, and the standard deviation.

Table 9 Local Shares Values[††]

Project Cost Data	JEDI default State-level Local Share	Cochise County Minimum Local Share	Cochise County Maximum Local Share
Construction Costs			
Materials			
Construction (concrete, rebar, equip, roads and site prep)	90%	25%	50%
Transformer	0%	0%	0%
Electrical (drop cable, wire,)	100%	10%	25%
HV line extension	100%	0%	10%
Labor			
Foundation	100%	40%	60%
Erection	75%	10%	15%
Electrical	75%	25%	50%
Management/supervision	0%	0%	0%
Equipment Costs			
Turbines (excluding blades and towers)	0%	0%	0%
Blades	0%	0%	0%
Towers	0%	0%	0%
Other Costs			
HV Sub/Interconnection	100%	10%	25%
Engineering	0%	0%	5%
Legal Services	100%	25%	50%
Land Easements	100%	100%	100%
Site Certificate/Permitting	100%	100%	100%
Wind Plant Annual Operating and Maintenance Costs			
Personnel			
Field Salaries	100%	60%	75%
Administrative	100%	60%	75%
Management	100%	60%	75%
Materials and Services			
Vehicles	100%	50%	75%
Misc. Services	80%	25%	50%
Fees, Permits, Licenses	100%	100%	100%
Utilities	100%	100%	100%
Insurance	0%	0%	0%
Fuel (motor vehicle gasoline)	100%	100%	100%
Tools and Misc. Supplies	100%	60%	75%
Spare Parts Inventory	2%	2%	2%

[††] JEDI default values should not be used for a county-level analysis. The JEDI default values are appropriate only for a state-level analysis. If used for a county-level analysis, benefits will be greatly overstated.

Results of Economic Impact Analysis

All economic outputs from JEDI are divided into benefits that occur during the construction phase (usually less than a year) and annual benefits that occur during the operational life of the wind project. For each phase, the model estimates:

- Jobs – the number of full-time equivalent employment for a year.
- Earnings - wage and salary compensation paid to workers.
- Output - economic activity or the value of production in the county economy.

For all three estimates, the simulation in conjunction with the JEDI model produces a frequency distribution. We report the percentiles for these distributions. The 50th percentile is the median. That is there is 50% chance that the number of jobs will be above the median and a 50% chance that the number of jobs will be below the median. We report the minimum, 5th percentile, 50th percentile, 95th percentile and maximum. There is a 95% likelihood that the number of jobs will be less than the 95th percentile.

Jobs

Results pertaining to job creation for each wind energy project size and project phase are given in Figure 6 and Figure 7. A summary table is given in Appendix A-1. Based on simulation, there is a 90% likelihood that the number of jobs created during the construction phase in Cochise County will be between 21 and 33 for a 60 MW wind energy project. During the O&M phase, there is a 90% likelihood that the number of jobs created in Cochise County will be between 10 and 12.

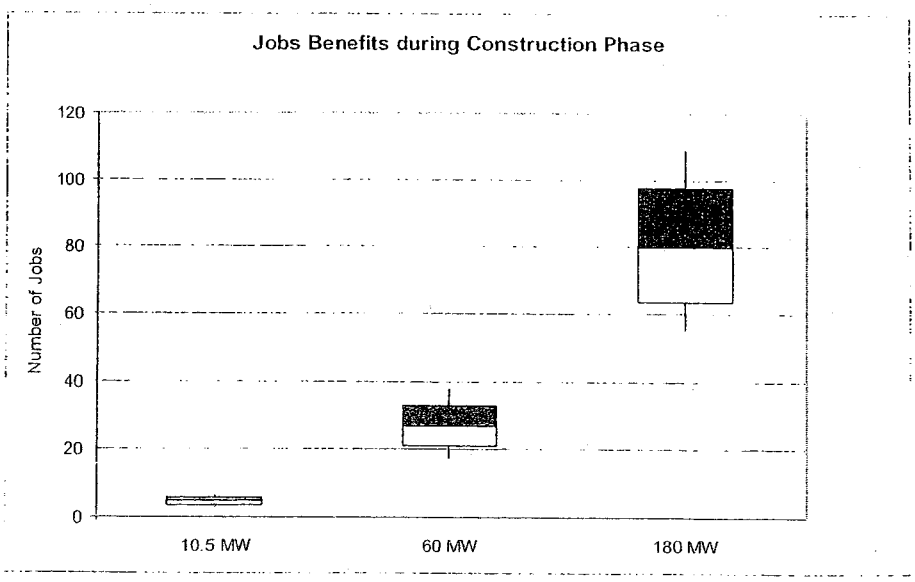


Figure 6 Wind Energy Project Impact on JOBS during Construction Phase

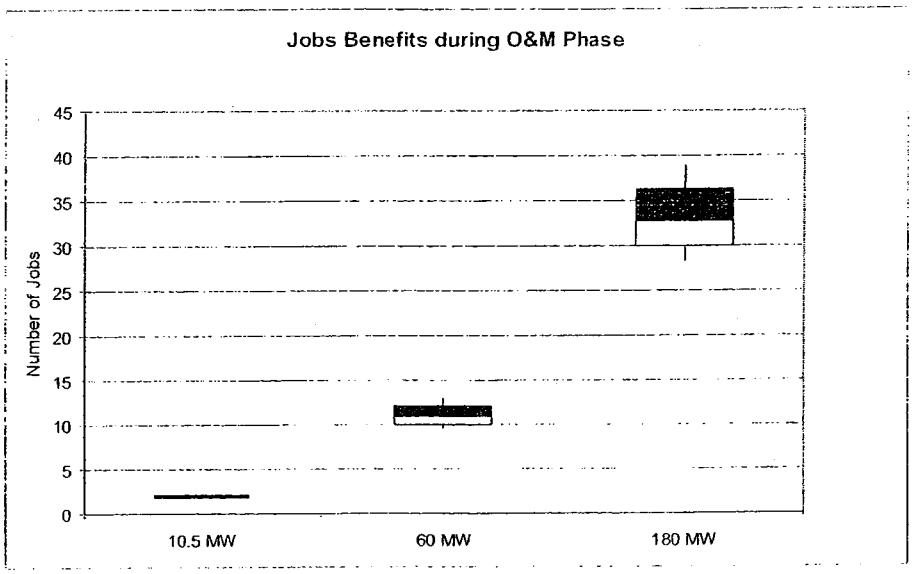


Figure 7 Wind Energy Project Impact on JOBS during O&M Phase

Earnings

Earnings refer to millions of dollars in wages and salary paid to workers. Results for earnings for all wind energy project sizes and phases are given in Figure 8 and Figure 9. A summary table is given in Appendix A-2. Based on simulation, there is a 90% likelihood that the earnings paid during the construction phase in Cochise County will be between $0.60 and $0.93 million annually for a 60 MW wind energy project (in 2007 dollars). During the O&M phase, there is a 90% likelihood that the annual earnings in Cochise County will be between $0.33 and $0.58 million.

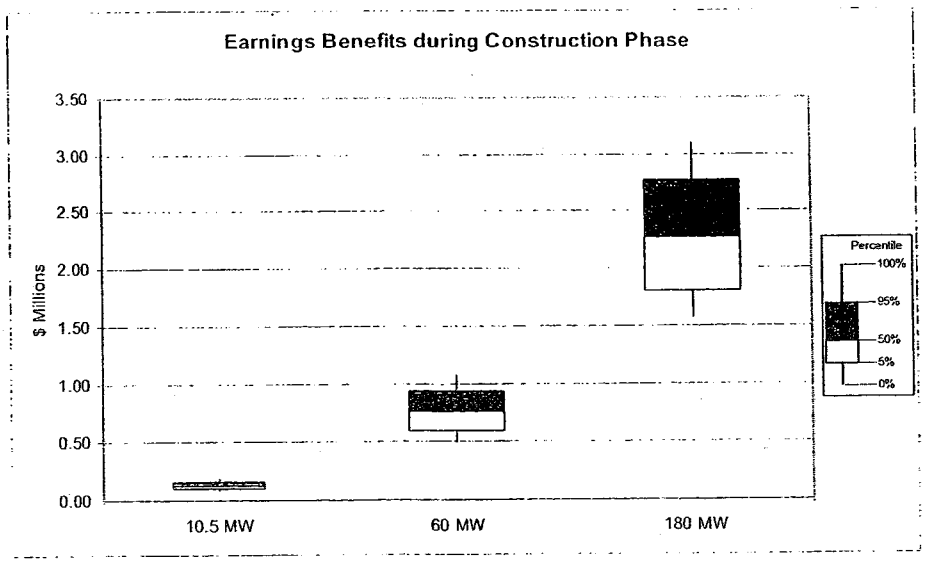


Figure 8 Wind Energy Project Impact on EARNINGS during Construction

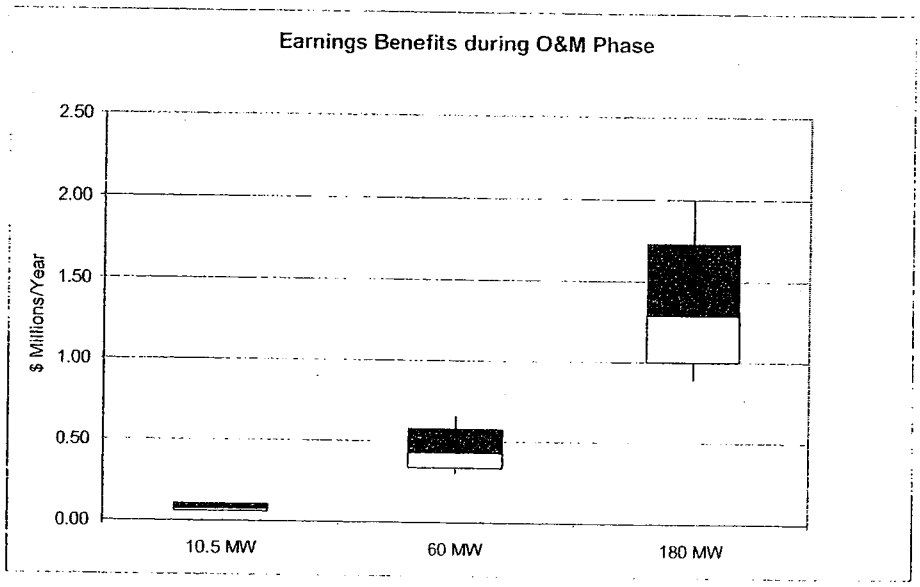


Figure 9 Wind Energy Project Impact on EARNINGS during O&M Phase

Output

Figure 10 and Figure 11 show a summary of output results for all wind energy project sizes and phases. A summary table is given in Appendix A-3. Output refers to economic activity or the value of production in the county and is also in millions of 2007 dollars. Based on the simulation results there is a 90% likelihood that the output will be between $2.52 and $3.95 million annually for Cochise County. During the O&M phase, there is a 90% likelihood that the annual output in Cochise County will be between $0.83 and $1.21 million.

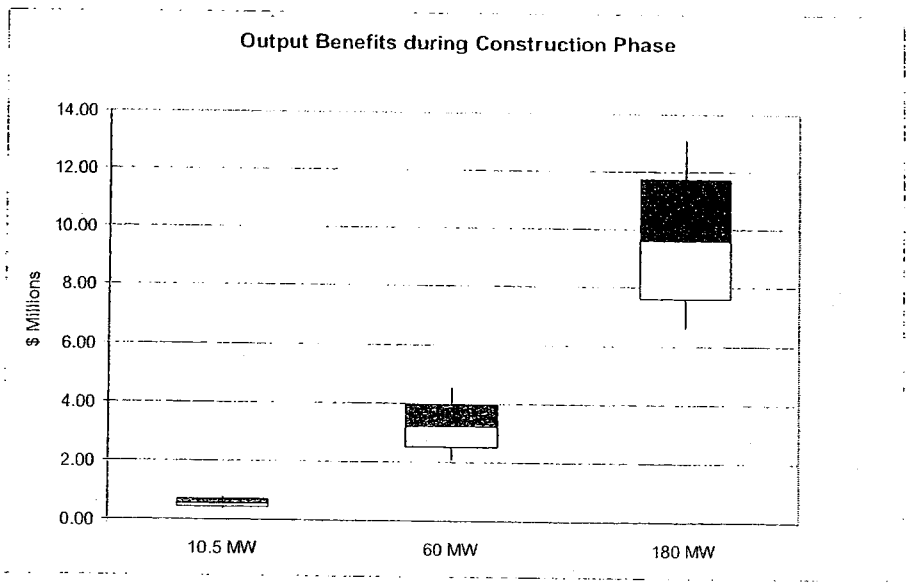


Figure 10 Wind Energy Project Impact on OUTPUT during Construction Phase

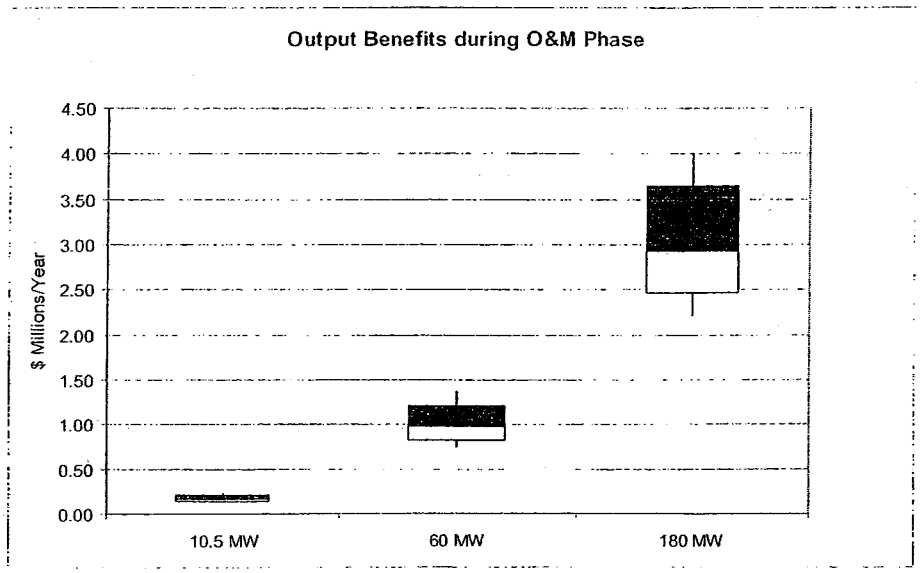


Figure 11 Wind Energy Project Impact on OUTPUT during O&M Phase

Conclusions

The first objective of this project was to estimate the wind energy development potential for Cochise County. Based on high-resolution wind map data analyzed in a GIS while considering development exclusions, it was estimated that the developable windy land and potential installed capacity for Cochise is approximately 275 MW. The majority of this capacity is from Class 3 wind. When this estimate is restricted to windy lands of class 4 or better, the developable capacity is 50 MW.

The second objective of this work was to estimate the economic impact of constructing and operating wind energy projects of various sizes in Cochise County. Monte Carlo simulation was conducted in conjunction with the JEDI model and provided a range of outputs corresponding to a range of estimated input parameters. For a 60 MW wind energy project, there is 90% likelihood that:

- number of jobs created during the construction phase is between 21 and 33 with a median of 27 jobs.
- number of jobs created during the O&M phase is between 10 and 12 with a median of 11.
- earnings during the construction phase is between $0.60 and $0.93 million with a median of $0.76 million in Cochise.
- earnings during the O&M phase is between $0.33 and $.58 million annually with a median of $0.43 million.
- output during the construction phase is between $2.52 and $3.95 million with a median of $3.21 million.
- output during the O&M phase is between $1.02 and $1.55 million annually with a median of $1.24 million.

Appendix A Tables of JEDI/Monte Carlo Simulation Results

Appendix A- 1 Wind Energy Project Impact on JOBS

	Jobs for 10.5 MW Wind Farm	
Percentile	Construction	O & M
0th	3	2
5th	4	2
50th	5	2
95th	6	2
100th	6	2
	Jobs for 60 MW Wind Farm	
Percentile	Construction	O & M
0th	17	10
5th	21	10
50th	27	11
95th	33	12
100th	38	13
	Jobs for 180 MW Wind Farm	
Percentile	Construction	O & M
0th	55	28
5th	63	30
50th	80	33
95th	98	36
100th	109	39

Note: Percentile is a descriptive statistic. When we simulate 1000 times, there are 1000 measurements of each output (i.e. Construction Jobs for 60 MW Wind Farm). The 95th percentile tells us that 95% of those 1000 simulations had 33 or fewer Construction Jobs for a 60 MW Wind Farm. We interpret this as a 95% probably that the number of Construction Jobs for a 60 MW Wind Farm will be 33 or less. The 50th percentile represents the median.

Appendix A- 2 Wind Energy Project Impact on EARNINGS

($ millions)

	Earnings for 10.5 MW Wind Farm	
Percentile	Construction	O & M
0th	0.09	0.05
5th	0.10	0.06
50th	0.13	0.08
95th	0.16	0.10
100th	0.18	0.11
	Earnings for 60 MW Wind Farm	
Percentile	Construction	O & M
0th	0.49	0.30
5th	0.60	0.33
50th	0.76	0.43
95th	0.93	0.58
100th	1.07	0.66
	Earnings for 180 MW Wind Farm	
Percentile	Construction	O & M
0th	1.56	0.89
5th	1.80	1.00
50th	2.27	1.29
95th	2.77	1.73
100th	3.10	2.00

Note: Percentile is a descriptive statistic. When we simulate 1000 times, there are 1000 measurements of each output (i.e. Earnings for 60 MW Wind Farm). The 95th percentile tells us that 95% of those 1000 simulations had $0.93 million or less Earnings from a 60 MW Wind Farm. We interpret this as a 95% probably that the amount of Earnings from a 60 MW Wind Farm will be $0.93 million or less. The 50th percentile represents the median.

Appendix A- 3 Wind Energy Project Impact on OUTPUT

($ millions)

	Output for 10.5 MW Wind Farm	
Percentile	Construction	O & M
0th	0.36	0.13
5th	0.44	0.14
50th	0.56	0.17
95th	0.69	0.21
100th	0.78	0.23
	Output for 60 MW Wind Farm	
Percentile	Construction	O & M
0th	2.06	0.75
5th	2.52	0.83
50th	3.21	0.98
95th	3.95	1.21
100th	4.55	1.38
	Output for 180 MW Wind Farm	
Percentile	Construction	O & M
0th	6.63	2.21
5th	7.62	2.47
50th	9.59	2.92
95th	11.73	3.65
100th	13.10	4.02

Note: Percentile is a descriptive statistic. When we simulate 1000 times, there are 1000 measurements of each output (i.e. Output from a 60 MW Wind Farm). The 95th percentile tells us that 95% of those 1000 simulations had $3.95 million or less Output from a 60 MW Wind Farm. We interpret this as a 95% probably that the amount of Output from a 60 MW Wind Farm will be $3.95 million or less. The 50th percentile represents the median.

References

[1] Arizona Quick Facts. http://quickfacts.census.gov/qfd/states/04000.html (accessed 6/24/05). US Census Bureau.

[2] Holmes R. CA Marks. J. Conover. Statewide Economic Study 2002: Arizona's Energy Infrastructure. September 2002. Arizona Department of Commerce. www.azcommerce.com/prop/ses.htm

[3] Arizona Department of Commerce. *Profile: Cochise County.* http://www.azcommerce.com/communities/county_profiles.asp. 2004.

[4] US Census Bureau, http://quickfacts.census.gov/qfd/states/04/04005.html, accessed 12/19/06.

[5] US Census Bureau, http://factfinder.census.gov/servlet/QTTable?_bm=y&-qr_name=DEC_2000_SF3_U_DP3&-ds_name=DEC_2000_SF3_U&-_lang=en&-_sse=on&-geo_id=05000US04005, accessed 12/19/06.

[6] Schwartz, M., *Arizona Wind Resource*, presentation to the Arizona Wind Working Group, August 6, 2003, http://wind.nau.edu/azwwg/meeting/arizonawwg03.pdf.

[7] Palisade Corporation, www.palisade.com.

[8] Goldberg M, K Sinclair, M. Milligan. Job and Economic Development Impact (JEDI) Model: A User-Friendly Tool to Calculate Economic Impacts from Wind Projects. NREL/CP-500-35953. March 2004.

[9] Winston, WL, SC Albright, *Practical Management Science*, Duxbury Thomson Learning, p. 563-613, 2001.

[10] Winston, WL, *Simulation Modeling using @Risk,* Duxbury Press, 2000.

[11] Costanti M. Quantifying the Economic Development Impacts of Wind Power in Six Rural Counties Using NREL's JEDI Model. NREL/SR-500-36414, September 2004.

[12] Tegen, S., *Statewide Economic Impacts of Wind Energy Compared with Coal and Natural Gas,* NREL draft, 2004.

[13] Goldberg M, personal communication, September 26, 2004.

[14] American Wind Energy Association, http://www.awea.org/projects/index.html, accessed 2/4/05.

[15] EWEA, *Wind Energy: The Facts Volume 2 Cost*, eds P.E. Morthorst, H. Jacobsen, 2003, http://www.ewea.org/06projects_events/proj_WEfacts.htm.

[16] Poore, RZ, "*Wind 101: Wind Technology Overview*", AWEA Fall Educational Symposium, 2005.

[17] Law, AM, WD Kelton, *Simulation Modeling and Analysis*, McGraw-Hill, NY, 1982.

[18] Coconino County Tax Assessor, http://co.coconino.az.us/assessor/taxarea.asp, accessed April, 13, 2005.

Start new search Search Home Services

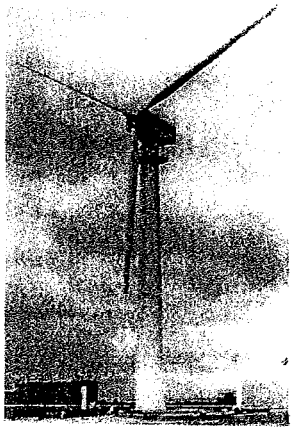
DIY Trade
B2B Trading Platform

Hello, Sign In or Register Free

Products Trade Leads Companies

Products Search Advanced Search

1 MW Wind Turbine Generator



Model: Raduga-1

Brand: SAVOIA(TM)

Origin: -

Category: Metallurgy , Mining & Energy / New Energy / Winc Power

Keywords: Wind Power , Wind Power Generator , HAWT

Price: - Min Order: -

Post Time: 14 Jan, 2006 Last Modified: 21 Jun, 20

Send Inquiry Add to Basket

This Co. have total **2** Related Items 1 2 Next

Product Description

SAVOIA(TM) "Raduga-1" windpower unit is intended for electric power generation in two ways:
a) Operating as part of windpower stations or independently interconnected with power systems and
b) Stand-alone operation or operation in parallel with other windpower units as part of windpower stat

Annual Electric Power Output Depending on Average Winds : MWh----2600 - 4900

MAIN FEATURES
· Version "Raduga-1" Generator power rating, kW---------1000
· Output voltage (three-phase),V----380 or 6600 - Other by request
· Operating wind speed range, m/s---5 - 25
· Propeller diameter, m----------48
· Tower height, m----------36
· Number of propeller blades----------3
· Propeller speed (variable), r/min---21 - 42
· Generator speed (variable) depending on make, r/min---500 or 650 - 1300
· Design stormy wind speed, m/s----60

· Operating temperature range, °C--------minus 50 - plus 40
· Design seismic stability at earthquake shocks of---------8
· Design service life of main load-bearing units, years----25
· Windpower unit mass, Ton--127 - 130

CONTROL SYSTEM
1. Ensures orientation of the propeller into wind.
2. Diagnoses the technical condition of the wind-power unit components.
3. Controls the propeller blade pitch.
4. Provides automatic starting and braking.
5. Generates signals to connect/disconnect the windpower unit to/from the network.
6. Generates emergency braking signals and executes the emergency braking algorithms.
7. Controls the windpower unit in response to remote control signals.

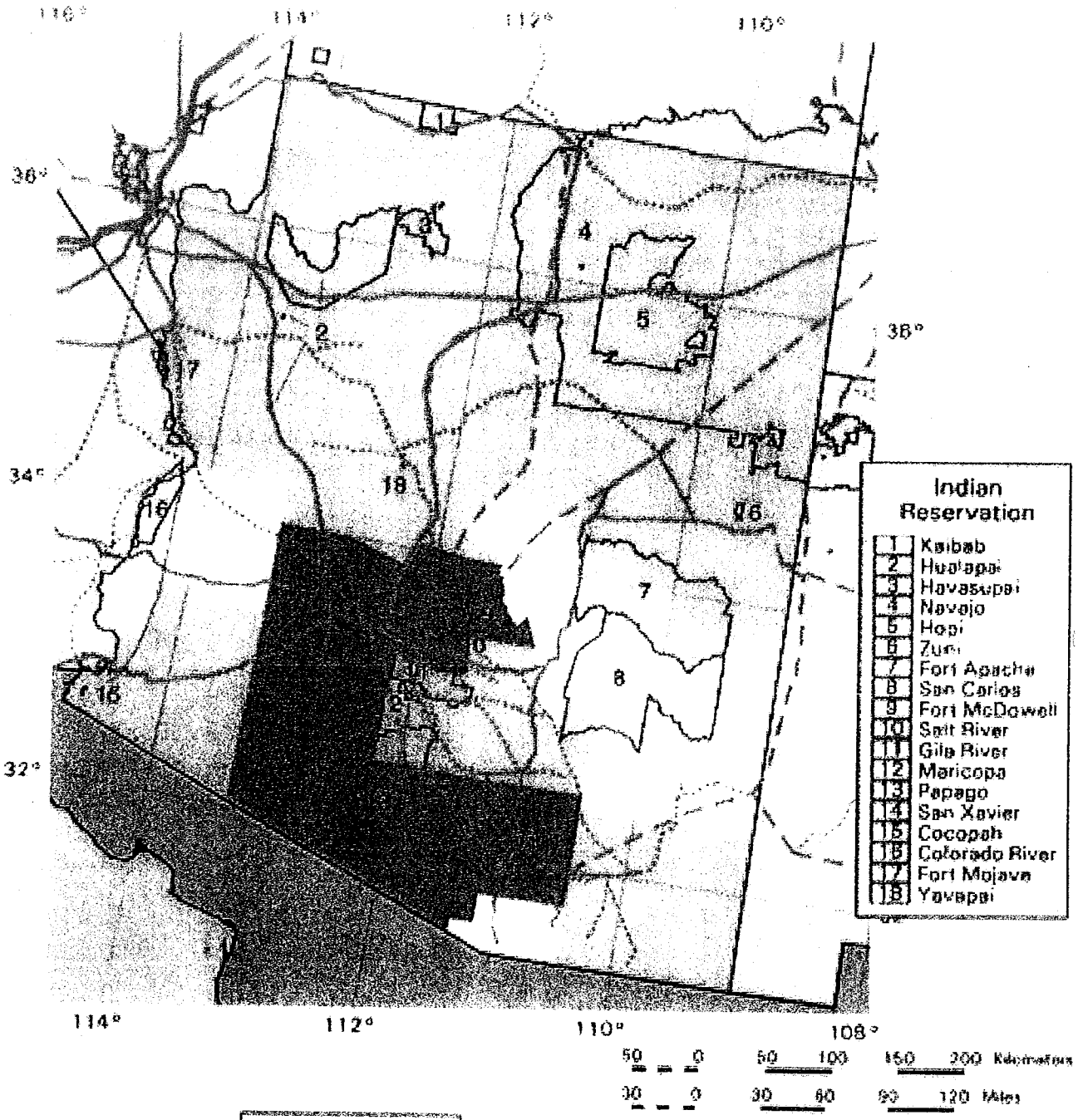
Product Image

click for larger image

Img 1

Related Products of this Company

Arizona - Biomass Resource Map



Biomass resource includes municipal solid waste and forestry residues.

Potential Kilowatts
Per County

- more than 40,000
- 5,000 - 40,000
- 0 - 5,000
- No Data

Transmission Line
Kilovolts

- 1000
- 500
- 345
- 230
- 161
- 170
- 115
- 69

U.S. Department of Energy
National Renewable Energy Laboratory

HERALD

NOVEMBER 21, 2004

The County is reviewing a proposal to change trash into recyclable material. But the plan hasn't come without voices of caution

By Michael Sullivan

Although intrigued by the prospect of converting trash into energy at the Cochise County landfill, county officials are taking a go-slow approach to a proposal presented to representatives of local government on Nov. 9 by Global Energy Resources LLC.

The 6-month-old company, based in Pacific Palisades, Calif., is proposing to spend millions of investors' dollars to build a plant at the landfill.

Using an intense heating process for converting virtually everything now being buried there into energy, clean water and a solid, recyclable material, the plant would purportedly release no hazardous emissions.

Board of Supervisors Chairman Pat Call and Facilities Director L.H. Hamilton find the concept fascinating but are not leaping on the plasma gasification bandwagon just yet.

District 2 Supervisor Paul Newman is downright suspicious.

In an interview last week, Call recalled thinking during the Nov. 9 presentation by Global Energy Resources President John D. Cummings that the proposal sounded "too good to be true." Although wary, Call said the county has nothing to lose at this point. The burden of proof is on Global Energy Resources.

Hamilton is of the same mind.

"The bottom line here is that people have to understand that this has to be permitted from the get-go," Hamilton said on Wednesday.

Before anything is built, the plasma gasification process would need to be approved by the Arizona Department of Environmental Quality.

"We're not scientists here. As long as they (GER) can meet those requirements, they have assumed all the risk," Hamilton said.

Newman is uneasy about the entire process, saying that meetings were held by Call and Hamilton with representatives for GER and General Electric that he was not advised of in advance.

"That's rather unusual," he said Wednesday.

"The technology is intriguing, but I don't think the answers regarding emissions satisfied me," Newman added.

The proposal

A plasma-arc process would be used in combination with "pyrolysis" to reduce virtually everything now being buried in the county landfill - including refrigerators and car batteries - to a recyclable, glassy material.

Pyrolysis is chemical decomposition brought about by using very high heat in the absence of air.

The glass can be used as roadfill or by the abrasives industry, Cummings said. The bulk of the trash would be converted to "syn" gas and ethanol and also could be used to generate electricity. Whatever liquid is contained in the trash would be converted to clean water and recharged into the aquifer, he said.

The technology is already being used around the world, Cummings noted during the work session of the supervisors and local government officials.

The only material not acceptable is radioactive waste.

Cummings described plasma as "an intense energy force" consisting of an ionized gas source that, "when subjected to the proper combination of conditions, becomes an electrical conductor generating extremely intense energy, such as lightning."

"This is not a burner," he said. "We're not incinerating trash."

The only emissions from the process would come from the Jenbacher engine that runs the gasification operation, said Paul McGuire of GE. McGuire appeared with Cummings at the work session.

During the session, McGuire showed photos of plants located in Gussing, Austria; Harboore, Denmark; Chiba, Japan; Profusa, Spain; and Italy that are using this technology. More than 900 Jenbacher engines are in use at landfills worldwide, McGuire said. None, however, are located in the United States.

Confirmation of those plants can be found on the World Wide Web, but no emissions information was available.

The proposal is that a $25 million, 2,000-square-foot plant would be built by GER at the county's 240-acre landfill, at no cost to the county. The company asked that the county arrange for a 20-year "feedstock" supply contract to include 100,000 tons of municipal solid waste and 100,000 waste tires per year.

Cummings said the time from the start of the process to beginning of operations would be about 18 months.

Intergovernmental agreements between the municipalities and the county for the landfill will expire in 2007, so the agreements will have to be extended, Call told the audience at the work session.

Each municipality could extract whatever recyclable materials they choose, such as paper and aluminum, before sending the refuse to the plant, Hamilton said.

The county now sends about 78,000 tons of refuse per year to the landfill, which has increased by 5,000 tons during the past three years, Hamilton said.

The process would not only accept new trash but could "mine" the trash already buried, Hamilton said.

All local units of government that are now paying a "tipping fee" of $41.50 per ton to have their trash buried at the landfill, would see at least a $10-per-ton reduction, Hamilton said.

The next step, if local government officials wish to pursue the proposal, is a letter of intent or memo of understanding, leading to a contract. This will enable the company to start the engineering process. This is where the matter now stands.

Wait a minute

Newman is in no hurry to proceed.

"I think we should be very cautious about entering into a multi-year contract," he said. "I don't think they're telling us everything we need to know."

One of Newman's concerns was a news report that GER's chief executive officer, Armen Kazanchian, was charged with fraud in California. A medical doctor, Kazanchian was one of seven people charged in 2003 by the state Attorney General's Office with defrauding Medi-Cal, plus identify theft and money laundering.

Hamilton said he was aware of the situation three weeks ago and checked it out. All charges were dropped on July 16, according to court records provided to the Herald/Review.

An "overzealous prosecutor charged everybody," Hamilton said. The court records cited "insufficiency of the evidence granted."

Whether or not the charges were dismissed, Newman said he should have been apprised of the matter.

"I want to know more about these people's backgrounds," Newman said.

Environmental organizations also are urging caution.

Daniel R. Patterson, with the Center for Biological Diversity in Tucson, wrote County Administrator Jody Klein on Nov. 9, recommending the county seek independent verification of the proposal rather than from "incinerator promoters."

Bradley Angel, of Greenaction in California, and Terry Nordbrock, with Families Against Cancer in Tucson, cite a number of objections to the proposal.

"We're up to our eyeballs in very similar proposals, all over California," Angel said during an interview by cell phone last week while en route to a public forum in Hanford, Calif. "We're seeing a pattern. The incineration industry has repackaged the incineration technology. There are always toxic emissions from incinerations. They can't possibly eliminate all the waste."

Burning plastic, for example, results in the creation and emission of toxic dioxin, Angel said.

Angel, executive director of Greenaction, said a garbage gasification plant in the Alameda, Calif., area was recently rejected by the Alameda Public Utilities Board. The Santa Cruz, Calif., County Board of Supervisors recently voted to study a proposal from American Ref-Fuel to build a giant waste-to-energy garbage incinerator to burn waste from several counties.

The Hanford public forum was a follow-up to the Alameda rejection, Angel said. He hopes to arrange a similar forum in Cochise County.

"The potential for liability is enormous," he said. "There's been an alarming trend for government agencies to approve these without sufficient data. We're urging everyone to take a deep breath, have a public process and put all the facts on the table. The companies are making wild, fantastic claims that are not holding up to scrutiny."

Nordbrock is also concerned about whether GER's promises regarding emissions can be validated.

"It's potentially interesting technology," she said. "But it does not seem safe. You can make money accepting hazardous waste."

Does it work?

During his presentation on Nov. 9, Cummings showed a video to the audience that was produced by Startech Environmental Corp., a producer of plasma torch technology.

At that time, Startech had not yet been approached by GER, said Chad Gonzalez, a Startech sales associate.

Contacted by the Herald/Review on Thursday, Gonzalez said, "We just made contact with them last week. They want us (to submit a proposal) and two other companies (which were unknown to Gonzalez)."

The Startech process uses a plasma torch to create temperatures inside a chamber up to 30,000 degrees Fahrenheit, "four times the temperature of the sun's surface," Gonzalez said. The process does not, however, use pyrolysis, he added.

Although not in use anywhere in the United States, the plasma torch technology is being successfully used in Japan to turn waste into bricks, Gonzalez said.

Gonzalez also referred to plasma torch technology first being used to dispose of chemical weapons at the Army's Aberdeen, Md., Proving Grounds in 1999.

Conflicting information exists on the success of the tests.

An October 2000 Startech press release, headlined "Startech Environmental and Burns & Roe selected by U.S. Army for Chemical Weapons Destruction Program," says the process was selected for "the safe and irreversible destruction of the United States' stockpile of chemical weapons."

However, an examination of the Board on Army Science and Technology's "Evaluation of Demonstration Test Results of Alternative Technologies for Demilitarization of Assembled Chemical Weapons" shows that Startech's technology did not pass with flying colors.

The test was conducted for the Assembled Chemical Weapons Assessment program by Burns & Roe, in partnership with Startech.

"The chemistries of all four of the primary technologies, (including plasma arc) can decompose the chemical agents with destruction efficiencies of 99.9999 percent. However, each technology package raises other technical issues that must be resolved. One of the crucial issues is the identity and disposition of byproducts," the report said.

"Based on input from the ACWA Dialogue, the plasma arc process was deemed unlikely to obtain public acceptability due to the incomplete demonstration and the perceived similarity to incineration," according to ACWA's Sept. 30, 1999, report to Congress. "The process was not validated for agent destruction."

That assessment was confirmed Thursday by Kathy DeWeese, public information officer for ACWA.

"The process was approved for demonstration," she said. It is not now being used by the Army.

The U.S. Environmental Agency, in a February 2002 fact sheet, said: "EPA believes the gasification systems processing hazardous secondary materials are better viewed as a production or manufacturing operation rather than a hazardous waste management activity."

The origins

How did this all come about in the first place?

Lee Basnar, a columnist for the Herald/Review, said he was investigating ways to remove cardboard from the landfill for recycling about a year ago. He approached Call to discuss an idea he'd come across for converting cardboard to energy, but that bore no fruit. Basnar said Thursday. About two or three months ago, Call asked Basnar to research the GER proposal, knowing of Basnar's interest in the landfill.

Cummings said that Robert Brown of Green Valley, a consultant for Arizona Public Service, approached Hamilton with information about GER and arranged a meeting. Basnar was privy to what was happening and wrote a column about the proposal, which was published Nov. 4 in the Herald/Review.

Why Cochise County?

"It fits our profile," Cummings said last week.

The county's size, lack of opposition to the idea, control over waste and the "ability to put energy onto the grid" make the county attractive, he said.

Cummings characterized his reception in Bisbee Nov. 9 as "outstanding," adding, "The majority of the board seems to be very positive."

Newman was in the minority. He feels Call and Hamilton were overly enthusiastic about the proposal.

"The spirit of the meeting was that the county was leading the effort, and that's why I urged caution," he said.

Ron Orozco, P.E., CEM, CDSM

Engineering Manager, SSVEC

Phone: (520) 609-5026

e-mail: rorozco@ssvec.com

Ron possesses a unique background of education and work experience on both the electric utility side and the industry side of various renewable energy technologies. This experience spans thirty years beginning in 1979 with early solar and wind energy system research at the University of Arizona to current position as Engineering Manager at Sulphur Springs Valley Electric Cooperative. Included in this period is: increasingly more challenging and professional development in conventional rural electric utility engineering; energy efficiency, and demand-side management; renewable energy system design, installation and maintenance; renewable energy program design, implementation and evaluation worldwide; solar and wind energy training worldwide; wind resource assessment.

Ron holds the following credentials: B.Sc. Engineering – University of Arizona; registered Professional Engineer in Arizona (AZ#21623) and New Mexico (NM#12607); Certified Energy Manager (#5266) and Certified Demand Side Manager (#83) through Association of Energy Engineers; Journeyman Electrician (EE-98J in NM #35084) and Licensed Electrical Contractor (EE98 in NM #91998) in New Mexico (neither current to avoid any conflict of interest with current position at SSVEC); NABCEP Certified Solar PV Installer™ (not current to avoid conflict of interest); Member of the NRECA Cooperative Research Council's Renewable and Distributed Energy Management Advisory Group; graduate of the NRECA/University of Nebraska Management Internship Program.

Electric Utility Experience

- **Conventional Electric Utility Engineering**
  - Engineering Manager with direct management responsibility for a team of 28, including five Professional Engineers, for all design, field staking, right-of-way acquisition, power quality, construction standards, and planning for a $25M+ construction work plan
  - Transmission line (up to 115 kV), distribution line (7.2/12.47 kV and 14.4/24.9 kV), and substation design and construction
  - Load flow analysis and system losses evaluation
  - Development, training, and use of distribution line staking manuals
  - Power requirements studies
  - Rate studies and presentation to state utility commission

- **Energy Management**
  - Certified Energy Manager and Certified Demand Side Manager through Association of Energy Engineers
  - Completed energy audits of dozens of irrigated farms in Arizona establishing metric for energy conservation program goals leading to implementation of a demand-side load management program to shed 20+ MW of irrigation load for peak shaving
  - Taught irrigation load management programs for Western Area Power Authority
  - Conducted dozens of residential energy audits as part of marketing and application assessment for grid and off-grid renewable energy applications

- Provided technical assistance in energy conservation programs to various Central American electric utilities during nationwide power shortages
- Arranged for representatives of the National Association of Energy Service Companies to visit Central American utilities and present ESCO and ESPC concepts
- Developed and implemented energy conservation training programs and materials for use in newly electrified rural villages of Central America
- Successfully identified funding for, and completed field installation of, 100+ residential electric meters in previously unmetered solar/wind/diesel hybrid village in Mexico

Renewable Energy Experience

➢ **Renewable Energy System Design, Installation and Maintenance**

- Charter NABCEP Certified Solar PV Installer™ through the North American Board of Certified Energy Practitioners dedicated to recognizing the most qualified and experienced solar energy professionals (not current)
- Responsible for design review and field inspection of forty-one 21kW, 3-phase grid connected photovoltaic systems installed at schools in Cochise County
- Responsible for design review and field inspection of dozens of residential grid-connected solar and wind energy systems through SSVEC's SunWatts program.
- Owned and managed Energía Total – an electrical contracting firm specializing in solar and wind energy system design, installation and maintenance in New Mexico (1996-2001)
- Designed and installed over 50kW of solar and wind electric systems for domestic, Arctic, Antarctic and Latin American markets
- Designed, built and marketed the "FireFly" line of pre-assembled, skid-mounted solar and solar/wind/gasoline genset systems
- Designed and built DC power control system for remote telecomm application in the Amazon of Brazil
- Designed and built two solar/wind/gasoline hybrid systems for Arctic application
- Designed and installed more than six wind energy systems using turbines ranging from 10kW to 500 watts
- Designed and installed approximately 20kW of grid-connected solar electric systems including a one commercial 10kW and one 6kW – 3 phase system and several residential systems
- Field engineer for 75MW+ wind energy project in Appalachia responsible for site evaluation, permitting, and project design including array layout, substation design and underground sub-distribution system design

➢ **Renewable Energy Program Design, Implementation and Evaluation**

- Renewable Energy Consultant to World Bank, US Agency for International Development, Sandia National Laboratories, Southwest Technology Development Institute, American Wind Energy Association, Solar Energy Industries Association, Solar Energy Research and Development Fund and others in design and evaluation of renewable energy programs in US, Mexico, Central and South America and Africa.
- World Bank assessment of renewable energy opportunities in rebuilding of energy infrastructure for Mozambique

- **Solar and Wind Energy Training**
  - Developed training materials and presented dozens of training sessions ranging from community meetings to week-long technical training courses in US, Mexico, Central and South America, and Africa for audiences ranging from national Ministers of Energy to small farmers

- **Village Power**
  - Established and implemented a private ownership model for a 6MW diesel generation station and associated transmission and distribution system on the island of Roatan, Honduras including interim management and implementation of a demand- and supply-side energy management programs
  - Directly engaged in design, installation, review and/or maintenance of numerous diesel only, wind/diesel, and wind/solar/diesel village power systems in Mexico, Central America, Brazil and Peru
  - Conducted field evaluation of 10+ village diesel systems in Amazon for potential conversion to hybrid renewable systems
  - Institutional and Energy Management Specialist for large diesel/solar village power system in the Peruvian Amazon with International Lead Zinc Research Institute, the Solar Energy Industry Association and the Solar Energy Research and Education Fund

- **Domestic Wind Energy Experience**
  - **Western Maryland**
    - Installation of 50-meter meteorological tower and supervision of two other towers
    - Implement project scheduling, land acquisition, permitting, micro-siting, and town meetings
    - Engineering representative to transmission utility on substation and interconnect issues
    - Oversee various site environmental studies, surveying, and sub-contractor activities
  - **New Mexico**
    - Owner/Operator of company that installed seven 40-meter anemometer towers for State of NM Energy, Minerals and Natural Resources
    - Personally installed two 40-meter resource assessment towers
    - Isleta Pueblo Wind energy proposal for DOE/Kirtland Air Force Base/Sandia Labs
  - **South Dakota**
    - Site assessment, partnering agreements, PPA discussions with local utilities, interconnect review, avian issue paper, oversight of environmental assessment, detailed financial analysis, for single-turbine grid-connected 750kW-1MW project with Rosebud Sioux tribe and DOE.
    - Integrated Resource Plan for Rosebud Sioux tribe including wind energy

- **International Wind Energy Experience**
  - **Mexico**
    - Baja California – Directed wind resource assessment program for DOE/Sandia. Arranged institutional partnering, general and micro siting for anemometer towers, local fabrication and installation of 15-meter towers in seven sites along Pacific coast of Baja California. Facilitated data collection and delivery of data.
    - Yucatan Assessment – Pilot and project director for aerial and ground survey of potential wind energy sites along Southern Yucatan coastline.
    - Oaxaca Assessment - Pilot and project director for aerial and ground survey of potential wind energy sites along the coastline and Isthmus of Tehuantepec (La Ventosa).
  - **Brazil**
    - Co-author of Training Needs Assessment for USAID/Brazil including support large wind energy technologies
    - Taught technical and commercial portions training course on commercial development of large wind energy projects in Brazil
  - **Guatemala**
    - Assisted in identification and project development for Huité Wind Energy Project and facilitated tour of US manufacturers
    - Consultant to Ministry of Energy of Guatemala for development of energy policy friendly to renewables
  - **Honduras**
    - Facilitate wind project near Tegucigalpa
    - INCAE/REETI Wind Energy Training
  - **Peru**
    - Host Ministry of Energy representative to Tehachapi and beyond
  - **Canada**
    - Prepare Wind/Gas project proposal for First Nations of Canada
    - Prepare Wind/Gas project proposal to Canadian Department of Energy