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50TP

January 29, 2002

Arizona Corporation Commission
1200 West Washington
Phoenix, Arizona 85007

Attention: Nancy Cole, Supervisor Docket Control

Re: Bowie Power Station, L.L.C
10-year Plan(s)

Dear Ms. Cole:

Pursuant to A.R.S. 40-360.02, Bowie Power Station L.L.C. ("Bowie") hereby submits its current 10-year plan for the proposed electric generating station and associated transmission lines which have been the subject of proceedings before the Arizona Power Plant and Transmission Line Sitting Committee("Sitting Committee") and the Commission in Docket No. L-00000Y-01-0118 (Case No.118).

On January 3, 2002, the Chairman of the Sitting Committee issued recommended form(s) of Decision and Certificate of Environmental Compatibility ("CEC") in Case No. 118. Appendix "A" to this letter contains a copy of page 2 of the Decision and CEC which describe the proposed electric generating station facilities which Bowie proposes to construct. Appendix "B" to this letter contains a copy of pages 2 and 3 of the Decision and CEC, which describes the 345kv and 230kv transmission facilities associated with the Bowie Power Station[1]. These descriptions are incorporated herein by reference.

[1] As indicated in a June 8, 2001 informational filing with the Commission, Bowie will not construct, own or operate these transmission lines. These lines will be owned and operated by a transmission service provider

The recommended form(s) of Decision and CEC are scheduled to be considered by the Commission at an Open Meeting on February 26, 2002. In the event the Commission approves the proposed sitings, Bowie currently anticipates the following commercial in-service operation dates for the Bowie Power Station:

Phase 1 [2]	2nd Quarter 2004
Phase 2	4th Quarter 2005

The anticipated commercial in- service date for the 345kv and 230kv transmission facilities associated with the power station are no later than the second quarter of 2004.

In connection with the proposed transmission facilities, and with reference to A.R.S.40-360.02 (C) (7) and a January 11, 2002 memorandum from the Commission's Utilities Director to Arizona Transmission Providers, attached is a copy of a July, 2001 Interconnection Power Flow Study submitted as an exhibit by Bowie in Case No. 118.

In the event you have any questions regarding the above and the attached report, or would like additional information, please contact Tom Wray at (602) 808-2004.

Very truly yours,

Lawrence V. Robertson, Jr.

Lawrence V. Robertson, Jr.

LVR/jm
Cc: Ernest Johnson, Utilities Director
Tom Wray, General Manager

[2] Each phase consist of a 500MW (nominal) power block.

Appendix A

Mark McWhirter	Designee for Director of Energy Office of Arizona Department of Commerce
Patrick Schiffer	Designee for Director of Arizona Department of Water Resources
Richard Tobin	Designee for Director of Arizona Department of Environmental Quality
Jeff McGuire	Appointed Member
Mike Palmer	Appointed Member
A. Wayne Smith	Appointed Member
Sandie Smith	Appointed Member
Margaret Trujillo	Appointed Member
Mike Whalen	Appointed Member

The Applicant was represented by Lawrence V. Robertson, Jr. The Arizona Corporation Commission ("Commission") staff was represented by Jason D. Gellman. Wayne Bryant appeared on his own behalf as an individual intervenor.

At the conclusion of the public hearings, after consideration of (i) the Application and the evidence presented during the public hearings, (ii) the closing arguments of the parties, and (iii) the legal requirements of Arizona Revised Statutes §40-360 through §40-360.13 and A.A.C. R14-3-213, upon motion duly made and seconded, by a 9-1 vote the Committee voted to grant the Applicant the following Certificate.

Applicant is hereby granted a Certificate to site and construct the following facilities ("Project"):

> A natural gas fired, combined cycle electric generating plant with an operating capability not to exceed a nominal site rating of 1000 megawatts (MW). The facilities shall consist of up to two (2) power blocks, each rated up to 500 MW nominal. Each power block shall consist of (i) two combustion turbine generators (CTG), (ii) two heat recovery steam generators (HRSG) and (iii) one steam turbine electric generator. The plant design may also incorporate supplementary or duct-firing of the HRSG for a given power block. The duct-firing design would be incorporated in the HRSG's. The power plant and supporting infrastructure shall be located in Section 28 and a portion of Section 29, Township 12 South, Range 28 East, G&SRB&M.

As testified to by the Applicant during the public hearings, electric power and energy produced at the Bowie Power Station are intended primarily to serve Southeastern Arizona markets. The

Appendix B

Mark McWhirter	Designee for Director of Energy Office of Arizona Department of Commerce
Patrick Schiffer	Designee for Director of Arizona Department of Water Resources
Richard Tobin	Designee for Director of Arizona Department of Environmental Quality
Jeff McGuire	Appointed Member
Mike Palmer	Appointed Member
A. Wayne Smith	Appointed Member
Sandie Smith	Appointed Member
Margaret Trujillo	Appointed Member
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The Applicant was represented by Lawrence V. Robertson, Jr. The Arizona Corporation Commission ("Commission") staff was represented by Jason B. Gellman. Wayne Bryant appeared on his own behalf as an individual intervenor.

At the conclusion of the public hearings, after consideration of (i) the Application and the evidence presented during the public hearings, (ii) the closing arguments of the parties, and (iii) the legal requirements of Arizona Revised Statutes § 40-360 through § 40-360.13 and A.A.C. R14-3-213, upon motion duly made and seconded, by a 10-0 vote the Committee voted to grant the Applicant the following Certificate.

Applicant is hereby granted a Certificate to site and construct the following facilities, as requested in the Application: (i) a double-circuit 345 kV transmission line, which shall interconnect Applicant's Bowie Power Station facilities with the Western Systems Coordinating Council ("WSCC") transmission grid at Tucson Electric Power Company's ("TEP") 345 kV Greenlee-Vail transmission line and Arizona Electric Power Company's ("AEPCO") 230 kV Red Tail-Dos Condados Transmission Line; and (ii) the new Willow 345/230 kV switchyard [Sec.14, T11S, R26E, G&SRB&M], through which the aforesaid interconnections will be accomplished. As testified to by the Applicant during the public hearings, electric power and energy produced at the Bowie Power Station are intended primarily to serve Southeastern Arizona markets.

The double-circuit 345 kV transmission line hereby authorized shall originate at Applicant's Bowie Power Station and follow the route proposed by Applicant in its Application for a distance of approximately 14.3 miles to the point of interconnection with the proposed Willow switchyard. In that regard, Applicant is further authorized to use a 2500' wide corridor within which it will ultimately acquire up to a 250' wide right-of-way for purposes of siting and construction of the line. Exhibit "A" to this Decision and Certificate sets forth a generalized narrative legal description of the routing hereby approved for the double-circuit 345 kV transmission line. Exhibit "B", as attached hereto, consists of a map depicting the aforementioned 345 kV transmission line corridor.

The authorized double- circuit 345 kV transmission line shall be designed and constructed on single-pole or monopole structures. The monopole structures shall consist of dulled galvanized steel. The conductors shall be non-specular. The spans between the transmission structures shall vary in distance from 800' to 1100' depending upon conductor size, terrain and environmental mitigation conditions at a given location.

The details of the aforementioned interconnections shall be the subject of contractual arrangements to be entered into between the Applicant and TEP, and the Applicant and AEPCO, respectively.

This Certificate is further granted upon the following conditions.

1. Applicant shall comply with all existing applicable air and water pollution control standards and regulations, and with all existing applicable ordinances, master plans and regulations of the State of Arizona, Cochise County and Graham County, the United States of America, and any other governmental entities having jurisdiction.

2. A) Applicant shall make every reasonable effort to identify and correct, on a case-specific basis, all complaints of interference with radio or television signals from operation of the lines and related facilities. In addition to any transmission repairs, and depending upon the circumstances, the relevant corrective actions may include, adjusting or modifying receivers, adjusting or repairing, replacing or adding antennas, antenna signal amplifiers, filters, lead-in cables, or other corrective actions.

Issue Date – 07/26/01

Bowie Power Station
Interconnection Power Flow Study

Bowie Power Station, LLC

July 2001

R·W·BECK

2201 E. Camelback Road, Suite 115B Phoenix, AZ 85016-3433Phone (602) 957-2888

BOWIE
GENERATION INTERCONNECTION
POWER FLOW STUDY

Table of Contents

Table of Contents

EXECUTIVE SUMMARY

This report summarizes the results of the study to examine the potential impacts on the transmission system of interconnecting the proposed Bowie Power Station, LLC ("Client") 500/1100 MW plant ("Project") addition to the Tucson Electric Power ("TEP") and for Alternatives 2 and 4, the Arizona Electric Power Cooperative ("AEPCO"), Western Systems Coordinating Council ("WSCC") transmission grid approximately 40 miles south of the Greenlee 345 kV substation.

The Interconnection Power Flow Study was prepared by R. W. Beck at the request of Bowie Power Station, LLC to address alternative interconnection scenarios for power delivery from the proposed nominal 1,000 MW Bowie Power Station to the WSCC grid. The alternatives considered Project dispatch at both the 500 MW and 1,100 MW levels to provide interconnection at a range of potential output capacities.

Four different interconnection alternatives, corresponding to those requested in the CEC application, are evaluated herein. Where the power flow analysis identifies facilities that are loaded beyond the applicable facility ratings defined in the load flow case model, whether or not the facility requires upgrade to interconnect the Project to the system and/or to acquire transmission service from the Project will be dependent on specific utility criteria.

The study indicates that the Project can deliver its full output to the transmission grid with few to no transmission upgrades depending upon the interconnection Alternative selected.

Alternative 1 shows no loading violations based on the criteria used for either a 500 or an 1100 MW Project.

Alternative 2 has two 230 kV line violations for the loss of the Willow to Vail 345 kV line (the original Greenlee – Vail 345 kV line). Loss of this line forces the Project output down to the 230 kV system resulting in the 230 kV overloads shown in the table. However, based on the results of Alternative 1 (without the 230 kV interconnection) the violation would be alleviated by transfer tripping the 345/230 kV transformer at Willow for the loss of the identified line.

Alternatives 3 and 4 may require upgrade to the Vail 2 345/138 kV transformer unless a higher shorter term rating can be utilized. Additionally, connections to both 345 kV lines resulted in a violation of the Willow to Vail 2 345 kV (originally the Springerville to Vail 345 kV line) line rating. It is noted however, that this line has a much lower rating than the Greenlee to Vail 345 kV line. The line is identified in TEP's FERC Form 1 data as having twin bundled 954 ACSR for a portion of the line and 954 ACSR Rail for another portion. It is possible that an upgrade of this line could be required to integrate the Project into both 345 kV Vail lines.

All four Alternatives had little to no impact on the listed WSCC transmission paths. Additionally, it is noted that flow on the Springville to Vail 345 kV line is greater than the

output of Springerville Unit 2 in all cases evaluated, i.e., in line with the TEP Two County bond tax restrictions.

PROJECT DESCRIPTION

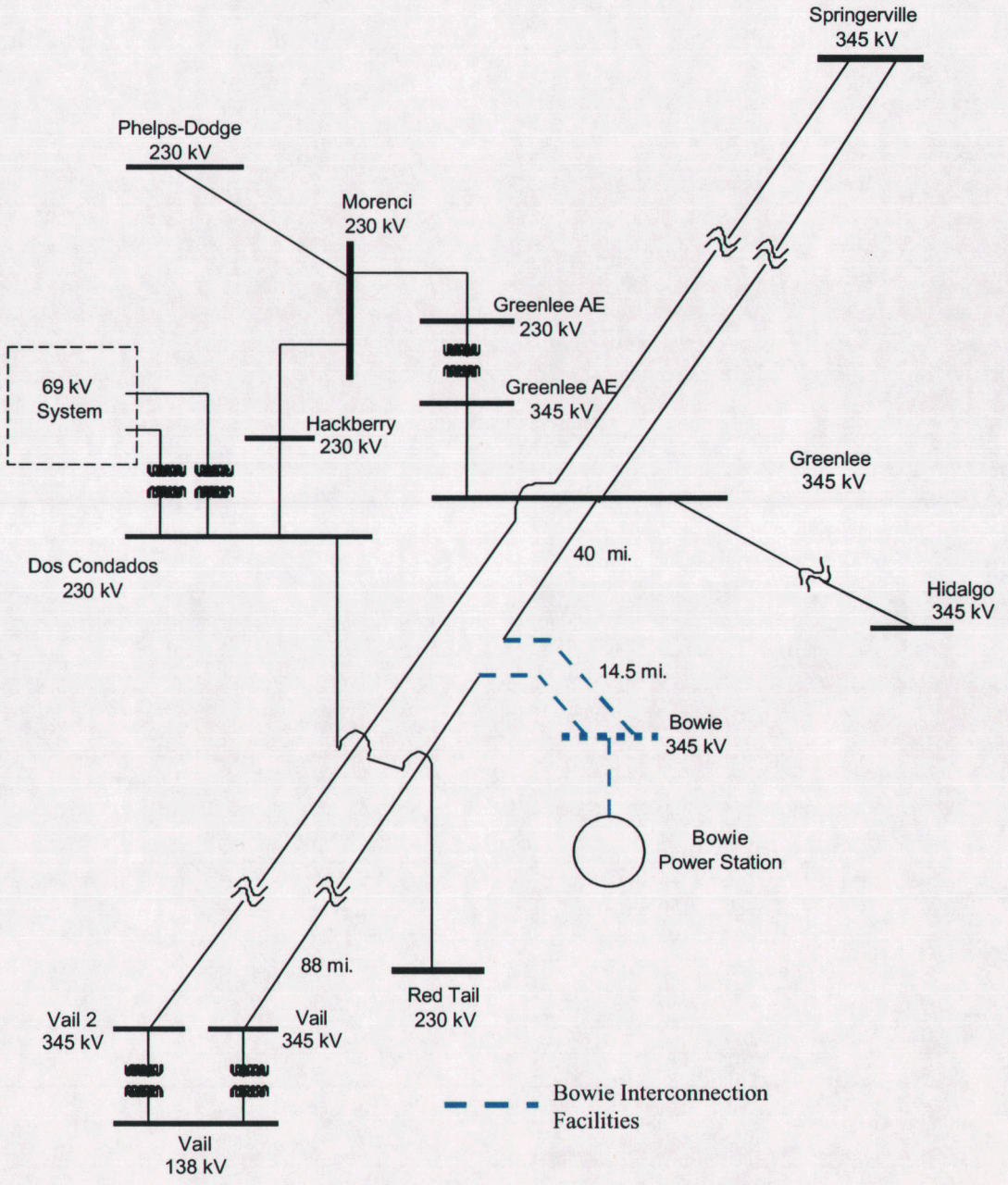
The following lists the Project assumptions used in the analyses.

Project Name:	Bowie
Maximum Summer Capability (MW):	500/1100
Interconnection Voltage:	345 kV (and 230 kV for Alts 2 and 4)
Interconnection Location:	40 miles south of Greenlee 345 kV substation
Interconnection Alternatives:	• Alt 1 – Greenlee – Vail 345 kV • Alt 2 – Greenlee – Vail 345 kV & Red Tail – Dos Condados 230 kV • Alt 3 – Greenlee – Vail 345 kV line & Springerville – Vail 345 kV • Alt 4 – Greenlee – Vail 345 kV line, Springerville – Vail 345 kV line, Red Tail – Dos Condados 230 kV
Host Transmission Utility:	TEP (and AEPCO for Alts 2 and 4)
Reliability Council/RTO:	WSCC
Plant Configuration:	One or Two 2 on 1 GE7FA/Steam Turbnie Combine Cycle with duct firing

Four separate interconnection alternatives were evaluated as shown in the following figures.

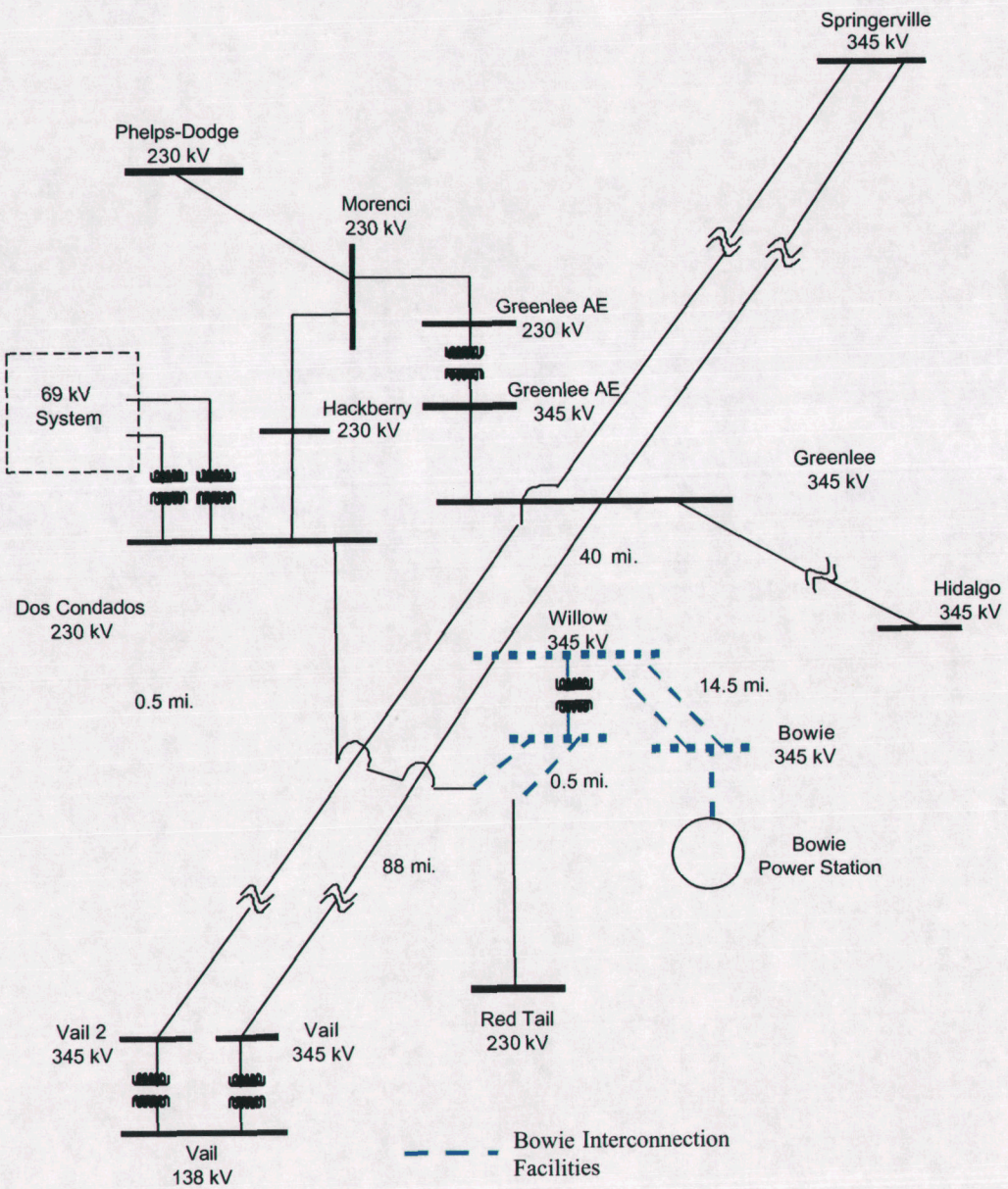
1. Alternative 1: An interconnection to the TEP system via a new 14.5 mile double circuit 345 kV loop in and out of the Greenlee – Vail transmission line approximately 40 miles south of Greenlee.

ALTERNATIVE 1 INTERCONNECTION CONFIGURATION



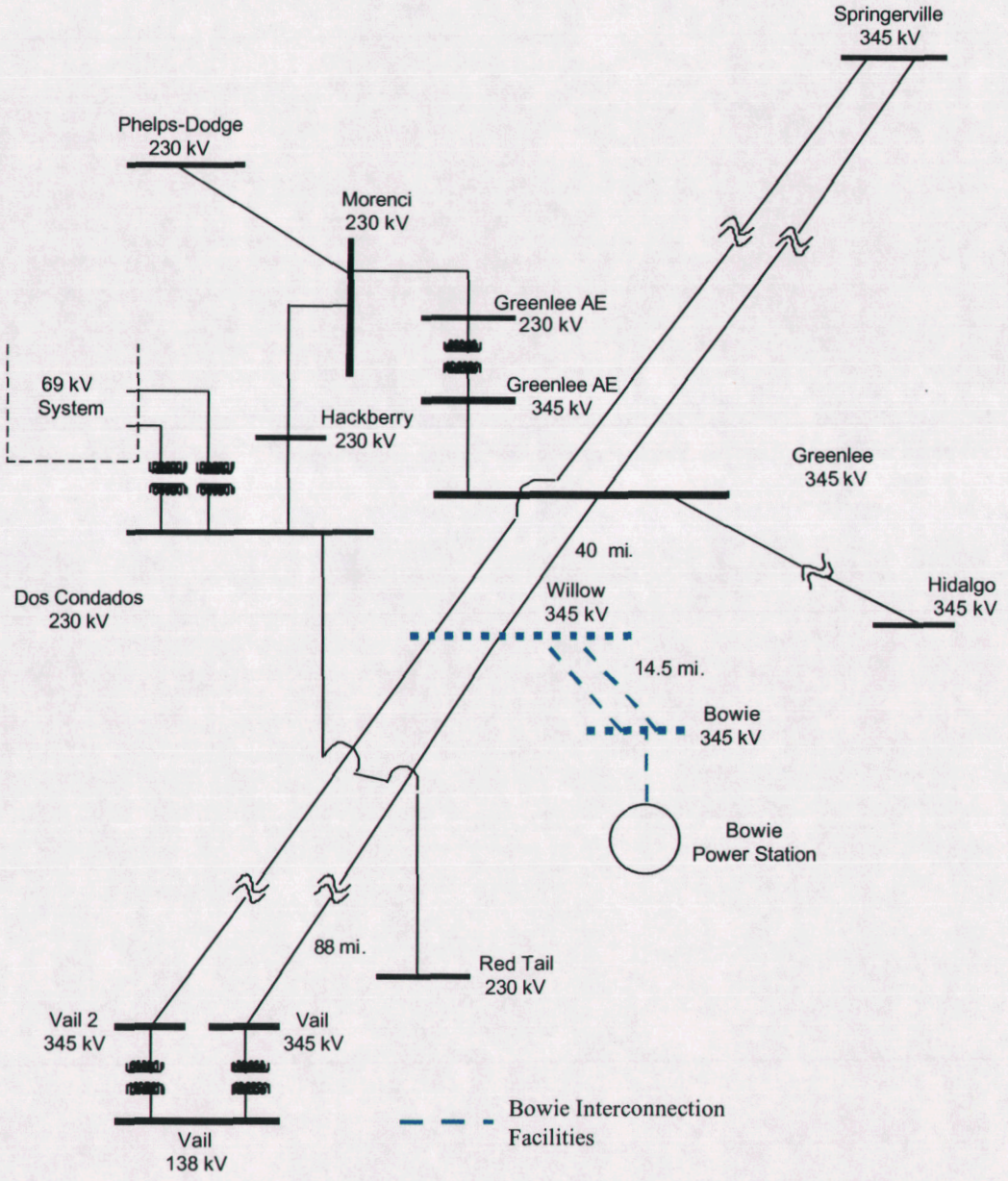
2. Alternative 2: A new substation, Willow, is constructed near the intersection of TEP's Greenlee to Vail 345 kV line and AEPCO's Dos Condados to Red Tail 230 kV line. The 14.5 mile double circuit 345 kV Bowie lines will terminate into the new breaker and a half substation. The Greenlee to Vail 345 kV line also connects to the new substation. Additionally, a 345/230 kV transformer will also be located at the substation with a 0.5 mile double circuit in and out loop of the AEPCO's Dos Condados to Red Tail 230 kV line.

ALTERNATIVE 2 INTERCONNECTION CONFIGURATION



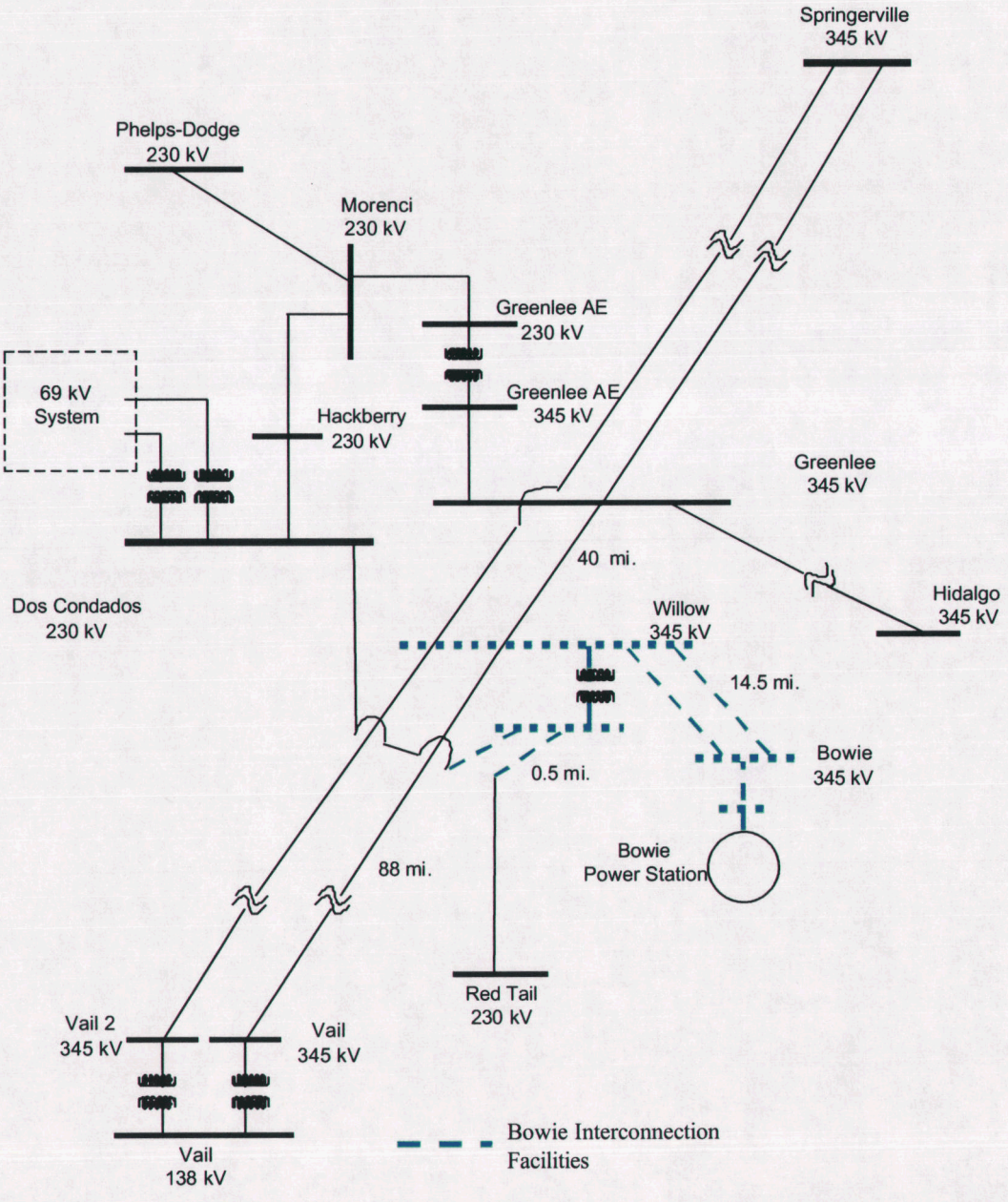
3. Alternative 3: A new substation, Willow, is constructed near the intersection of TEP's Greenlee to Vail 345 kV line and AEPCO's Dos Condados to Red Tail 230 kV line. The 14.5 mile double circuit 345 kV Bowie lines will terminate into the new breaker and a half substation. The Greenlee to Vail 345 kV and the Springerville to Vail 345 kV lines also connect to the new substation.

ALTERNATIVE 3 INTERCONNECTION CONFIGURATION



4. Alternative 4: A new substation, Willow, is constructed near the intersection of TEP's Greenlee to Vail 345 kV line and AEPCO's Dos Condados to Red Tail 230 kV line. The 14.5 mile double circuit 345 kV Bowie lines will terminate into the new breaker and a half substation. The Greenlee to Vail 345 kV and the Springerville to Vail 345 kV lines also connect to the new substation. Additionally, a 345/230 kV transformer will be located at the substation with a 0.5 mile double circuit in and out loop of the AEPCO's Dos Condados to Red Tail 230 kV line.

ALTERNATIVE 4 INTERCONNECTION CONFIGURATION



NEW GENERATION MODELED IN BASE CASE

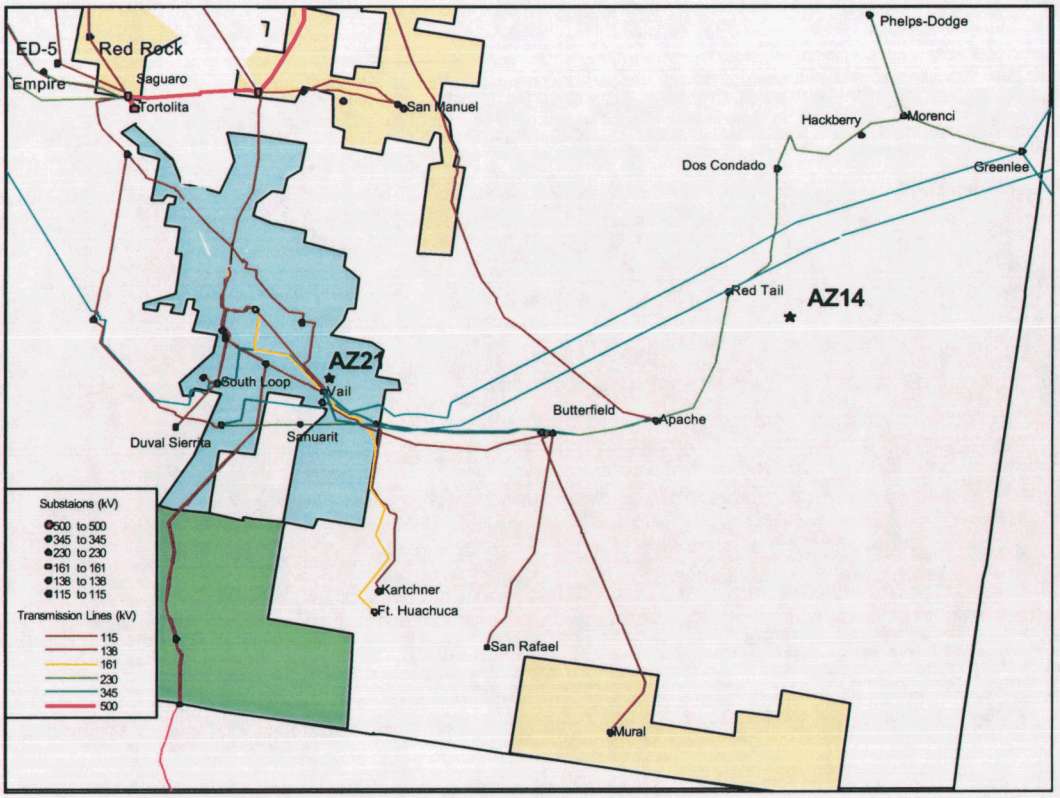
The dispatch of generation in a region impacts transmission system power flows. While it is not possible to evaluate all possible operational impacts, for planning purposes, it is necessary to assume a certain level of generation to meet the projected load. In this regard, assumptions need to be made as to which new generation projects should be included in the Base Case model used. For this analysis, plants that will be operating by 2002, additional CEC approved combined cycle plants in the Phoenix/East Valley/Tucson areas and a portion of the Palo Verde hub generation have been included in the model. Additionally, due to the proximity of the site location to New Mexico, the 500 MW Duke plant at Luna has been included in the Base Case. New projects included in the Base Case are summarized below:

1. Red Hawk 1000 MW Project (added to Base Case dispatched at 886 MW)
2. Santan 850 MW Project (already in 2001 series WSCC Case dispatched at 726 MW)
3. Desert Basin 500 MW Project (already in 2001 series WSCC Case dispatched at 460 MW)
4. Calpine West Phoenix 500 MW Project (already in 2001 series WSCC case dispatched at 300 MW)
5. Griffith Energy 650 MW Project (already in 2001 series WSCC case dispatched at 540 MW)
6. Calpine Southpoint 520 MW Project (already in 2001 series WSCC case dispatched 420 MW)
7. Panda Gila River 2080 MW Project (added to Base Case and dispatched 900 MW)
8. Other PV area new generation dispatched at 35 MW
9. Toltec Power Station 2000 MW Project (added to Base Case and dispatched at 1000 MW)
10. Duke Luna 550 MW Project in New Mexico (added to Base Case and dispatched at 500 MW)

TRANSACTION SCENARIOS

Based on the location of the Project, primary markets are located in southeast Arizona, an area shown on the following figure.

SOUTHEAST ARIZONA REGION



Proposed Generation Table in Southeastern Arizona

#	Developer	Plant Name	Location	State	MW	ISDN	Comments
AZ14	Bowie Power Station, LLC.	Bowie Power Station	Bowie	AZ	1000	2004	Planned – Announced 1/31/01
AZ21	Tucson Electric Power Co	Vail Generating Station	Rita Ranch	AZ	150	2002	Peaking Facility

The transaction schedules shown in Table 2 were simulated in the load flow case models to examine the potential impact on the transmission system of delivery to the primary markets.

Table 2
Transaction Schedules in MW

Region	"a" (Alt 1 Only) AEPCO	"b" (Alt 1 Only) TEP	"c" (All Alternatives) AEPCO/ TEP
Southeastern AZ	500	0	500
Southeastern AZ/Tucson	0	500	600

RESULTS

The following table summarizes the results for the integration Project under all four Alternatives. For lines where only one rating is identified, we have assumed that an emergency rating of 110% of continuous rating would apply based on assumptions made in the Southeast Arizona Transmission Study report as discussed under the evaluation criteria section. Loadings above the 110% of continuous rating limit have been highlighted in the table.

Tp	Overloaded Element	Rating N/E (MVA)	AC Power Flows % of E Rating						
			Base	Alt 1 Single 345 kV Connection			Alt 2 Single 345 kV & 230 kV Connection	Alt 3 Double 345 kV Connection	Alt 4 Double 345 kV & 230 kV Connection
				"a" 500	"b" 500	"c" 1100	"c" 1100	"c" 1100	"c" 1100
L	Apache To Red Tail 230kv[1]	351	29%	N.O.	N.O.	N.O.	109%	N.O.	N.O.
X	Bicknell To Bicknell 230/345kv[1]	150/193	65%	1%	100%	43%	88%	N.O.	N.O.
L	Buterfld To Pantano 230kv[1]	268	75%	23%	101%	51%	N.O.	N.O.	N.O.
L	Red Tail To Willow 230kv[1]	351	27%	-	-	-	111%	-	N.O.
L	Sag.East To Oracle 115kv[2]	120	93%	110%	90%	106%	103%	107%	104%
X	Tortolit To Tortolit 500/138k[1]	600/672	64%	66%	93%	102%	100%	91%[3]	92%
L	Vail2 To Willow 345kv[1] (originially Springerville – Vail)	666/806	42%	-	-	-	-	121%	113%
X	Vail2 To Vail 345/138kv[1]	600/720	49%	58%	73%	88%	87%	135%	126%

1. Loss of Project Bus (Alt 1) or Willow (Alts 2, 3 and 4) to Vail 345 kV line (originally Greenlee – Vail 345 kV line)
2. Loss of Saguaro West to San Manuel 115 kV line
3. Loss of Willow to Vail 345 kV line (originally Springerville – Vail 345 kV line)

Alternative 1 shows no loading violations based on the criteria used for either a 500 or an 1100 MW Project with the exception of a slight overload of the Tortolita 500/138 kV transformer which reached 102% of emergency rating. It is expected that this violation could be handled via operational means. All other facilities are within their identified emergency ratings or within 110% of their continuous ratings.

Alternative 2 has two 230 kV line violations for the loss of the Willow to Vail 345 kV line (the original Greenlee – Vail 345 kV line). Loss of this line forces the Project output down to the 230 kV system resulting in the 230 kV overloads shown in the table. However, based on the results of Alternative 1 (without the 230 kV interconnection) the violation would be alleviated by transfer tripping the 345/230 kV transformer at Willow for the loss of the identified line.

Alternatives 3 and 4 may require upgrade to the Vail 2 345/138 kV transformer unless a higher shorter term rating can be utilized. Additionally, connections to both 345 kV lines resulted in a violation of the Willow to Vail 2 345 kV (originally the Springerville to Vail 345

kV line) line rating. It is noted however, that this line has a much lower rating than the Greenlee to Vail 345 kV line. The line is identified in TEP's FERC Form 1 data as having twin bundled 954 ACSR for a portion of the line and 954 ACSR Rail for another portion. It is possible that an upgrade of this line could be required to integrate the Project under the Alternatives 3 and 4 configuration, i.e., connected to both 345 kV Vail lines.

Interface Impact

Impact on key interface limitations are a consideration. The following tables show the contribution of the Project on the defined transmission paths.

Power Flow over Defined Paths and Regional Facilities

WSCC Path #	Path/Facility Description	Rating	Path/Facility Flows						
			Base	"1a" AEPCO 500 MW	""1b" TEP 500 MW	"1c" AEPCO/TEP 1100 MW	"2c" AEPCO/TEP 1100 MW	"3c" AEPCO/TEP 1100 MW	"4c" AEPCO/TEP 1100 MW
			MW	MW	MW	MW	MW	MW	MW
22	Southwest of Four Corners	2325 (E – W)	1751	1767	1777	1797	1790	1795	1793
47	Southern New Mexico (NM1)	925 (S)[1] 1048 (NS)[2]	589	590	589	590	590	590	590
49	East of the River (EOR)	7550 (E – W) Not rated (W – E)	5011	5009	5007	5006	5005	5005	5005
50	Cholla to Pinnacle Peak	1200 (E – W)	1096	1107	1094	1103	1101	1105	1103
NA	Springerville – Greenlee 345 kV line	745/1010	378	335	261	195	220	342	328
NA	Greenlee – Vail 345 kV line	896/1210	190	-	-	-	-	-	-
NA	Greenlee – Project Bus 345 kV line	896/1210	-	-73	20	-278	-	-	-
NA	Project Bus – Vail 345 kV line	896/1210	-	419	508	790	-	-	-
NA	Greenlee – Willow 345 kV line	896/1210	-	-	-	-	-106	-75	15
NA	Willow – Vail 345 kV line	896/1210					754	619	584
NA	Springerville – Vail 345 kV line	666/806	322	318	390	402	395	-	-
NA	Springerville – Willow 345 kV line	666/806	-	-	-	-	-	215	240
NA	Willow – Vail 345 kV line	666/806	-	-	-	-	-	586	566
NA	Greenlee 230/345 kV xfmr #1	150/193	39	-64	26	-78	-9	-69	-17
NA	Greenlee 230/345 kV xfmr #2	150/193	37	-68	28	-83	-10	-73	-18
NA	Dos Condados – Red Tail 230 kV line	350/438	-126	80	-105	108	-	90	-
NA	Dos Condados – Willow 230 kV line	350/438	-	-	-	-	-32	-	-15
NA	Willow – Red Tail 230 kV line	350/438	-	-	-	-	180	-	155

1. Simultaneous
2. Non-Simultaneous

All four Alternatives had little to no impact on the listed WSCC transmission paths. Additionally, it is noted that flow on the Springville to Vail 345 kV line is greater than the output of Springerville Unit 2 in all cases evaluated, i.e., in line with the TEP Two County bond tax restrictions.

Section 1

INTRODUCTION AND METHODOLOGY

Introduction

This report summarizes the results of the study to examine the potential impacts on the transmission system of interconnecting the proposed Bowie Power Station, LLC ("Client") 500/1100 MW plant ("Project") addition to the Tucson Electric Power ("TEP") and for Alternatives 2 and 4, the Arizona Electric Power Cooperative ("AEPCO"), Western Systems Coordinating Council ("WSCC") transmission grid approximately 40 miles south of the Greenlee 345 kV substation.

The Interconnection Power Flow Study was prepared by R. W. Beck at the request of Bowie Power Station, LLC to address alternative interconnection scenarios for power delivery from the proposed nominal 1,000 MW Bowie Power Station to the WSCC grid. The alternatives considered Project dispatch at both the 500 MW and 1,100 MW levels to provide interconnection at a range of potential output capacities.

Four different interconnection alternatives, corresponding to those requested in the CEC application, are evaluated herein.

Purpose of Study

The study uses "N-1" contingency load flow analyses in examining the potential impact of integration of the Project on the transmission system. To examine the effects (i.e., power flow changes) of adding generation, it is common practice to use power flow analyses to compare power flows on the transmission system with and without the added generation. It is important, however, when performing power flow comparisons, to recognize the difference between "typical" effects and "detrimental" effects on an AC transmission grid.

Where the power flow analysis identifies facilities that are loaded beyond the applicable facility ratings defined in the load flow case model, whether or not the facility requires upgrade to interconnect the Project to the system and/or acquire transmission service from the Project will be dependent on specific utility criteria.

Additionally, the results are based on the assumptions used in creating the power flow case model(s). Therefore, it is necessary to not only document the assumptions used but to evaluate a series of cases based on reasonable assumptions. The assumptions used for the analyses, discussed herein, are in line with common utility practices. However, the study is not intended to reflect detailed design of generation and system modification assumed for

the purpose of the study, nor does it assess operational issues associated with the day to day operation of the power grid.

Characteristics of AC Transmission Grid

Recognizing the difference between typical and detrimental effects requires an understanding of certain characteristics of an AC transmission system. In particular, there are two important characteristics of AC transmission that are relevant to this understanding. The first is that, for any given configuration of generators, power is delivered from generation to load in precisely the most efficient manner possible. Sometimes, this inherent and beneficial feature is referred to as "taking the path of least resistance". A second characteristic of AC transmission is that, when a circuit goes off-line unexpectedly (i.e., trips), power transfers automatically and instantaneously to parallel circuits on the grid. This capability greatly enhances the reliability of interconnected transmission grids.

These beneficial characteristics come with a consequence, namely that power flowing over AC transmission systems obeys the laws of physics and, therefore, follow the "paths of least resistance" without regard for ownership or corporate boundaries. Thus, on an integrated transmission, all generators will have an effect on the entire transmission grid and not just the transmission system to which they are interconnected. Moreover, the effects of generators on adjacent systems is dynamic, in that actual power flows on the transmission system are continually changing as generation is dispatched to serve load that changes hour-by-hour throughout each day and throughout the year.

When using a power flow program to evaluate the transmission system, it must be remembered that each power flow case represents only a single snapshot in time; i.e., an assumed load level, VAr schedule, system configuration and generation dispatch to serve the load at one instant in time. Evaluating potential impacts of the Project means adding new generation to an original configuration or "base case" and requires that a corresponding amount of existing generation be removed or reduced (presumably at another plant location) in order to maintain the necessary load and resource balance (or alternately an increase in load). The potential impacts of the changed case or "change case" are evaluated by comparing it to the "base case". When the "change case" is compared to the "base case", power flows on the system will be observed to change. Such changes are neither positive nor negative in and of themselves and, instead, may simply be indicative of normal operating changes which the transmission grid was designed to accommodate. Therefore, the analysis must attempt to determine when the changes caused by adding new generation, such as the Project, are perceived as being detrimental and/or beneficial to the transmission grid.

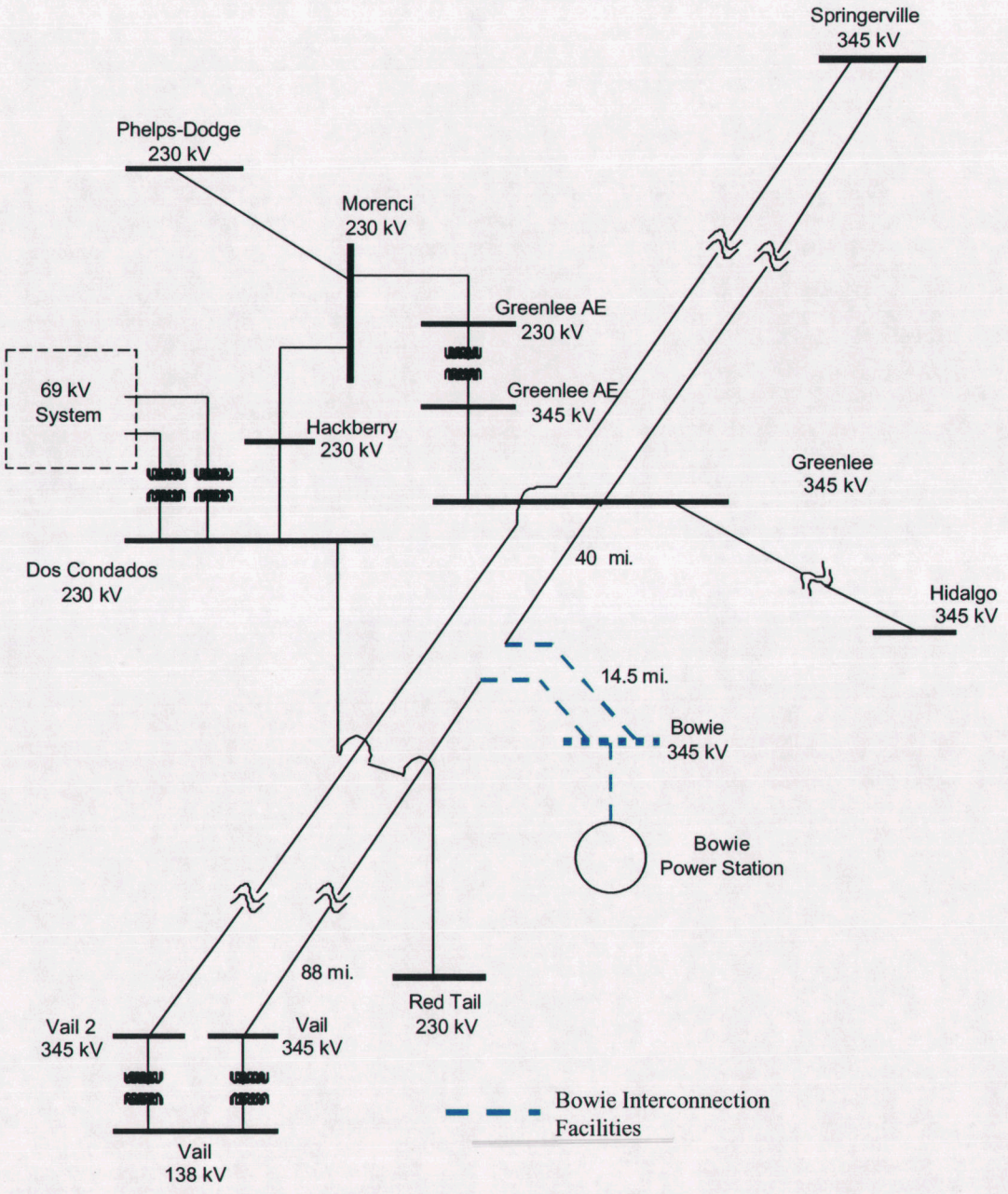
Project Description

The following lists the Project assumptions used in the analyses.

Project Name:	Bowie
Maximum Summer Capability (MW):	500/1100
Interconnection Voltage:	345 kV (and 230 kV for Alts 2 and 4)
Interconnection Location:	40 miles south of Greenlee 345 kV substation
Interconnection Alternatives:	• Alt 1 – Greenlee – Vail 345 kV • Alt 2 – Greenlee – Vail 345 kV & Red Tail – Dos Condados 230 kV • Alt 3 – Greenlee – Vail 345 kV line & Springerville – Vail 345 kV • Alt 4 – Greenlee – Vail 345 kV line, Springerville – Vail 345 kV line, Red Tail – Dos Condados 230 kV
Host Transmission Utility:	TEP (and AEPCO for Alts 2 and 4)
Reliability Council/RTO:	WSCC
Plant Configuration:	One or Two 2 on 1 GE7FA/Steam Turbnie Combine Cycle with duct firing

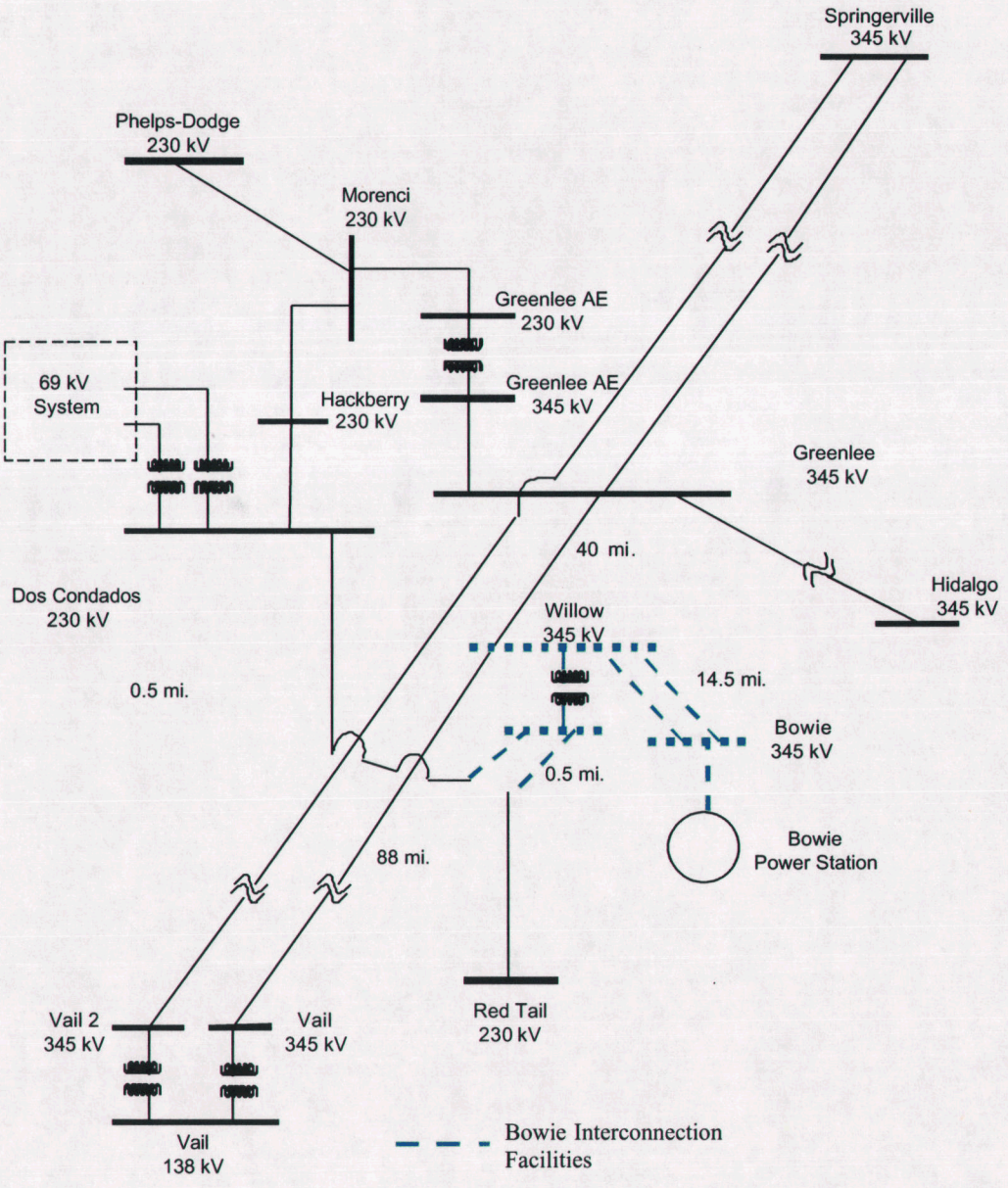
1. Alternative 1: An interconnection to the TEP system via a new 14.5 mile double circuit 345 kV loop in and out of the Greenlee – Vail transmission line approximately 40 miles south of Greenlee.

ALTERNATIVE 1 INTERCONNECTION CONFIGURATION



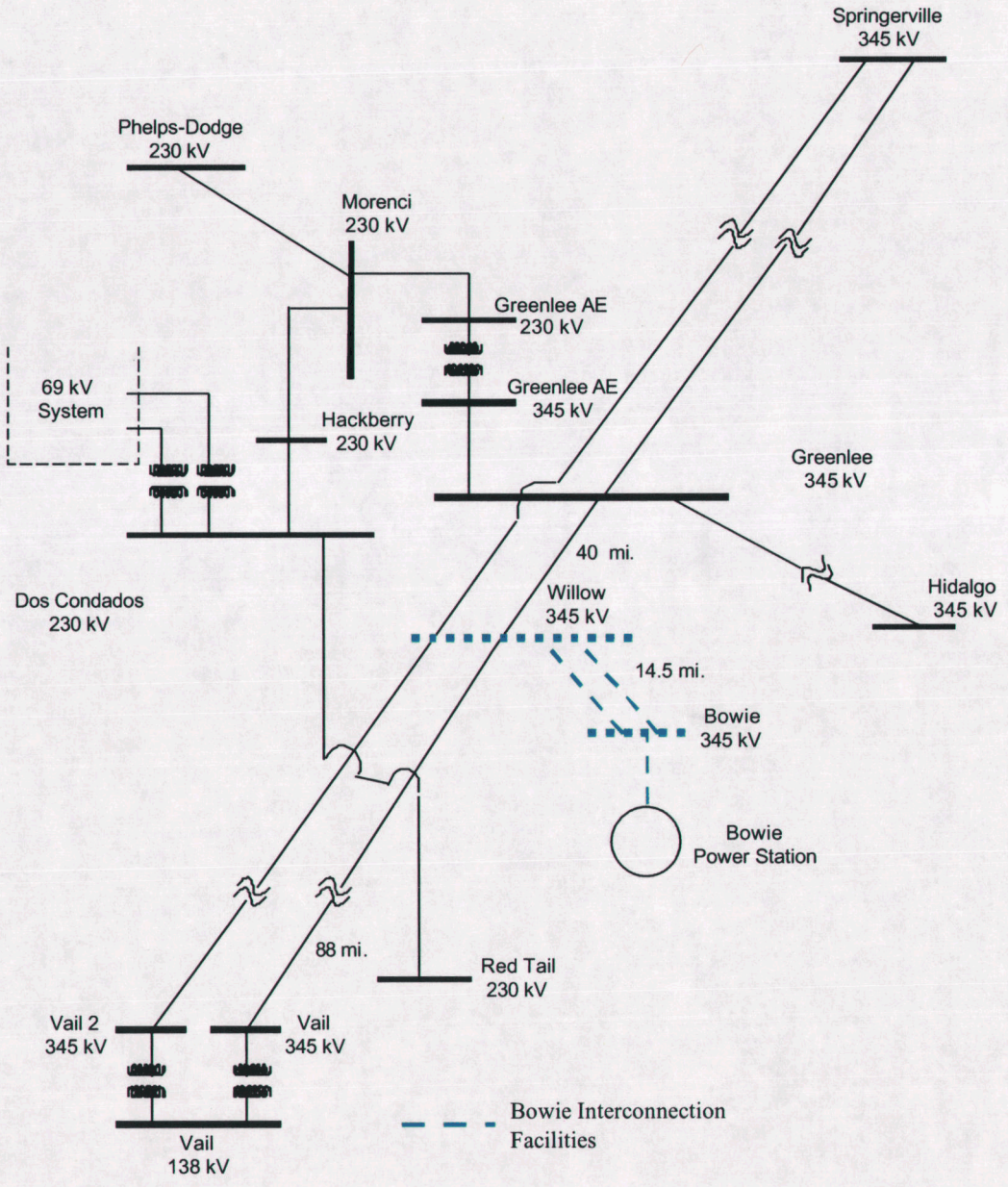
2. Alternative 2: A new substation, Willow, is constructed near the intersection of TEP's Greenlee to Vail 345 kV line and AEPCO's Dos Condados to Red Tail 230 kV line. The 14.5 mile double circuit 345 kV Bowie lines will terminate into the new breaker and a half substation. The Greenlee to Vail 345 kV line also connects to the new substation. Additionally, a 345/230 kV transformer will also be located at the substation with a 0.5 mile double circuit in and out loop of the AEPCO's Dos Condados to Red Tail 230 kV line.

ALTERNATIVE 2 INTERCONNECTION CONFIGURATION



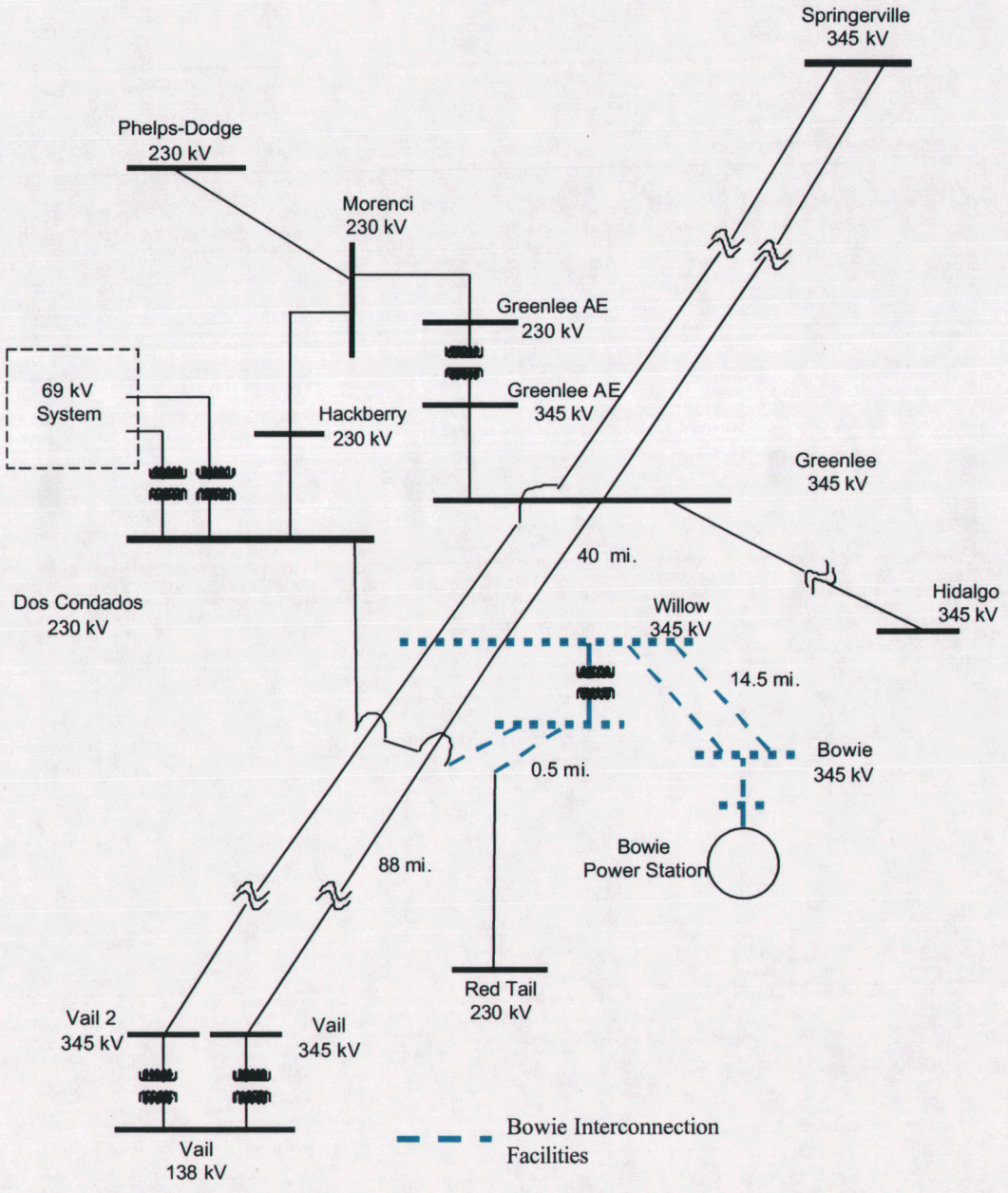
3. Alternative 3: A new substation, Willow, is constructed near the intersection of TEP's Greenlee to Vail 345 kV line and AEPCO's Dos Condados to Red Tail 230 kV line. The 14.5 mile double circuit 345 kV Bowie lines will terminate into the new breaker and a half substation. The Greenlee to Vail 345 kV and the Springerville to Vail 345 kV lines also connect to the new substation.

ALTERNATIVE 3 INTERCONNECTION CONFIGURATION



4. Alternative 4: A new substation, Willow, is constructed near the intersection of TEP's Greenlee to Vail 345 kV line and AEPCO's Dos Condados to Red Tail 230 kV line. The 14.5 mile double circuit 345 kV Bowie lines will terminate into the new breaker and a half substation. The Greenlee to Vail 345 kV and the Springerville to Vail 345 kV lines also connect to the new substation. Additionally, a 345/230 kV transformer will be located at the substation with a 0.5 mile double circuit in and out loop of the AEPCO's Dos Condados to Red Tail 230 kV line.

ALTERNATIVE 4 INTERCONNECTION CONFIGURATION



"N-1" Analysis Goals and Methodology

The goal of the Load Flow "N-1" Contingency Analysis is to perform an evaluation of the incremental impact of the Project on the loading of the regional transmission system. To achieve this goal, Beck uses the following process:

1. Examine level and location of existing and planned generation in the vicinity of the Project.
2. A Base Case is developed to establish a baseline performance of the system before the Project. The Base Case may include other proposed generating project or transmission system additions/modifications in the region.
3. "Change" Case(s) are then developed which include the Project. These cases may represent various interconnection configurations, transactions or Project sizes. Common approaches include:
   - ❖ The examination of a single project size with multiple transactions. The approach can be used when assessing the ability to deliver from the Project to particular markets and can be coupled with more detailed transmission service evaluations.
   - ❖ The examination of separate plant sizes at the same location. This approach can be useful in narrowing the Project size to that which results in the fewest loading violations on the system.
   - ❖ The examination of different interconnection alternatives from the same site. Project sites may have several different lines, substations or interconnection voltages in the vicinity, providing interconnection options. As with the previous approach, this approach presents which interconnection may result in the fewest loading violations.
   - ❖ The examination of different injection points on the system. This approach may help to narrow the list of physical sites to those which appear to have the least loading violations.
4. Single contingency ("N-1") analysis is then performed on each scenario.
5. Results from the change case(s) are compared to the results from the Base Case to evaluate the incremental impact of the Project on the loading of the transmission system.
6. The results are analyzed and presented.

Beck uses General Electric's PSLF program to run the load flow cases.

The results of the analyses may not reflect (i) operating limitations and (ii) loading violations that result from different assumptions used to create the cases. Additionally, the analysis "forces" the plant to be dispatched and therefore does not reflect the competitive aspects of the Project. The purpose of the analyses is to identify transmission facilities that have the potential to limit the dispatch of the Project and/or other generators in the local region under heavy load conditions (when power is most needed to serve load). Whether or not upgrade of the facilities is required for integration of the Project will depend on many factors such as the local utilities Generation Interconnection procedures.

The interconnection/deliverability studies are typically performed using summer peak load cases. A peak load "N-1" analysis adheres to what has traditionally been considered good utility practice. The analyses are used to demonstrate the ability to serve load under heavy load conditions when flexibility of generation resource dispatch is reduced. Additionally, for new generation interconnections, peak load analyses are used to demonstrate the ability of the Project to deliver power to the grid at the point in time where market prices are likely highest. However, for a more rigorous system impact or integration study, light load (approx. 40-50%) and "shoulder" load (approx. 60-70%) load flow cases should also be evaluated, often in conjunction with a market price/economic dispatch study. When studying generation export conditions worst case conditions may occur at lighter load levels. The transmission system in close proximity to the Project frequently has the most severe loading under minimum conditions when more power has to be exported from the immediate vicinity as opposed to serving regional load. "Shoulder" load periods (generally 60-70% of peak load) often represent the worst case conditions for the bulk transmission system in the region due to more economic transactions occurring over large regions.

In addition, studies other than the load flow analysis (e.g., stability and/or short circuit analysis) will frequently be performed as part of a System Impact or Facilities Study, to fully measure the impact of the Project on the interconnected power system.

Section 2

MARKET BACKGROUND

Market Structure

The structure of the market will play a major role in many factors that will affect the operation, expansion and liquidity of the market (e.g., how congestion is managed, how transmission expansion costs are allocated).

With the exception of California, the west has not yet transitioned to Regional Transmission Organizations ("RTO's") or even tightly operated pools. Although filings have been made in that regard (specifically Desert STAR and RTO-West), progress has been slow. As with other regions of the country, the region is composed of many different utility systems that have integrated transmission facilities. The Project is located near Bowie, Arizona and will interconnect with the TEP and for Alternatives 2 and 4 to the AEPCO transmission system(s), which in turn connect(s) to the surrounding systems. In an integrated AC transmission network, changes on one system will affect power flows on another. In that regard, coordinated planning is performed across regions as opposed to only examination of a single company in isolation.

While planning for regions has generally been coordinated by the NERC Regional Reliability Councils (e.g., WSCC, SERC, MAPP, MAIN), the council regions divisions are blurring with the FERC directed establishment of RTOs, given that participants of several established reliability councils are splitting between different RTOs.

Organizations applicable to this region in particular are:

- The Federal Energy Regulatory Commission ("FERC").
- The Western Systems Coordinating Council ("WSCC")
- Desert STAR

Organizational Entities

The WSCC territory covers all the western states including western Canada.

All public utilities (except those participating in an approved regional transmission entity that conforms to the Commission's RTO principles) that own, operate or control interstate transmission facilities were required to file with the Commission by October 15, 2000 a proposal for an RTO with the minimum characteristics and functions adopted in the Final Rule, or, alternatively, a description of efforts to participate in an RTO, any existing obstacles to RTO participation, and any plans to work toward RTO participation.

FERC RTO'S

FERC has taken several steps in re-emphasizing its position on the development of large, independent, transmission organizations in order to fulfill the goals outlined in Order No. 888. Steps include the May 1999 notice of proposed rulemaking (NOPR), the subsequent FERC Order 2000, and several precedent setting orders to individual utility or RTO/ISO filings. In June 2001, FERC recommended the establishment of four large RTO's that would cover most of the United States.

The Commission identifies the following minimum characteristics and functions that must be met in order to qualify as an RTO.

- Independence from market participants;
- Appropriate scope and regional configuration;
- Possession of operational authority for all transmission facilities under the RTO's control; and
- Exclusive authority to maintain short-term reliability.

Seven Minimum Functions an RTO must perform:

1. Administer its own tariff and employ a transmission pricing system that will promote efficient use and expansion of transmission and generation facilities;
2. Create market mechanisms to manage transmission congestion;
3. Develop and implement procedures to address parallel path flow issues;
4. Serve as a supplier of last resort for all ancillary services required in Order No. 888 and subsequent orders;
5. Operate a single OASIS site for all transmission facilities under its control with responsibility for independently calculating TTC and ATC;
6. Monitor markets to identify design flaws and market power; and
7. Plan and coordinate necessary transmission additions and upgrades.

DESERT STAR

The following is the December 28, 2000 FERC Compliance filing (Docket No. RTO1-44-000) filed reporting on the status of Desert Star:

"On October 16, in Arizona Public Service Co. Docket No. RO1-44-000, Desert STAR, Inc., ("Desert STAR") together with six utilities subject to the Commission's jurisdiction –Arizona Public Company, El Paso Electric Company, Public Service Company of Colorado, Public Service Company of New Mexico, Texas-New Mexico Power Company and Tucson Electric Power Company (the "Jurisdictional Utilities") – filed a detailed report on their efforts to establish a Regional Transmission Organization ("RTO") ("October 16 Filing"). The RTO is expected to encompass all or portions of Arizona, New Mexico, Colorado, Eastern Wyoming and West Texas.

By mid-October the Jurisdictional Utilities, Desert STAR, Numerous non jurisdictional transmission owners in the region and other stakeholders representing wholesale and retail customers, generators, marketers and utility commissions had made substantial

progress in developing an RTO. Since then the stakeholders have intensified their efforts.

Numerous issues have been resolved. Others remain, not the least of which is the development of a suitable transmission rate design. The task is especially difficult in light of the fact that approximately one-half of the transmission facilities in the region are owned by entities, such as Federal power marketing administrations, tax-exempt utilities and cooperatives, that are not subject to the Commission's jurisdiction. Moreover, the current transmission rates differ markedly among the various entities. The jurisdictional Utilities and Salt River Project Agricultural Improvement & Power District ("Salt River Project") made a transmission rate design proposal and are working with non-jurisdictional transmission owners (such as Western Area Power Administration, Tri-State Generation and Transmission Association, Southwest Transmission Cooperative, Inc. and Colorado Springs Utilities) to further develop and refine the proposal for presentation to the stakeholders and Board of Directors. Other issues remain to be resolved.

The stakeholders are continuing to develop the documentation that will be necessary for a more complete and better developed filing. The utilization of a collaborative process involving substantial stakeholders input should produce a better end product, with fewer issues to be resolved by the Commission, but such process is necessarily time-consuming."

Transmission Interconnection Requirements

Transmission Interconnection requirements can vary from utility to utility. FERC Order 888 outlined equal access to transmission service but did not address the ability to interconnect to a utility's transmission system without requesting firm transmission service. FERC precedence, however, has provided for two distinct types of service, and therefore two study paths, i.) Interconnection Service and ii.) Transmission Service. This is an important consideration and distinction – Interconnection Service allows the facility addition to interconnect to the power system, but does not grant the right to transmit power to the ultimate consumers (deliverability). In order to obtain the right to transfer power to the ultimate consumer, Transmission Service needs to be procured. Most transmission providers limit non-Load Serving Entities (LSE's) to Point to Point Transmission Service, and therefore, a merchant generation developer must also specify a Point of Delivery, or "sink" when requesting Transmission Service. This requirements makes it difficult to request firm transmission service, and pay the substantial associated reservation fee, prior to firm power sale contracts being in place.

The initial step of the response by the host to both the transmission service and/or interconnection request is a study, if required, completed at the expense of the requestor.

In addition to electrical interconnection requirements, merchant power providers will require significant interface with local regulatory bodies.

Regional Background

The proposed site is located in eastern Arizona and interconnects to the regional 345 kV system (and the 230 kV system in Alts 2 and 4). The Greenlee 345 kV substation is co-owned by TEP and AEPCO and ties to the Springerville 345 kV substation in the north, TEP's Vail 345 kV substation near Tucson and the Hidalgo 345 kV substation in New Mexico. The Greenlee 345 kV substation also ties to 230 kV system, which steps down to the AEPCO 69 kV system.

There are two main transmission paths to southeastern Arizona from the Project site. The first path includes the Greenlee – Vail and Springerville – Vail 345 kV lines. The Vail 345 kV substation is one of the three main delivery points for Tucson. The second is AEPCO's Dos Condados to Red Tail 230 kV line that ties to the 345 kV system at Greenlee and at Bicknell substations.

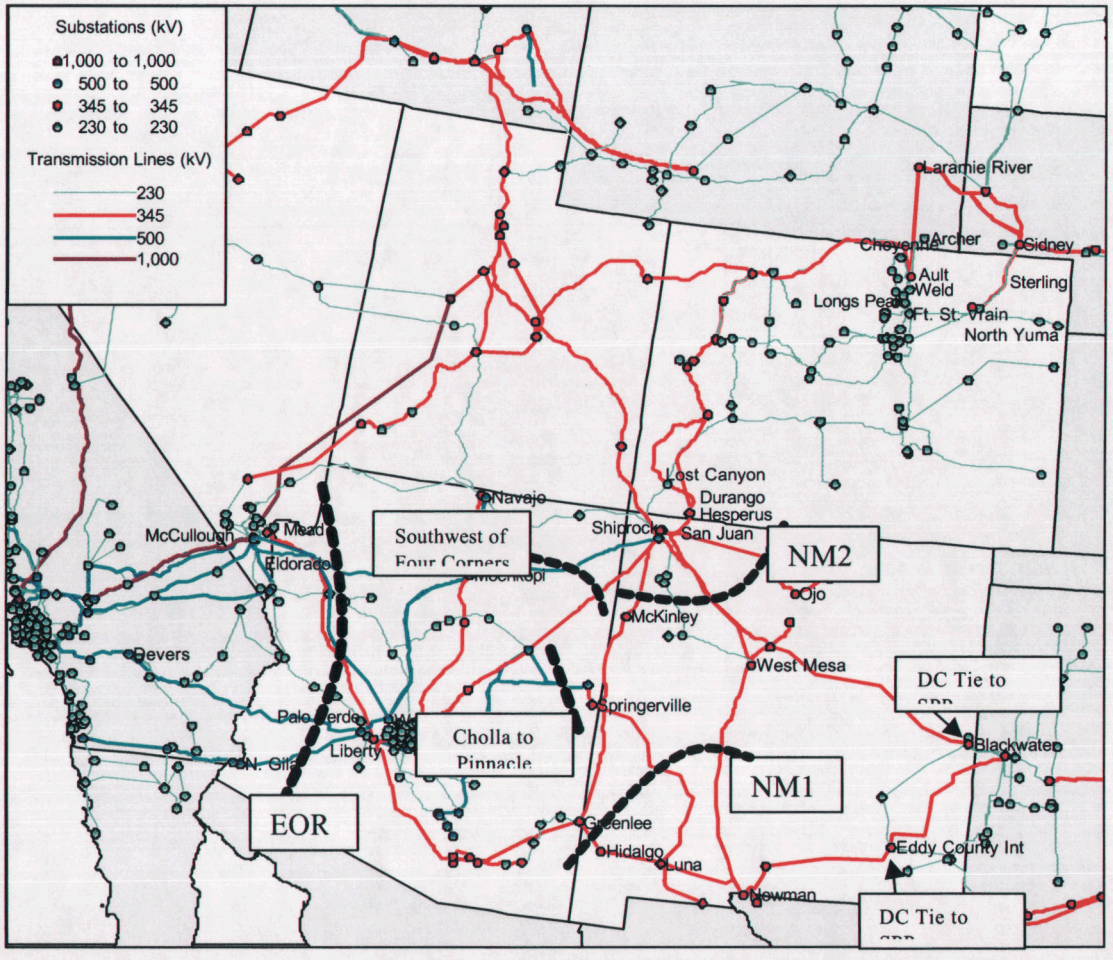
Infrastructure and Constraints

The Extra High Voltage ("EHV") transmission system in the region includes 345 kV and 230 kV. Many of these facilities are proposed to be placed under the operational control of the Desert STAR.

For Arizona, flow is constrained from the Four Corners region, the Navajo plant and the Cholla plant into Phoenix. The Springerville lines into Tucson are not currently identified in the WSCC Path Rating Catalog as constrained. The predominant power flow across Arizona is from the coal generation in the north/northeast to the west into Southern Nevada/California and south southwest into the Tucson/ Phoenix markets. Additionally, there is significant power flow from Arizona over the East of the River ("EOR") path into Southern California. New generation construction to date has been predominantly located in the west/northwest portions of Arizona with the largest amount under construction near the Palo Verde Nuclear generating station located west of Phoenix. As new plants are constructed around Palo Verde, it is likely that without new transmission additions this EOR path will become more congested and that transmission will also be constrained from the Palo Verde hub into the Phoenix area.

Paths are included in the WSCC Path Rating Catalog and the descriptions of selected paths are included in Appendix C.

ARIZONA/NEW MEXICO REGION WSCC TRANSMISSION PATHS



Several of the existing transmission constraints are identified on the figure above.

Path #	Path Description	Rating (MW)
22	Southwest of Four Corners	2325 (East – West)
47	Southern New Mexico (NM1)	925 (S)[1] 1048 (NS)[2]
49	East of the River (EOR)	7550 (East – West) Not rated (West – East)
50	Cholla to Pinnacle Peak	1200 (East – West)

Regional Generation

Dispatch of generation in the region of the Project affects the results of the analyses. Therefore, an important factor in evaluating the Project is the dispatch of existing generation and the proposed or "announced" generation in the region.

For the existing generation, an economic dispatch order was derived from the filed FERC Form 1 data. The data is presented in the order of highest to lowest capacity factor of the units as opposed to the fuel type or variable costs.

Table 1
Summary of Existing Regional Generation

Ownership	Plant Name	Prime Mover	Prime Fuel	Year(s) Built	Cap Factor (%)	Net Generation (MWh)	Total Production $/MWh	Maximum Capability (MW)	Base Case Dispatch (MW)
APS	Palo Verde	NU	Nuclear	1986-88	92.0	13970770	18.21	4186	4186
TEP	Springerville	ST	Coal	1985/90	87.6	5829792	32.56	760	760
Jointly	Four Corners	ST	Coal	1970	82.1	3478408	12.56	2060	2060
Jointly	Navajo	ST	Coal	1974/76	65.8	10581100	16.38	2415	2415
SRP	Stewart Mt.	HY	Hydro	1929	61.4	33565	27.81	13	13
AEPCO	Apache	ST	Coal/Gas	1964/79	54.0	UNK	UNK	425	425
APS	Cholla	ST	Coal	1962/81	51.7	3845135	20.11	995	995
WAPA	Parker – Davis	HY	Hydro	1951	48.8	UNK	UNK	366	310
SRP	Coronado	ST	Coal	1979/80	46.4	5039392	25.24	736	736
WAPA	Glen Canyon	HY	Hydro	1964/66	39.1	UNK	UNK	1304	960
SRP	Roosevelt	HY	Hydro	1972	31.5	70299	26	34	34
TEP	Irvington	ST	Coal/Gas	1967	29.9	1104485	45.7	425	415
SRP	Mormon Flat	HY	Hydro	1920/71	27.3	109749	15.18	51	51
APS	West Phoenix CC	CC	Gas (Old)	1976	27.0	602590	36.09	380	380
SRP	Agua Fria	ST	Gas/Oil (Old)	1961	24.6	888092	32.86	386	149
SRP	Horse Mesa	HY	Hydro	1927/72	24.4	207372	16.75	125	124
APS	Ocotillo	ST	Gas	1960	15.9	319380	45.43	230	230
APS	Saguaro	ST	Gas/Oil	1955	9.7	178262	46.47	209	209
SRP	Santan	CC	Gas (Old)	1974-5	9.7	714062	35.11	307	201
SRP	Kyrene	ST	Gas/Oil	1954	5.4	50072	76.48	106	0
APS	West Phoenix	GT	Gas	1973	5.2	50903	53.92	281	206
APS	Ocotillo	GT	Gas	1972-3	3.4	33501	62.81	187	112
APS	Saguaro GT	GT	Gas/Oil (Old)	1973	2.7	26142	65.35	109	109
SRP	Agua Fria GT	GT	Gas	1975	2.2	42223	196.66	226	132
APS	Yucca	GT	Gas/Oil (Old)	1971-4	2.0	25551	63.14	223	203
AEPCO	Apache CT	GT	Gas/Oil (Old)	1975	1.2	UNK	UNK	130	130
SRP	Kyrene GT	GT	Gas/Oil (Old)	1973	1.2	18990	75.2	158	0
TEP	Irvington GT	GT	Gas/Oil (Old)	1973	0.8	5161	72.68	60	50
TEP	North Loop	GT	Gas/Oil (Old)	1973	0.7	5631	70.64	310	205
TEP	DeMoss Petrie	GT	Gas/Oil (Old)	1973	0.1	569	441.7	130	130
District Owned	New Waddell	HY	Hydro	1993	UNK	UNK	UNK	46	30
Non-utility	Yuma	CC	Gas (Old)	1994	UNK	UNK	UNK	56	56
AEPCO	Apache CC	CC	Gas (Old)	1963	NA	UNK	UNK	30	28
UNK	Vail CT	UNK	Gas/Oil (Old)	UNK	NA	UNK	UNK	130	130

Proposed Regional Generation

Since dispatch of other generating resources affects power flows in the region, it may be necessary to add some level of "new" generation to the Base Case. As such, the following table lists proposed generation in the region and that which has been selected to include in the Base Case model.

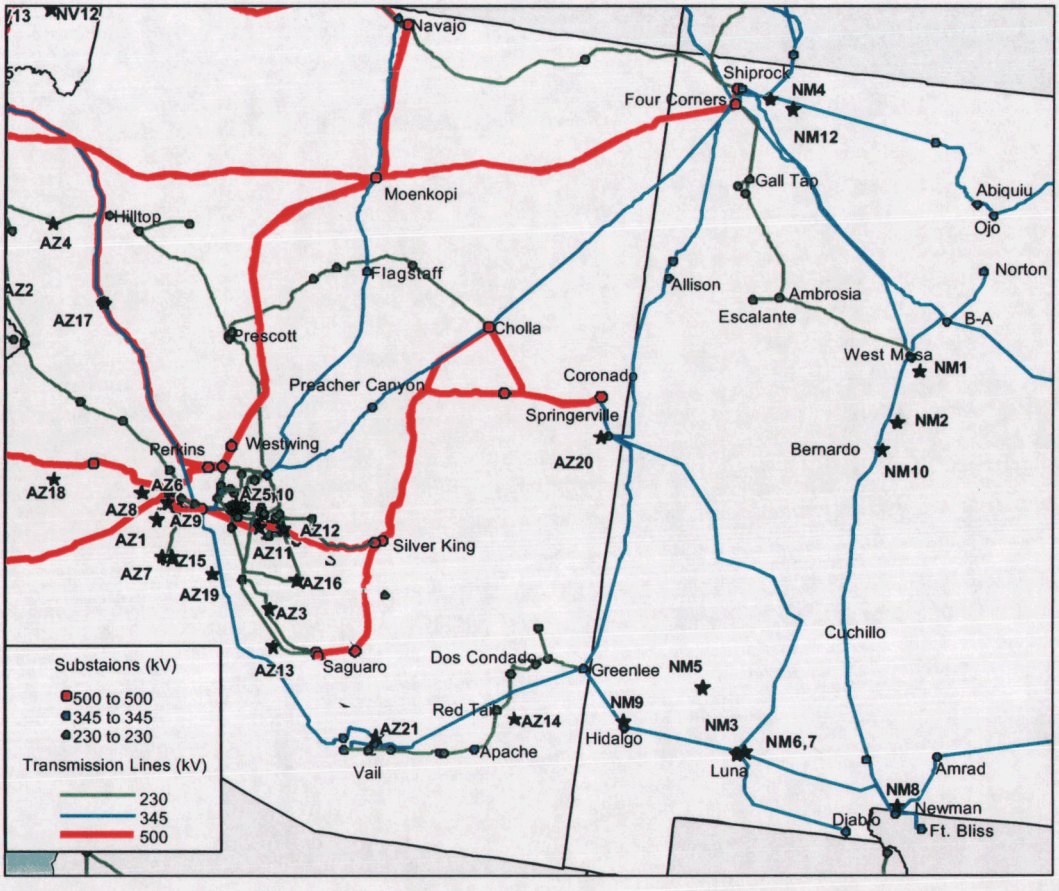
Proposed Generation Table

#	Developer	Plant Name	Location	State	MW	ISDN	Comments
AZ1	Duke Energy Power Services L.L.C.	Arlington Valley	SW of Buckeye	AZ	500	2002	CEC approval - Under Construction
AZ2	Calpine Mojave	South Point	Bullhead City	AZ	500	2001	Operating
AZ3	Reliant Energy Power Generation, Inc.	Desert Basin	Casa Grande	AZ	550	2001	Operating
AZ4	Griffith Energy/Duke/PPL	Griffith	Kingman	AZ	540	2001	Operating
AZ5	Arizona Public Service Company	West Phoenix	West Phoenix	AZ	130	2001	Operating
AZ6	Pinnacle West Energy	Red Hawk	Palo Verde	AZ	1000	2002	Under Construction
AZ7	Panda Energy International	Gila River	Gila River	AZ	2000	2003	CEC approval – Under Construction
AZ8	PG&E Generating	Harquahala	Harquahala	AZ	1000	2003	CEC approval – Under Construction
AZ9	Sempra Energy Resources	Mesquite	Near Palo Verde	AZ	1000	2003	CEC Approval –Under Construction
AZ10	Pinnacle West Capital Corp./Calpine	43rd Avenue	West Phoenix	AZ	511	2001	CEC approval
AZ11	Salt River Project	Kyrene	Kyrene	AZ	250	2002	CEC Approval –Under Construction
AZ12	Salt River Project	Santan	Santan (Gilbert)	AZ	825	2004	CEC approval
AZ13	Toltec Power Station, LLC.	Toltec Power Station	Eloy (Toltec)	AZ	1000	2003	CEC Pending
	Toltec Power Station, LLC.	Toltec Power Station	Eloy (Toltec)	AZ	1000	2004	CEC Pending
AZ14	Bowie Power Station, LLC.	Bowie Power Station	Bowie	AZ	1000	2004	Planned – Announced 1/31/01
AZ15	Gila Bend Power Partners	Gila Bend	Gila Bend	AZ	750	2003	CEC approval
AZ16	PP&L	PPL Sundance Energy	Coolidge	AZ	600	2002	CEC approval – Peaking unit
AZ17	Caithness Big Sandy LLC		Wikieup	AZ	720	2002	Status of CEC unknown
AZ18	Allegheny Energy Supply Co	La Paz	La Paz county	AZ	1080	2005	Status of CEC unknown
AZ19	AES	Montezuma Energy	Mobile	AZ	520	2003?	Status of CEC unknown
AZ20	Unisource/Bechtel	Springerville	Springerville	AZ	380	2005	Announced 02/05/2001
AZ21	Tucson Electric Power Co	Vail Generating Station	Rita Ranch	AZ	150	2002	Peaking
NM1	Delta Power Corporation	Cobisa Person	Albuquerque	NM	140	2000	In operation
NM2	Cobisa Corp	Cobisa – Rio Puerci	Belen	NM	220	2003	Planned
NM3	Deming Power Partners I		Deming	NM	250	N/A	Planned
NM4	Navajo Tribal Utility Authority		Farmington	NM	20	2001	Planned
NM5	Phelps Dodge Corp.	Chino Mines	Hurley	NM	50	Jul-01	Advanced Development
NM6	Duke Energy	Duke Energy Luna	Deming	NM	550	Jun-03	Facilities Study Completed
NM7	Unknown – Phase 1		Luna	NM	587	N/A	Facilities Study Completed
NM7	Unknown – Phase 2		Luna	NM	1200	N/A	Facilities Study Completed
NM8	Unknown		Vicinity of Newman	NM	250	N/A	Facilities Study Completed
NM9	Tri-state G&T Association, Inc.	Lordsburg	Lordsburg	NM	160	N/A	Facilities Study in Progress
NM10	Unknown		West Mesa-Arroyo	NM	120	N/A	Facilities Study in Progress
NM11	Unknown		Eddy	NM	80	N/A	Facilities Study in Progress
NM12	Ameramex	Bloomfield	Bloomfield	NM	50	N/A	Early development
NV12a	Duke Energy North America	Duke Energy Moapa	Clark County	NV	1080	Jun-02	Early development
NV12b	Duke Energy North America	Duke Energy Moapa	Clark County	NV	90	Jul-02	Early development
NV13	Nevada Power Co.	Harry Allen	Las Vegas	NV	500	Jun-04	Early development

Blue Highlight	Indicates the plant was already modeled in the WSCC Summer Peak Case
Yellow Highlight	Indicates the plant was modeled in the Base Case and may or may not be dispatched
No Highlight	Indicates the plant was not added to the Base Case

The following figure provides a geographic representation of the proposed and planned generation plants.

Proposed Generation Figure



Section 3

CASE DEVELOPMENT AND ASSUMPTIONS

As with all load flow analyses, the results of the study are driven by the assumptions used in developing the load flow case. To minimize the impact of these assumptions, Beck starts the process with a filed load flow case model or another model supplied by the Client, and then details the changes made to the model in evaluating the Project. Although the filed cases are often part of the FERC 715 Filing, RTO or Multi-Regional Modeling Working Group ("MMWG") cases may also be used when available.

Case Development

The Base Case was created from the FERC-715 Filing 2001 Series WSCC Summer Peak Case, as modified by the CA-ISO for load and generation dispatch in California. The Arizona load level was assumed to be reflective of the 2003 time frame. The WSCC cases are filed with FERC as part of the annual 715 filing requirement. Beck relies upon these load flow models but does not independently verify all of the data in the models.

The Base Case is then used to create the Change Case(s) by adding the Project. For generating project additions, the generation is re-dispatched to accommodate the generation addition(s). The method used to re-dispatch the generation and a table showing the modifications to the dispatch are shown under Dispatch Assumptions.

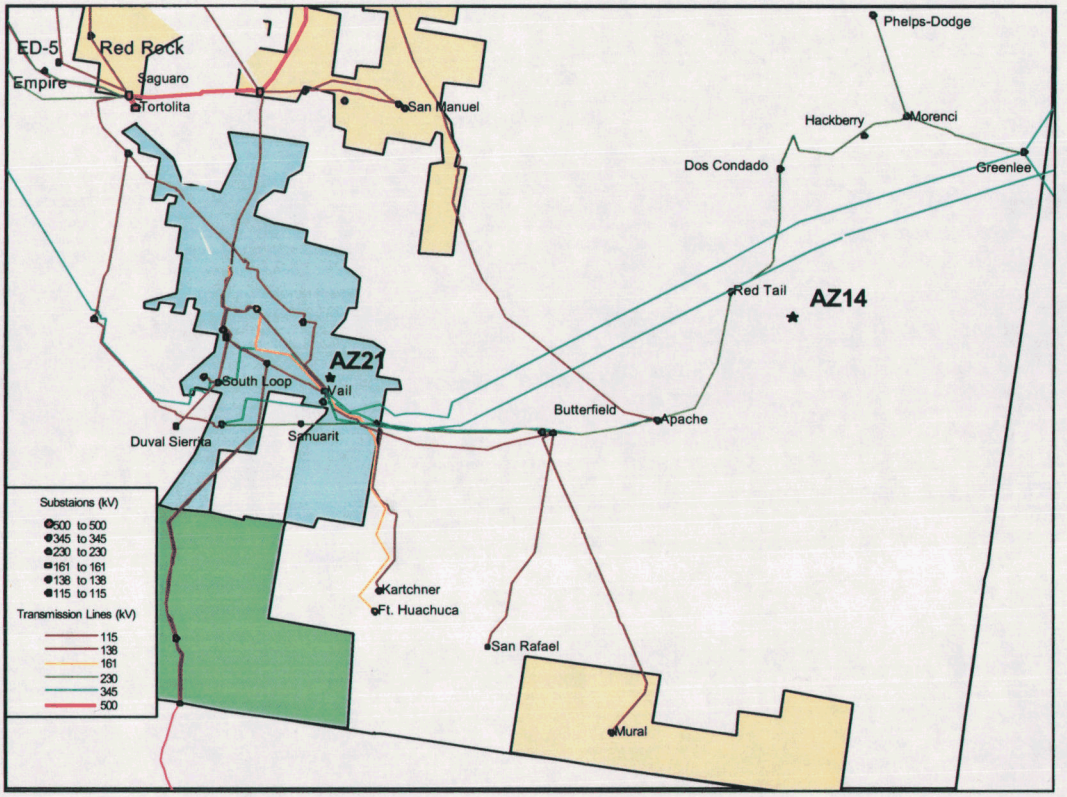
The cases developed for this analysis are described below:

- Base Case – WSCC Summer Peak load flow case modified, if applicable to include proposed generation in the region with a dispatch as shown in Table 3.
- Alternative 1 – An interconnection to the TEP system via a new 14.5 mile double circuit 345 kV loop in and out of the Greenlee – Vail transmission line approximately 40 miles south of Greenlee.
- Alternative 2 – A new substation, Willow, is constructed near the intersection of TEP's Greenlee to Vail 345 kV line and AEPCO's Dos Condados to Red Tail 230 kV line. The 14.5 mile double circuit 345 kV Bowie lines will terminate into the new breaker and a half substation. The Greenlee to Vail 345 kV line also connects to the new substation. Additionally, a 345/230 kV transformer will be located at the substation with a 0.5 mile double circuit in and out loop of the AEPCO's Dos Condados to Red Tail 230 kV line.
- Alternative 3 – A new substation, Willow, is constructed near the intersection of TEP's Greenlee to Vail 345 kV line and AEPCO's Dos Condados to Red Tail 230 kV line. The 14.5 mile double circuit 345 kV Bowie lines will terminate into the new breaker and a half substation. The Greenlee to Vail 345 kV and the Springerville to Vail 345 kV lines also connect to the new substation.

Transaction Scenarios

Based on the location of the Project, primary markets are located in southeast Arizona, an area shown on the following figure.

SOUTHEAST ARIZONA REGION



Proposed Generation Table in Southeastern Arizona

#	Developer	Plant Name	Location	State	MW	ISDN	Comments
AZ14	Bowie Power Station, LLC.	Bowie Power Station	Bowie	AZ	1000	2004	Planned – Announced 1/31/01
AZ21	Tucson Electric Power Co	Vail Generating Station	Rita Ranch	AZ	150	2002	Peaking Facility

The transaction schedules shown in Table 2 were simulated in the load flow case models to examine the potential impact on the transmission system of delivery to the primary markets.

Table 2
Transaction Schedules in MW

Region	"a" (Alt 1 Only) AEPCO	"b" (Alt 1 Only) TEP	"c" (All Alternatives) AEPCO/ TEP
Southeastern AZ	500	0	500
Southeastern AZ/Tucson	0	500	600

Dispatch Assumptions

Generation is adjusted to accommodate, where applicable, other new generation projects assumed in the study to create the Base Case. Generation is further adjusted to accommodate the proposed Project to create the Change Case(s). Generation is adjusted considering the following factors:

- Other new generating projects added to the Base Case are generally assumed sold on an approximated economic dispatch to the utility (or power pool) to which the competing plant is interconnected.
- Transactions to primary markets (see Table 2);
- Capacity factors of existing generating units within the region where the proposed plant's power is to be sold, e.g., reducing the dispatch of low capacity factor units to accommodate the Project;
- A general philosophy of stressing the transmission interface by increasing the region's export.

Table 3 shows the generation dispatch used to simulate the transactions for the analysis for each dispatch level.

Table 3
Generation Dispatch Summary

Area: Generating Units (Bus #)	Capacity Factor	Generation Dispatch Modifications (MW)			
		Base Case	Transaction Scenarios		
			"a" AEPCO	"b" TEP	"c" AEPCO/ TEP
AZ: Santan (19521,4))	9.69%	0	0	0	0
AZ: Apache CT (17024-7)	1.23%	158	0	158	0
AZ: Apache ST (17028-30)	54.04%	425	83	425	83
AZ: North Loop CT (16510,5-6)	0.68%	205	205	0	0
AZ: Irvington CT (16504)	0.81%	50	50	0	0
AZ: Vail CT (16517)	NA	130	130	0	0
AZ: Irvington GT (16503,7-9)	29.88%	415	415	300	200
NM: Rio Grande	35.68%	243	243	243	243
NM: Person	New	140	140	140	140
AZ: Gila River (90001-12)	New	900	900	900	900
AZ: Remaining PV Area Generation	New	35	35	35	35
AZ: Toltec (93000)	New	1000	1000	1000	1000
NM: Duke Luna	New	500	500	500	500
Project (94000)	New	0	500	500	1100
Total Dispatched (Selected units)		4201	4201	4201	4201

Contingencies Evaluated

Beck evaluated the system for single contingency (N-1) outages (and possibly selected N-2 contingencies) as identified in Appendix A.

For the Base Case and Contingency analyses, Beck monitored flows and voltages on regional facilities.

Evaluation Criteria

Criteria are necessary to evaluate the performance of the transmission system within this analysis. This section describes the applicable criteria used for evaluation in this analysis.

WSCC Planning Criteria

(WSCC, under their Reliability Criteria for Transmission System Planning, requires its members to comply with standards set forth by the organization. WSCC, however, acknowledges the need for planning criteria to reflect "practical considerations such as the geography, type of load being served, system configuration, weather, local acceptance, or political and regulatory oversight." Therefore, the organization believes each individual member's planning criteria should "complement the reliability of the Western Interconnection with the practical needs of each individual system" and states "each individual system may use its internally applied reliability criteria to plan its internal system" as long as they meet WSCC criteria.

The following evaluation criteria are used for the analysis:

- During normal operation (e.g., prior to any contingency), line and transformer loading should not exceed the specified Normal Rating ("N" or Rating 1 within the load flow case).
- During contingency operation, line and transformer loading should not exceed the specified Emergency Rating ("E" or Rating 2 in the load flow case). Additionally, since some systems supply only one rating, for the facilities with only one rating identified, 110% of continuous rating has been assumed for N-1 contingency loadings.

According to the "Southeast Arizona Regional Transmission Study" published in March 2000, transmission lines without an Emergency Rating in southeastern Arizona use the following criterion under Emergency Operating Conditions, defined as single contingency outages:

"Transmission lines should not be loaded greater than 110% of the thermal rating of the conductors."

The "Southeast Arizona Regional Transmission Study" was jointly prepared by AEPCO, Arizona Public Service, Citizens Utilities, Public Service Company of New Mexico, Tucson Electric Power, and Western Area Power Administration. The study analyzed the interactions and reliability between the different transmission providers in Southeastern Arizona.

The results of the contingency analyses for the Change Case(s) are compared with the Base Case loadings for the same contingency to determine if integration of the Project resulted in any new overloads. The Results section details the overloads occurring in the Alternative Case(s) both with and without contingencies.

Section 4

RESULTS

There are several considerations when examining the impact of a particular project on the grid. Discussed within this section is the impact on facilities where the loading exceeds the rating of the facility. Loading violations such as these may indicate that (1) transmission system upgrades are necessary, (2) special protection schemes need to be implemented in conjunction with the Project, (3) other system configuration change(s) is(are) warranted or (4) that staging of integration of various output levels of the Project requires coordination with future transmission expansion plans.

The power flow analysis results have two key components, an AC analysis to identify facilities that are overloaded in any of the cases examined and a Linear, DC, analysis which projects the Project output level at which loading violation occurs ("FCITC"). In conjunction with these results are the presentation of the distribution and participation factors ("TDF" and "TPF" respectively) of the Project on these same facilities.

Interface and Facility Impact

Impact on key interface limitations are a consideration. The following tables show the contribution of the Project on the defined transmission paths.

Power Flow over Defined Paths and Regional Facilities

WSCC Path #	Path/Facility Description	Rating	Path/Facility Flows						
			Base	"1a" AEPCO 500 MW	""1b" TEP 500 MW	"1c" AEPCO/TEP 1100 MW	"2c" AEPCO/TEP 1100 MW	"3c" AEPCO/TEP 1100 MW	"4c" AEPCO/TEP 1100 MW
			MW	MW	MW	MW	MW	MW	MW
22	Southwest of Four Corners	2325 (E – W)	1751	1767	1777	1797	1790	1795	1793
47	Southern New Mexico (NM1)	925 (S)[1] 1048 (NS)[2]	589	590	589	590	590	590	590
49	East of the River (EOR)	7550 (E – W) Not rated (W – E)	5011	5009	5007	5006	5005	5005	5005
50	Cholla to Pinnacle Peak	1200 (E – W)	1096	1107	1094	1103	1101	1105	1103
NA	Springerville – Greenlee 345 kV line	745/1010	378	335	261	195	220	342	328
NA	Greenlee – Vail 345 kV line	896/1210	190	-	-	-	-	-	-
NA	Greenlee – Project Bus 345 kV line	896/1210	-	-73	20	-278	-	-	-
NA	Project Bus – Vail 345 kV line	896/1210	-	419	508	790	-	-	-
NA	Greenlee – Willow 345 kV line	896/1210	-	-	-	-	-106	-75	15
NA	Willow – Vail 345 kV line	896/1210					754	619	584
NA	Springerville – Vail 345 kV line	666/806	322	318	390	402	395	-	-
NA	Springerville – Willow 345 kV line	666/806	-	-	-	-	-	215	240
NA	Willow – Vail 345 kV line	666/806	-	-	-	-	-	586	566
NA	Greenlee 230/345 kV xfmr #1	150/193	39	-64	26	-78	-9	-69	-17
NA	Greenlee 230/345 kV xfmr #2	150/193	37	-68	28	-83	-10	-73	-18
NA	Dos Condados – Red Tail 230 kV line	350/438	-126	80	-105	108	-	90	-
NA	Dos Condados – Willow 230 kV line	350/438	-	-	-	-	-32	-	-15
NA	Willow – Red Tail 230 kV line	350/438	-	-	-	-	180	-	155

3. Simultaneous
4. Non-Simultaneous

All four Alternatives had little to no impact on the listed WSCC transmission paths. Additionally, it is noted that flow on the Springville to Vail 345 kV line is greater than the output of Springerville Unit 2 in all cases evaluated, i.e., in line with the TEP Two County bond tax restrictions.

Power Flow Summary

The load flow results are summarized below. Complete results tables are included in Appendix B.

Both Normal and Outage Conditions are presented in separate tables.

Table description:

Column 1: FCITC, i.e., First Contingency Incremental Transfer Capability (This column identifies the level of Project dispatch for which the applicable overload element occurs. Negative FCITC numbers represent pre-existing Base Case loading violations. Although pre-existing, the negative FCITC elements must be examined closely to determine if integration of the Project reduces the Base Case loading or increases

the Base Case loading. Increases in Base Case loading could result in cost sharing of upgrades, if applicable.)

Column 2: TDF, i.e., Normal "N" or Outage "O" Transaction Distribution Factor. (The percent of the transaction that flows over the overloaded element under either normal or outage conditions. In utility Interconnection/Transmission Service evaluations, a threshold percentage may apply.) Positive or negative designation corresponds to the direction of the flow.

Column 3: TPF, i.e., Normal "N" or Outage "O" Transaction Participation Factor. (The incremental flow due to the transaction divided by the facility rating.) Positive or negative designation corresponds to the direction of the flow.

Column 4: Type "Tp" (Designation of overloaded element as either a line "L" or transformer "X".)

Column 5: Overloaded Element (Element that overloads at the Project output identified in the FCITC column)

Column 6: Area (Area designation of the overloaded element)

Column 7: Contingency (Outage resulting in the overloaded element)

Column 8: Rating (Normal/Emergency rating of the overloaded element)

Columns 9 –10: Base and Change loading of the element considering the Project at maximum output. (These correspond with the levels presented in the Maximum Project Output Analysis section.)

For the analyses "Normal Condition" or "continuous loading" is defined as all facilities normally in-service. "Post-Contingency" is defined as a single contingency (N-1), i.e., one line or transformer out of service.

The results are presented as follows:

1. Alternative 1a: Project at 500MW, Sale to AEPCO
2. Alternative 1b: Project at 500MW, Sale to TEP
3. Alternative 1c: Project at 1100MW, Sale to AEPCO/TEP
4. Alternative 2c: Project at 1100MW, Sale to AEPCO/TEP
5. Alternative 3c: Project at 1100MW, Sale to AEPCO/TEP
6. Alternative 4c: Project at 1100MW, Sale to AEPCO/TEP

The following Normal Condition pre-existing facility violations were present in all cases. Integration of the Project had no impact on the loading of these facilities.

All Alternatives

Normal (Pre-Contingency) Summary

Project Full Output: 500/1100 MW							Rating	AC Power Flow	
FCITC	NTDF	NTPF	Tp	Overloaded Element	Area	Contingency	N/E (MVA)	% of N Rating Base	Chg
-	-	-	L	Irving To Westms_T 115kv	Nm	No Outage	134	111%	111%
-	-	-	L	Lenkurt To Sandia_1 115kv	Nm	No Outage	108	112%	112%
-	-	-	L	Person To Wesmecot 115kv	Nm	No Outage	120	110%	110%
-	-	-	L	Westms_1 To Westms_T 115kv	Nm	No Outage	134	118%	118%
-	-	-	L	Mesa___# To Rio_Gran 115kv	Nm	No Outage	144/196	100%	100%
-	-	-	L	Clapham To Rosebud 115kv	Nm	No Outage	60	102%	102%
-	-	-	L	Hollywo# To Alamogcp 115kv	Nm	No Outage	40	106%	106%
-	-	-	X	Socorrop To Socorrop 69/115kv	Nm	No Outage	17	103%	103%

Alternative 1: Project Connection to 345 kV

Alternative 1 models an interconnection to the TEP system via a new 14.5 mile double circuit 345 kV loop in and out of the Greenlee – Vail transmission line approximately 40 miles south of Greenlee.

Three separate scenarios were evaluated for this interconnection alternative.

Alternative 1a: 500 MW Sale to AEPCO

Alt 1a Post-Contingency Summary

Project Full Output : 500 MW							Rating	AC Power Flow	
FCITC	TDF	TPF	Tp	Overloaded Element	Area	Contingency	N/E (MVA)	% of E Rating Base	Chg
-	-64.2%	-119.8%	L	Apache To Buterfld 230kv	AZ	Apache To Red Tail 230kv	268	114%	7%
-	10.4%	52.5%	L	Haydenaz To Apache 115kv	AZ	Buterfld To Apache 230kv	99	115%	47%
-	0.8%	2.0%	X	Saguaro To Sag.East 230/115kv	AZ	Coronado To Silverkg 500kv	200	102%	100%
-	-	-	L	Avra To Marana 115kv	AZ	Bicknell To Bicknell 230/115kv	57	109%	109%
-750	0.4%	1.7%	L	Sag.West To Ed-5 115kv	AZ	Coronado To Silverkg 500kv	120	103%	104%
-	1.2%	1.2%	X	Cholla To Cholla 500/345kv #2	AZ	Coronado To Silverkg 500kv	500	105%	107%
-	1.4%	1.4%	X	Cholla To Cholla 500/345kv	AZ	Coronado To Silverkg 500kv	500	106%	108%
-1167	0.6%	2.2%	L	Hidalgo To Turquois 115kv	NM	Hidalgo To Luna 345kv	134	104%	106%
0	0.4%	1.7%	L	Sag.East To Red Rock 115kv	AZ	Coronado To Silverkg 500kv	120	99%	101%
525	4.0%	3.3%	X	Westwing To Ww.3wp 345/500kv	AZ	Saguaro To Toltec 500kv	600	98%	101%
571	4.2%	17.5%	L	Sag.East To Oracle 115kv	AZ	Sag.West To Snmanuel 115kv	120	93%	110%
667	0.6%	2.5%	L	Ed-5 To Ed-4 115kv	AZ	Coronado To Silverkg 500kv	120	99%	101%

Integration of the Project results in no new emergency rating violations, i.e., no loading exceeds the identified emergency rating or 110% of continuous rating if an emergency rating was not identified.

Alternative 1b: 500 MW Sale to TEP

Alt 1b Post-Contingency Summary

Project Full Output : 500 MW							Rating	AC Power Flow	
FCITC	TDF	TPF	Tp	Overloaded Element	Area	Contingency	N/E (MVA)	% of E Rating Base	Chg
-	1.4%	3.5%	X	Saguaro To Sag.East 230/115kv	AZ	Coronado To Silverkg 500kv	200	102%	98%
-	-0.6%	-2.5%	L	Sag.West To Ed-5 115kv	AZ	Coronado To Silverkg 500kv	120	103%	100%
-	-1.4%	-1.4%	X	Cholla To Cholla 500/345kv #2	AZ	Coronado To Silverkg 500kv	500	105%	104%
-	-1.4%	-1.4%	X	Cholla To Cholla 500/345kv	AZ	Coronado To Silverkg 500kv	500	106%	105%
-	-0.4%	-0.7%	L	Apache To Buterfld 230kv	AZ	Apache To Red Tail 230kv	268	114%	113%
-	-	-	L	Avra To Marana 115kv	AZ	Bicknell To Bicknell 230/115kv	57	109%	109%
-500	1.4%	5.2%	L	Hidalgo To Turquois 115kv	NM	Hidalgo To Luna 345kv	134	104%	110%
151	12.6%	23.5%	L	Apache To Buterfld 230kv	AZ	Bowie To Vail 345kv	268	91%	116%
500	-0.6%	-3.0%	L	Haydenaz To Apache 115kv	AZ	Buterfld To Apache 230kv	99	115%	119%
508	12.4%	23.1%	L	Buterfld To Pantano 230kv	AZ	Bowie To Vail 345kv	268	75%	101%
516	12.8%	33.2%	X	Bicknell To Bicknell 230/345kv	AZ	Bowie To Vail 345kv	150/193	65%	100%
						Saguaro To Tortolit 500kv		-	Div

Integration of the Project results in no new emergency rating violations, i.e., no loading exceeds the identified emergency rating or 110% of continuous rating if an emergency rating was not identified. While the Apache to Buttefield 230 kV line did overload for the loss of Butterfield to Apache, this same line had a pre-existing loading violation for the loss of Apache to Red Tail 230 kV line in the Base Case.

Alternative 1c: 1100 MW Sale to AEPCO/TEP

Alt 1b Post-Contingency Summary

Project Full Output : 1100 MW							Rating	AC Power Flow	
FCITC	TDF	TPF	Tp	Overloaded Element	Area	Contingency	N/E (MVA)	% of E Rating Base	Chg
-	-29.1%	-119.4%	L	Apache To Buterfld 230kv	AZ	Apache To Red Tail 230kv	268	114%	11%
-	4.3%	47.5%	L	Haydenaz To Apache 115kv	AZ	Buterfld To Apache 230kv	99	115%	52%
-	1.3%	7.0%	X	Saguaro To Sag.East 230/115kv	AZ	Coronado To Silverkg 500kv	200	102%	95%
-	-0.2%	-1.7%	L	Sag.West To Ed-5 115kv	AZ	Coronado To Silverkg 500kv	120	103%	100%
-	-0.5%	-1.0%	X	Cholla To Cholla 500/345kv #2	AZ	Coronado To Silverkg 500kv	500	105%	104%
-	-0.5%	-1.0%	X	Cholla To Cholla 500/345kv	AZ	Coronado To Silverkg 500kv	500	106%	106%
-	-	-	L	Avra To Marana 115kv	AZ	Bicknell To Bicknell 230/115kv	57	109%	109%
-700	1.0%	8.2%	L	Hidalgo To Turquois 115kv	NM	Hidalgo To Luna 345kv	134	104%	113%
1082	-10.8%	-106.3%	X	Apache To Apache 115/230kv #2	AZ	Apache To Apache 230/115kv	100/112	14%	102%
1091	-10.7%	-105.4%	X	Apache To Apache 115/230kv	AZ	Apache To Apache 230/115kv #2	100/112	14%	101%
1091	22.3%	36.5%	X	Tortolit To Tortolit 500/138kv	AZ	Bowie To Vail 345kv	600/672	64%	102%
1553	1.5%	14.2%	L	Sag.East To Oracle 115kv	AZ	Sag.West To Snmanuel 115kv	120	93%	106%
2689	-0.8%	-1.5%	X	Westwing To Ww.3wp 500/345kv	AZ	Saguaro To Toltec 500kv	600	99%	101%
						Saguaro To Tortolit 500kv		-	Div

The Apache 230/115 kV transformers slightly overload for the loss of the parallel Apache 230/115 kV transformer. The violation is likely caused by the re-dispatch of power to offset the output of the Project, where generation was taken offline at the Apache Generating Station to accommodate a portion of the 1100 MW Project. It is assumed that this violation can be corrected via operational means.

Integration of the Project results in no new additional emergency rating violations, i.e., no loading (with the exception of the Apache transformers) exceeds the identified emergency rating or 110% of continuous rating if an emergency rating was not identified.

Alternative 2: Project interconnection to 345 kV and 230 kV

Alternative 2 includes a new substation, Willow, constructed near the intersection of TEP's Greenlee to Vail 345 kV line and AEPCO's Dos Condados to Red Tail 230 kV line. The 14.5 mile double circuit 345 kV Bowie lines will terminate into the new breaker and a half substation. The Greenlee to Vail 345 kV line also connects to the new substation. Additionally, a 345/230 kV transformer will be located at the substation with a 0.5 mile double circuit in and out loop of the AEPCO's Dos Condados to Red Tail 230 kV line.

Only an 1100 MW Project output level was evaluated.

Alternative 2c: 1100 MW Sale to AEPCO/TEP

Alt 2c Post-Contingency Summary

Project Full Output: 1100 MW							Rating	AC Power Flow	
FCITC	TDF	TPF	Tp	Overloaded Element	Area	Contingency	N/E (MVA)	% of E Rating Base	Chg
-	-29.1%	-119.4%	L	Apache To Buterfld 230kv	AZ	Apache To Red Tail 230kv	268	114%	11%
-	3.5%	39.4%	L	Haydenaz To Apache 115kv	AZ	Buterfld To Apache 230kv	99	114%	62%
-	1.2%	6.5%	X	Saguaro To Sag.East 230/115kv	AZ	Coronado To Silverkg 500kv	200	103%	96%
-	-0.5%	-1.2%	X	Cholla To Cholla 500/345kv #2	AZ	Coronado To Silverkg 500kv	500/0	105%	104%
-	-0.5%	-1.2%	X	Cholla To Cholla 500/345kv	AZ	Coronado To Silverkg 500kv	500/0	107%	106%
-	-0.2%	-1.7%	L	Sag.West To Ed-5 115kv	AZ	Coronado To Silverkg 500kv	120	103%	101%
-	-	-	L	Avra To Marana 115kv	AZ	Bicknell To Bicknell 230/115kv	57	109%	109%
-660	0.9%	7.5%	L	Hidalgo To Turquois 115kv	NM	Hidalgo To Luna 345kv	134	104%	111%
880	2.3%	9.3%	L	Apache To Buterfld 230kv	AZ	Willow2 To Vail 345kv	268	91%	103%
927	-12.7%	-125.0%	X	Apache To Apache 115/230kv	AZ	Apache To Apache 230/115kv #2	100/112	14%	120%
927	-12.7%	-125.0%	X	Apache To Apache 115/230kv #2	AZ	Apache To Apache 230/115kv	100/112	14%	120%
999	-44.6%	-139.9%	L	Red Tail To Willow3 230kv	AZ	Willow2 To Vail 345kv	351	27%	111%
1028	-44.2%	-138.5%	L	Apache To Red Tail 230kv	AZ	Willow2 To Vail 345kv	351	29%	109%
1167	21.0%	34.4%	X	Tortolit To Tortolit 500/138kv	AZ	Willow2 To Vail 345kv	600/672	63%	100%
2200	1.1%	10.0%	L	Sag.East To Oracle 115kv	AZ	Sag.West To Snmanuel 115kv	120	93%	103%
4675	-0.4%	-0.7%	X	Westwing To Ww.3wp 500/345kv	AZ	Saguaro To Toltec 500kv	600	100%	101%
						Saguaro To Tortolit 500kv		-	Div

With the exception of the Apache 230/115 kV transformers discussed under Alternative 1c, the integration of the 1100 MW Project resulted in only one slight emergency violation of

the Red Tail to Willow 3 230 kV line. While the loading on this facility reached 111% of continuous rating, it is assume that this violation could be alleviated via operational means, such as transfer tripping the Willow 345/230 kV transformer for the Willow2 to Vail 345 kV outage.

Alternative 3: Project Interconnection to Dual 345 kV Lines

Alternative 3 includes a new substation, Willow, constructed near the intersection of TEP's Greenlee to Vail 345 kV line and AEPCO's Dos Condados to Red Tail 230 kV line. The 14.5 mile double circuit 345 kV Bowie lines will terminate into the new breaker and a half substation. The Greenlee to Vail 345 kV and the Springerville to Vail 345 kV lines also connect to the new substation.

Only an 1100 MW Project output level was evaluated.

Alternative 3c: 1100 MW Sale to AEPCO/TEP

ALTERNATIVE 3C: POST-CONTINGENCY CONDITION

Project Full Output: 1100 MW							Rating	AC Power Flow	
FCITC	TDF	TPF	Tp	Overloaded Element	Area	Contingency	N/E (MVA)	% of E Rating Base	Chg
-	-29.0%	-119.0%	L	Apache To Buterfld 230kv	AZ	Apache To Red Tail 230kv	268	114%	9%
-	4.6%	51.5%	L	Haydenaz To Apache 115kv	AZ	Buterfld To Apache 230kv	99	114%	48%
-	1.3%	7.0%	X	Saguaro To Sag.East 230/115kv	AZ	Coronado To Silverkg 500kv	200	103%	96%
-	-0.1%	-0.8%	L	Sag.West To Ed-5 115kv	AZ	Coronado To Silverkg 500kv	120	103%	101%
-	-0.3%	-0.6%	X	Cholla To Cholla 500/345kv	AZ	Coronado To Silverkg 500kv	500	107%	106%
-	-0.3%	-0.6%	X	Cholla To Cholla 500/345kv #2	AZ	Coronado To Silverkg 500kv	500	105%	105%
-	-0.2%	-0.3%	X	Westwing To Ww.3wp 500/345kv	AZ	Saguaro To Toltec 500kv	600	100%	100%
-	-	-	L	Avra To Marana 115kv	AZ	Bicknell To Bicknell 230/115kv	57	109%	109%
-2200	0.3%	2.2%	L	Hidalgo To Turquois 115kv	NM	Hidalgo To Luna 345kv	134	104%	106%
638	53.0%	81.0%	X	Vail2 To Vail 345/138kv	AZ	Willow2 To Vail 345kv	600/720	52%	135%
800	-53.0%	-72.3%	L	Vail2 To Willow1 345kv	AZ	Willow2 To Vail 345kv	666/806	46%	121%
1141	-12.3%	-39.2%	L	Irvngtn To Vail 138kv	AZ	South To So.3wp2 345/138kv	287/344	58%	100%
1467	1.6%	15.0%	L	Sag.East To Oracle 115kv	AZ	Sag.West To Snmanuel 115kv	120	93%	107%
						Saguaro To Tortolit 500kv		-	Div

Interconnection Alternative 3 may require upgrade to the Vail 2 345/138 kV transformer unless a higher shorter term rating can be utilized. The transformer loading increased from 52% in the Base Case to 135% in the Alt 3 for the loss of the Willow 2 to Vail 345 kV line. Additionally, this interconnection configuration (a connection to both Springerville – Vail and Greenlee – Vail 345 kV lines) resulted in a violation of the Willow to Vail 2 345 kV (originally the Springerville to Vail 345 kV line) line rating. The line loading increased from 46% of its Emergency Rating in the Base Case to 121% in Alt 3. Under this configuration, transactions into AEPCO and TEP may potentially be limited at 800 MW based on the identified FCITC value (i.e., the Project output at which the violation occurs). It is noted however, that this line has a much lower rating than the Greenlee to Vail 345 kV line. The

line is identified in TEP's FERC Form 1 data as having twin bundled 954 ACSR for a portion of the line and 954 ACSR Rail for another portion. It is possible that an upgrade of this line could be required to integrate the Project under the Alternative 3 configuration, i.e., a connected to both 345 kV Vail lines.

Alternative 4: Interconnection to Dual-345kV Lines and 230kV

Alternative 4 includes a new substation, Willow, constructed near the intersection of TEP's Greenlee to Vail 345 kV line and AEPCO's Dos Condados to Red Tail 230 kV line. The 14.5 mile double circuit 345 kV Bowie lines will terminate into the new breaker and a half substation. The Greenlee to Vail 345 kV and the Springerville to Vail 345 kV lines also connect to the new substation. Additionally, a 345/230 kV transformer will also be located at the substation with a 0.5 mile double circuit in and out loop of the AEPCO's Dos Condados to Red Tail 230 kV line.

Only an 1100 MW Project output level was evaluated.

Alternative 4c: 1100 MW Sale to AEPCO/TEP

ALTERNATIVE 4C: POST-CONTINGENCY CONDITION

Project Full Output: 1100 MW							Rating	AC Power Flow	
FCITC	TDF	TPF	Tp	Overloaded Element	Area	Contingency	N/E (MVA)	% of E Rating Base	Chg
-	-29.0%	-119.0%	L	Apache To Buterfld 230kv	AZ	Apache To Red Tail 230kv	268	114%	9%
-	3.9%	43.4%	L	Haydenaz To Apache 115kv	AZ	Buterfld To Apache 230kv	99	114%	57%
-	1.2%	6.5%	X	Saguaro To Sag.East 230/115kv	AZ	Coronado To Silverkg 500kv	200	103%	96%
-	-0.2%	-1.7%	L	Sag.West To Ed-5 115kv	AZ	Coronado To Silverkg 500kv	120	103%	101%
-	-0.4%	-0.8%	X	Cholla To Cholla 500/345kv	AZ	Coronado To Silverkg 500kv	500	107%	106%
-	-0.4%	-0.8%	X	Cholla To Cholla 500/345kv #2	AZ	Coronado To Silverkg 500kv	500	105%	105%
-	0.2%	0.3%	X	Westwing To Ww.3wp 500/345kv	AZ	Saguaro To Toltec 500kv	600	100%	99%
-	-	-	L	Avra To Marana 115kv	AZ	Bicknell To Bicknell 230/115kv	57	109%	109%
-1650	0.4%	3.0%	L	Hidalgo To Turquois 115kv	NM	Hidalgo To Luna 345kv	134	104%	106%
710	47.6%	72.8%	X	Vail2 To Vail 345/138kv	AZ	Willow2 To Vail 345kv	600/720	52%	126%
890	-47.6%	-65.0%	L	Vail2 To Willow1 345kv	AZ	Willow2 To Vail 345kv	666/806	46%	113%
983	-12.0%	-117.9%	X	Apache To Apache 115/230kv	AZ	Apache To Apache 230/115kv #2	100/112	14%	112%
983	-12.0%	-117.9%	X	Apache To Apache 115/230kv #2	AZ	Apache To Apache 230/115kv	100/112	14%	113%
1886	1.3%	11.7%	L	Sag.East To Oracle 115kv	AZ	Sag.West To Snmanuel 115kv	120	93%	104%
						Saguaro To Tortolit 500kv		-	Div

While overloads are slightly reduced, the results for Alt 4 are in line with that of Alt 3. Additionally, however, the Apache 230/115 kV transformers overload as discussed under Alt 2. It is expected that this loading violation could be alleviated via operational means.

Interconnection Alternative 3 may require upgrade to the Vail 2 345/138 kV transformer unless a higher shorter term rating can be utilized. In addition, it is possible that an upgrade of the Willow to Vail 2 (formerly the Springville – Vail 345 kV line could be required for

transaction greater than 890 MW schedule south, as indicated by the FCITC value for this loading violation.

Appendix A

CONTINGENCY LIST

Contingency List

C- 1	Line	16101	GREENLEE	345kV	to	11080	HIDALGO	345kV	Ckt	1
C- 2	Line	16101	GREENLEE	345kV	to	16104	SPRINGR	345kV	Ckt	1
C- 3	Line	16101	GREENLEE	345kV	to	17010	GREEN-AE	345kV	Ckt	1
C- 4	Line	16105	VAIL	345kV	to	16103	SOUTH	345kV	Ckt	1
C- 5	Line	16105	VAIL	345kV	to	17005	BICKNELL	345kV	Ckt	1
C- 6	Transformer	16105	VAIL	345kV	to	16308	VAIL.3WP	100kV	Ckt	1
C- 7	Line	11080	HIDALGO	345kV	to	11093	LUNA	345kV	Ckt	1
C- 8	Line	16103	SOUTH	345kV	to	93001	TOLTC345	345kV	Ckt	1
C- 9	Line	16104	SPRINGR	345kV	to	16102	MCKINLEY	345kV	Ckt	1
C- 10	Line	16104	SPRINGR	345kV	to	16102	MCKINLEY	345kV	Ckt	2
C- 11	Line	16104	SPRINGR	345kV	to	11093	LUNA	345kV	Ckt	1
C- 12	Line	16104	SPRINGR	345kV	to	16100	CORONADO	345kV	Ckt	1
C- 13	Transformer	17005	BICKNELL	345kV	to	17004	BICKNELL	230kV	Ckt	1
C- 14	Transformer	17010	GREEN-AE	345kV	to	17009	GREEN-AE	230kV	Ckt	1
C- 15	Transformer	17010	GREEN-AE	345kV	to	17009	GREEN-AE	230kV	Ckt	2
C- 16	Transformer	16103	SOUTH	345kV	to	16306	SO.3WP2	100kV	Ckt	1
C- 17	Transformer	16308	VAIL.3WP	100kV	to	16220	VAIL	138kV	Ckt	1
C- 18	Transformer	16100	CORONADO	345kV	to	15001	CORONADO	500kV	Ckt	1
C- 19	Line	16102	MCKINLEY	345kV	to	10292	SAN_JUAN	345kV	Ckt	1
C- 20	Line	16102	MCKINLEY	345kV	to	10292	SAN_JUAN	345kV	Ckt	2
C- 21	Line	93001	TOLTC345	345kV	to	16107	WESTWING	345kV	Ckt	1
C- 22	Line	17004	BICKNELL	230kV	to	17102	SAHUARIT	230kV	Ckt	1
C- 23	Line	17009	GREEN-AE	230kV	to	17014	MORENCI	230kV	Ckt	1
C- 24	Transformer	17004	BICKNELL	230kV	to	17006	BICKNELL	115kV	Ckt	1
C- 25	Line	16220	VAIL	138kV	to	16204	IRVNGTN	138kV	Ckt	1
C- 26	Line	16220	VAIL	138kV	to	16211	ROBERTS	138kV	Ckt	1
C- 27	Line	16220	VAIL	138kV	to	16213	S.TRAIL	138kV	Ckt	1
C- 28	Line	16220	VAIL	138kV	to	16222	LITTLE	138kV	Ckt	1
C- 29	Line	16220	VAIL	138kV	to	16223	LOSREALS	138kV	Ckt	1
C- 30	Transformer	16306	SO.3WP2	100kV	to	16216	SOUTH	138kV	Ckt	1
C- 31	Line	15001	CORONADO	500kV	to	14000	CHOLLA	500kV	Ckt	1
C- 32	Line	15001	CORONADO	500kV	to	15041	SILVERKG	500kV	Ckt	1
C- 33	Line	17014	MORENCI	230kV	to	17011	HACKBRRY	230kV	Ckt	1
C- 34	Line	17016	PANTANO	230kV	to	17007	BUTERFLD	230kV	Ckt	1
C- 35	Line	17016	PANTANO	230kV	to	17102	SAHUARIT	230kV	Ckt	1
C- 36	Line	16202	E. LOOP	138kV	to	16208	NE.LOOP	138kV	Ckt	1
C- 37	Line	16202	E. LOOP	138kV	to	16211	ROBERTS	138kV	Ckt	1
C- 38	Line	16202	E. LOOP	138kV	to	16224	R.BILLS	138kV	Ckt	1
C- 39	Line	16202	E. LOOP	138kV	to	16213	S.TRAIL	138kV	Ckt	1
C- 40	Line	16202	E. LOOP	138kV	to	16215	SNYDER	138kV	Ckt	1
C- 41	Line	16204	IRVNGTN	138kV	to	16201	DREXEL	138kV	Ckt	1
C- 42	Line	16204	IRVNGTN	138kV	to	16216	SOUTH	138kV	Ckt	1
C- 43	Line	16204	IRVNGTN	138kV	to	16218	TUCSON	138kV	Ckt	1

C- 44	Line	16204	IRVNGTN	138kV	to	16222	LITTLE	138kV	Ckt	1	
C- 45	Line	16204	IRVNGTN	138kV	to	16214	SN.CRUZ	138kV	Ckt	1	
C- 46	Line	16216	SOUTH	138kV	to	16206	MIDVALE	138kV	Ckt	1	
C- 47	Line	16223	LOSREALS	138kV	to	16224	R.BILLS	138kV	Ckt	1	
C- 48	Line	17006	BICKNELL	115kV	to	17022	THREEPNT	115kV	Ckt	1	
C- 49	Line	14000	CHOLLA	500kV	to	14004	SAGUARO	500kV	Ckt	1	
C- 50	Line	14004	SAGUARO	500kV	to	16000	TORTOLIT	500kV	Ckt	1	
C- 51	Transformer	14004	SAGUARO	500kV	to	14356	SAG.EAST	115kV	Ckt	1	
C- 52	Transformer	14004	SAGUARO	500kV	to	14357	SAG.WEST	115kV	Ckt	1	
C- 53	Transformer	15041	SILVERKG	500kV	to	15042	SILVERKG	100kV	Ckt	1	
C- 54	Transformer	14101	FOURCORN	345kV	to	14001	FOURCORN	500kV	Ckt	1	
C- 55	Line	17007	BUTERFLD	230kV	to	17002	APACHE	230kV	Ckt	1	
C- 56	Line	17008	DOSCONDO	230kV	to	17011	HACKBRRY	230kV	Ckt	1	
C- 57	Line	16208	NE.LOOP	138kV	to	16210	RILLITO	138kV	Ckt	1	
C- 57	Line	17008	DOSCONDO	230kV	to	17018	RED TAIL	230kV	Ckt	1	Alt 1&3 Only
C- 58	Line	16208	NE.LOOP	138kV	to	16215	SNYDER	138kV	Ckt	1	
C- 59	Line	16214	SN.CRUZ	138kV	to	16200	DMP	138kV	Ckt	1	
C- 60	Line	16218	TUCSON	138kV	to	16221	WESTINA	138kV	Ckt	1	
C- 61	Line	10206	MIMBRES	115kV	to	12014	CABALLOT	115kV	Ckt	1	
C- 62	Line	17022	THREEPNT	115kV	to	17003	AVRA	115kV	Ckt	1	
C- 63	Transformer	16309	WW.3WP	100kV	to	14005	WESTWING	500kV	Ckt	1	
C- 64	Line	17002	APACHE	230kV	to	17018	RED TAIL	230kV	Ckt	1	
C- 65	Transformer	17002	APACHE	230kV	to	17001	APACHE	115kV	Ckt	1	
C- 66	Transformer	17002	APACHE	230kV	to	17001	APACHE	115kV	Ckt	2	
C- 67	Line	16200	DMP	138kV	to	16207	N. LOOP	138kV	Ckt	1	
C- 68	Line	16210	RILLITO	138kV	to	16207	N. LOOP	138kV	Ckt	1	
C- 69	Line	16210	RILLITO	138kV	to	16205	LACANADA	138kV	Ckt	1	
C- 70	Line	16221	WESTINA	138kV	to	16207	N. LOOP	138kV	Ckt	1	
C- 71	Transformer	14356	SAG.EAST	115kV	to	14225	SAGUARO	230kV	Ckt	1	
C- 72	Line	12014	CABALLOT	115kV	to	12041	HOT_SPRG	115kV	Ckt	1	
C- 73	Line	12059	PICACHO	115kV	to	12028	EL_BUTTE	115kV	Ckt	1	
C- 74	Line	14356	SAG.EAST	115kV	to	14357	SAG.WEST	115kV	Ckt	1	
C- 75	Line	14356	SAG.EAST	115kV	to	19057	ORACLE	115kV	Ckt	1	
C- 76	Line	14356	SAG.EAST	115kV	to	17013	MARANATP	115kV	Ckt	1	
C- 77	Line	14357	SAG.WEST	115kV	to	14358	SNMANUEL	115kV	Ckt	1	
C- 78	Line	14357	SAG.WEST	115kV	to	19048	EMPIRE	115kV	Ckt	1	
C- 79	Line	17003	AVRA	115kV	to	17012	MARANA	115kV	Ckt	1	
C- 80	Transformer	15042	SILVERKG	100kV	to	15215	SILVERKG	230kV	Ckt	1	
C- 81	Line	14004	SAGUARO	500kV	to	93000	TOLTEC	500kV	Ckt	1	
C- 82	Line	94003	WILLOW2	345kV	to	16101	GREENLEE	345kV	Ckt	1	Alt 2 – 4 Only
C- 83	Line	94003	WILLOW2	345kV	to	16105	VAIL	345kV	Ckt	1	Alt 2 – 4 Only
C- 83	Line	94000	BOWIE	345kV	to	16101	GREENLEE	345kV	Ckt	1	Alt 1 Only
C- 84	Line	94002	WILLOW1	345kV	to	16104	SPRINGR	345kV	Ckt	1	Alt 3&4 Only
C- 84	Line	94000	BOWIE	345kV	to	16105	VAIL	345kV	Ckt	1	Alt 1 Only
C- 85	Line	94002	WILLOW1	345kV	to	16106	VAIL2	345kV	Ckt	1	Alt 3&4 Only
C- 86	Transformer	94003	WILLOW2	345kV	to	94001	WILLOW3	230kV	Ckt	1	Alt 2&4 Only
C- 87	Line	94001	WILLOW3	230kV	to	17008	DOSCONDO	230kV	Ckt	1	Alt 2&4 Only
C- 88	Line	17018	RED TAIL	230kV	to	94001	WILLOW3	230kV	Ckt	1	Alt 2&4 Only

Appendix B

LOAD FLOW RESULTS TABLES

All Alternatives

Normal (Pre-Contingency) Summary

Project Full Output: 500/1100 MW							Rating	AC Power Flow	
FCITC	NTDF	NTPF	Tp	Overloaded Element	Area	Contingency	N/E (MVA)	% of N Rating Base	Chg
-	-	-	L	Irving To Westms_T 115kv	Nm	No Outage	134	111%	111%
-	-	-	L	Lenkurt To Sandia_1 115kv	Nm	No Outage	108	112%	112%
-	-	-	L	Person To Wesmecot 115kv	Nm	No Outage	120	110%	110%
-	-	-	L	Westms_1 To Westms_T 115kv	Nm	No Outage	134	118%	118%
-	-	-	L	Mesa___# To Rio_Gran 115kv	Nm	No Outage	144/196	100%	100%
-	-	-	L	Clapham To Rosebud 115kv	Nm	No Outage	60	102%	102%
-	-	-	L	Hollywo# To Alamogcp 115kv	Nm	No Outage	40	106%	106%
-	-	-	X	Socorrop To Socorrop 69/115kv	Nm	No Outage	17	103%	103%

ALTERNATIVE 1A: POST-CONTINGENCY SUMMARY

Tp	Overloaded Element	Area	Contingency	Rating N/E (MVA)	AC Power Flow % of E Rating Base	Chg
L	Apache To Buterfld 230kv	AZ	Doscondo To Red Tail 230kv	268	112%	8%
L	Apache To Buterfld 230kv	AZ	Apache To Red Tail 230kv	268	114%	7%
L	Avra To Marana 115kv	AZ	Bicknell To Bicknell 230/115kv	57	109%	109%
X	Cholla To Cholla 500/345kv	AZ	Coronado To Silverkg 500kv	500	106%	108%
X	Cholla To Cholla 500/345kv #2	AZ	Coronado To Silverkg 500kv	500	105%	107%
L	Ed-5 To Ed-4 115kv	AZ	Coronado To Silverkg 500kv	120	99%	101%
L	Haydenaz To Apache 115kv	AZ	Doscondo To Red Tail 230kv	99	104%	31%
L	Haydenaz To Apache 115kv	AZ	Apache To Red Tail 230kv	99	105%	32%
L	Haydenaz To Apache 115kv	AZ	Pantano To Sahuarit 230kv	99	106%	38%
L	Haydenaz To Apache 115kv	AZ	Bicknell To Sahuarit 230kv	99	105%	37%
L	Haydenaz To Apache 115kv	AZ	Pantano To Buterfld 230kv	99	109%	41%
L	Haydenaz To Apache 115kv	AZ	Buterfld To Apache 230kv	99	115%	47%
L	Haydenaz To Apache 115kv	AZ	Coronado To Silverkg 500kv	99	104%	60%
L	Hidalgo To Turquois 115kv	NM	Hidalgo To Luna 345kv	134	104%	106%
L	Hidalgo To Turquois 115kv	NM	Springr To Luna 345kv	134	101%	101%
L	Sag.East To Oracle 115kv	AZ	Sag.West To Snmanuel 115kv	120	93%	110%
L	Sag.East To Red Rock 115kv	AZ	Coronado To Silverkg 500kv	120	99%	101%
L	Sag.West To Ed-5 115kv	AZ	Coronado To Silverkg 500kv	120	103%	104%
X	Saguaro To Sag.East 230/115kv	AZ	Coronado To Silverkg 500kv	200/0	102%	100%
X	Westwing To Ww.3wp 345/100kv	AZ	Saguaro To Toltec 500kv	600	98%	101%
X	Westwing To Ww.3wp 500/100kv	AZ	Saguaro To Toltec 500kv	600	99%	102%

ALTERNATIVE 1B: POST-CONTINGENCY SUMMARY

Tp	Overloaded Element	Area	Contingency	Rating N/E (MVA)	AC Power Flow % of E Rating Base	Chg
L	Apache To Buterfld 230kv	AZ	Bowie To Vail 345kv	268	91%	116%
L	Apache To Buterfld 230kv	AZ	Apache To Red Tail 230kv	268	114%	113%
L	Apache To Buterfld 230kv	AZ	Doscondo To Red Tail 230kv	268	112%	111%
L	Avra To Marana 115kv	AZ	Bicknell To Bicknell 230/115kv	57	109%	109%
X	Bicknell To Bicknell 230/345kv	AZ	Bowie To Vail 345kv	150/193	65%	100%
L	Buterfld To Pantano 230kv	AZ	Bowie To Vail 345kv	268	75%	101%
X	Cholla To Cholla 500/345kv	AZ	Coronado To Silverkg 500kv	500	106%	105%
X	Cholla To Cholla 500/345kv #2	AZ	Coronado To Silverkg 500kv	500	105%	104%
L	Haydenaz To Apache 115kv	AZ	Doscondo To Red Tail 230kv	99	104%	104%
L	Haydenaz To Apache 115kv	AZ	Apache To Red Tail 230kv	99	105%	105%
L	Haydenaz To Apache 115kv	AZ	Buterfld To Apache 230kv	99	115%	119%
L	Haydenaz To Apache 115kv	AZ	Pantano To Buterfld 230kv	99	109%	114%
L	Haydenaz To Apache 115kv	AZ	Bicknell To Sahuarit 230kv	99	105%	109%
L	Haydenaz To Apache 115kv	AZ	Pantano To Sahuarit 230kv	99	106%	110%
L	Haydenaz To Apache 115kv	AZ	Coronado To Silverkg 500kv	99	104%	106%
L	Hidalgo To Turquois 115kv	NM	Hidalgo To Luna 345kv	134	104%	110%
L	Hidalgo To Turquois 115kv	NM	Springr To Luna 345kv	134	101%	101%
L	Sag.West To Ed-5 115kv	AZ	Coronado To Silverkg 500kv	120	103%	100%
X	Saguaro To Sag.East 230/115kv	AZ	Coronado To Silverkg 500kv	200	102%	98%
			Saguaro To Tortolit 500kv		-	div

ALTERNATIVE 1C: POST-CONTINGENCY SUMMARY

Tp	Overloaded Element	Area	Contingency	Rating N/E (MVA)	AC Power Flow % of E Rating Base	Chg
X	Apache To Apache 115/230kv	AZ	Apache To Apache 230/115kv #2	100/112	14%	101%
X	Apache To Apache 115/230kv #2	AZ	Apache To Apache 230/115kv	100/112	14%	102%
L	Apache To Buterfld 230kv	AZ	Doscondo To Red Tail 230kv	268	112%	12%
L	Apache To Buterfld 230kv	AZ	Apache To Red Tail 230kv	268	114%	11%
L	Avra To Marana 115kv	AZ	Bicknell To Bicknell 230/115kv	57	109%	109%
X	Cholla To Cholla 500/345kv	AZ	Coronado To Silverkg 500kv	500	106%	106%
X	Cholla To Cholla 500/345kv #2	AZ	Coronado To Silverkg 500kv	500	105%	104%
L	Haydenaz To Apache 115kv	AZ	Doscondo To Red Tail 230kv	99	104%	29%
L	Haydenaz To Apache 115kv	AZ	Apache To Red Tail 230kv	99	105%	30%
L	Haydenaz To Apache 115kv	AZ	Bicknell To Sahuarit 230kv	99	105%	42%
L	Haydenaz To Apache 115kv	AZ	Pantano To Sahuarit 230kv	99	106%	43%
L	Haydenaz To Apache 115kv	AZ	Pantano To Buterfld 230kv	99	109%	47%
L	Haydenaz To Apache 115kv	AZ	Buterfld To Apache 230kv	99	115%	52%
L	Haydenaz To Apache 115kv	AZ	Coronado To Silverkg 500kv	99	104%	62%
L	Hidalgo To Turquois 115kv	NM	Springr To Luna 345kv	134	101%	101%
L	Hidalgo To Turquois 115kv	NM	Hidalgo To Luna 345kv	134	104%	113%
L	Sag.East To Oracle 115kv	AZ	Sag.West To Snmanuel 115kv	120	93%	106%
L	Sag.West To Ed-5 115kv	AZ	Coronado To Silverkg 500kv	120	103%	100%

Tp	Overloaded Element	Area	Contingency	Rating N/E (MVA)	AC Power Flow % of E Rating Base	Chg
X	Saguaro To Sag.East 230/115kv	AZ	Coronado To Silverkg 500kv	200	102%	95%
X	Westwing To Ww.3wp 500/345kv	AZ	Saguaro To Toltec 500kv	600	99%	101%
			Saguaro To Tortolit 500kv		-	div

ALTERNATIVE 2C: POST-CONTINGENCY SUMMARY

Tp	Overloaded Element	Area	Contingency	Rating N/E (MVA)	AC Power Flow % of E Rating Base	Chg
X	Apache To Apache 115/230kv	AZ	Apache To Apache 230/115kv #2	100/112	14%	120%
X	Apache To Apache 115/230kv #2	AZ	Apache To Apache 230/115kv	100/112	14%	120%
L	Apache To Buterfld 230kv	AZ	Willow2 To Vail 345kv	268	91%	103%
L	Apache To Buterfld 230kv	AZ	Red Tail To Willow3 230kv	268	112%	12%
L	Apache To Buterfld 230kv	AZ	Apache To Red Tail 230kv	268	114%	11%
L	Apache To Buterfld 230kv	AZ	Willow3 To Doscondo 230kv	268	112%	39%
L	Apache To Red Tail 230kv	AZ	Willow2 To Vail 345kv	351	29%	109%
L	Avra To Marana 115kv	AZ	Bicknell To Bicknell 230/115kv	57	109%	109%
X	Cholla To Cholla 500/345kv	AZ	Coronado To Silverkg 500kv	500	107%	106%
X	Cholla To Cholla 500/345kv #2	AZ	Coronado To Silverkg 500kv	500	105%	104%
L	Haydenaz To Apache 115kv	AZ	Red Tail To Willow3 230kv	99	104%	30%
L	Haydenaz To Apache 115kv	AZ	Apache To Red Tail 230kv	99	105%	31%
L	Haydenaz To Apache 115kv	AZ	Willow3 To Doscondo 230kv	99	104%	55%
L	Haydenaz To Apache 115kv	AZ	Bicknell To Sahuarit 230kv	99	104%	56%
L	Haydenaz To Apache 115kv	AZ	Buterfld To Apache 230kv	99	114%	62%
L	Haydenaz To Apache 115kv	AZ	Pantano To Buterfld 230kv	99	109%	59%
L	Haydenaz To Apache 115kv	AZ	Pantano To Sahuarit 230kv	99	105%	57%
L	Haydenaz To Apache 115kv	AZ	Coronado To Silverkg 500kv	99	103%	73%
L	Hidalgo To Turquois 115kv	NM	Hidalgo To Luna 345kv	134	104%	111%
L	Hidalgo To Turquois 115kv	NM	Springr To Luna 345kv	134	101%	101%
L	Red Tail To Willow3 230kv	AZ	Willow2 To Vail 345kv	351	27%	111%
L	Sag.East To Oracle 115kv	AZ	Sag.West To Snmanuel 115kv	120	93%	103%
L	Sag.West To Ed-5 115kv	AZ	Coronado To Silverkg 500kv	120	103%	101%
X	Saguaro To Sag.East 230/115kv	AZ	Coronado To Silverkg 500kv	200	103%	96%
X	Tortolit To Tortolit 500/138kv	AZ	Willow2 To Vail 345kv	600/672	63%	100%
X	Westwing To Ww.3wp 500/345kv	AZ	Saguaro To Toltec 500kv	600	100%	101%
			Saguaro To Tortolit 500kv		-	div

ALTERNATIVE 3C: POST-CONTINGENCY SUMMARY

Tp	Overloaded Element	Area	Contingency	Rating N/E (MVA)	AC Power Flow % of E Rating Base	Chg
L	Apache To Buterfld 230kv	AZ	Willow3 To Doscondo 230kv	268	112%	10%
L	Apache To Buterfld 230kv	AZ	Red Tail To Willow3 230kv	268	112%	10%
L	Apache To Buterfld 230kv	AZ	Apache To Red Tail 230kv	268	114%	9%
L	Avra To Marana 115kv	AZ	Bicknell To Bicknell 230/115kv	57	109%	109%
X	Cholla To Cholla 500/345kv	AZ	Coronado To Silverkg 500kv	500	107%	106%

Appendix B

Tp	Overloaded Element	Area	Contingency	Rating N/E (MVA)	AC Power Flow % of E Rating Base	Chg
X	Cholla To Cholla 500/345kv #2	AZ	Coronado To Silverkg 500kv	500	105%	105%
L	Haydenaz To Apache 115kv	AZ	Willow3 To Doscondo 230kv	99	104%	30%
L	Haydenaz To Apache 115kv	AZ	Red Tail To Willow3 230kv	99	104%	30%
L	Haydenaz To Apache 115kv	AZ	Apache To Red Tail 230kv	99	105%	31%
L	Haydenaz To Apache 115kv	AZ	Bicknell To Sahuarit 230kv	99	104%	38%
L	Haydenaz To Apache 115kv	AZ	Pantano To Sahuarit 230kv	99	105%	39%
L	Haydenaz To Apache 115kv	AZ	Pantano To Buterfld 230kv	99	109%	43%
L	Haydenaz To Apache 115kv	AZ	Buterfld To Apache 230kv	99	114%	48%
L	Haydenaz To Apache 115kv	AZ	Coronado To Silverkg 500kv	99	103%	60%
L	Hidalgo To Turquois 115kv	NM	Hidalgo To Luna 345kv	134	104%	106%
L	Hidalgo To Turquois 115kv	NM	Springr To Luna 345kv	134	101%	101%
L	Irvngtn To Vail 138kv	AZ	South To So.3wp2 345/100kv	287/344	58%	100%
L	Irvngtn To Vail 138kv	AZ	So.3wp2 To South 100/138kv	287/344	58%	100%
L	Sag.East To Oracle 115kv	AZ	Sag.West To Snmanuel 115kv	120	93%	107%
L	Sag.West To Ed-5 115kv	AZ	Coronado To Silverkg 500kv	120	103%	101%
X	Saguaro To Sag.East 230/115kv	AZ	Coronado To Silverkg 500kv	200	103%	96%
X	Vail2 To Vail 345/138kv	AZ	Willow2 To Vail 345kv	600/720	52%	135%
X	Vail2 To Vail 345/138kv	AZ	Vail To Vail.3wp 345/100kv	600/720	48%	100%
X	Vail2 To Vail 345/138kv	AZ	Vail.3wp To Vail 100/138kv	600/720	48%	100%
L	Vail2 To Willow1 345kv	AZ	Willow2 To Vail 345kv	666/806	46%	121%
X	Westwing To Ww.3wp 500/345kv	AZ	Saguaro To Toltec 500kv	600	100%	100%
			Saguaro To Tortolit 500kv		-	div

ALTERNATIVE 4C: POST-CONTINGENCY SUMMARY

Tp	Overloaded Element	Area	Contingency	Rating N/E (MVA)	AC Power Flow % of E Rating Base	Chg
X	Apache To Apache 115/230kv	AZ	Apache To Apache 230/115kv #2	100/112	14%	112%
X	Apache To Apache 115/230kv #2	AZ	Apache To Apache 230/115kv	100/112	14%	113%
L	Apache To Buterfld 230kv	AZ	Red Tail To Willow3 230kv	268	112%	10%
L	Apache To Buterfld 230kv	AZ	Apache To Red Tail 230kv	268	114%	9%
L	Apache To Buterfld 230kv	AZ	Willow3 To Doscondo 230kv	268	112%	33%
L	Avra To Marana 115kv	AZ	Bicknell To Bicknell 230/115kv	57	109%	109%
X	Cholla To Cholla 500/345kv	AZ	Coronado To Silverkg 500kv	500	107%	106%
X	Cholla To Cholla 500/345kv #2	AZ	Coronado To Silverkg 500kv	500	105%	105%
L	Haydenaz To Apache 115kv	AZ	Red Tail To Willow3 230kv	99	104%	29%
L	Haydenaz To Apache 115kv	AZ	Apache To Red Tail 230kv	99	105%	31%
L	Haydenaz To Apache 115kv	AZ	Pantano To Buterfld 230kv	99	109%	54%
L	Haydenaz To Apache 115kv	AZ	Bicknell To Sahuarit 230kv	99	104%	51%
L	Haydenaz To Apache 115kv	AZ	Willow3 To Doscondo 230kv	99	104%	51%
L	Haydenaz To Apache 115kv	AZ	Buterfld To Apache 230kv	99	114%	57%
L	Haydenaz To Apache 115kv	AZ	Pantano To Sahuarit 230kv	99	105%	52%
L	Haydenaz To Apache 115kv	AZ	Coronado To Silverkg 500kv	99	103%	69%
L	Hidalgo To Turquois 115kv	NM	Hidalgo To Luna 345kv	134	104%	106%
L	Hidalgo To Turquois 115kv	NM	Springr To Luna 345kv	134	101%	101%
L	Sag.East To Oracle 115kv	AZ	Sag.West To Snmanuel 115kv	120	93%	104%
L	Sag.West To Ed-5 115kv	AZ	Coronado To Silverkg 500kv	120	103%	101%
X	Saguaro To Sag.East 230/115kv	AZ	Coronado To Silverkg 500kv	200	103%	96%
X	Vail2 To Vail 345/138kv	AZ	Willow2 To Vail 345kv	600/720	52%	126%
L	Vail2 To Willow1 345kv	AZ	Willow2 To Vail 345kv	666/806	46%	113%
X	Westwing To Ww.3wp 500/345kv	AZ	Saguaro To Toltec 500kv	600	100%	99%
			Saguaro To Tortolit 500kv		-	Div

Appendix C

TRANSMISSION BACK-UP

Revised February 2000

22. Southwest of Four Corners (Unscheduled Flow Qualified Path)

Accepted Rating ☐
Existing Rating ☒
Other ☐

Location:	Northeastern Arizona
Definition:	Sum of the flows on the following transmission lines: Line — Metered End Four Corners-Moenkopi 500 kV — Four Corners Four Corners-Cholla 345 kV #1 — Four Corners Four Corners-Cholla 345 kV #2 — Four Corners
Transfer Limit:	East-West: 2325 MW nominal West-East: Not rated The 2325 MW nominal operating limit is limited by the thermal rating of the Four Corners-Cholla 345 kV lines and voltage deviation at Pinnacle Peak following the critical disturbance. The actual rating is defined by the diagonal on the attached nomogram.
Critical Disturbance that limits the transfer capability:	The critical disturbance is loss of the Four Corners-Moenkopi 500 kV line.
When:	The transfer rating was established in the mid 1980's by the Four Corners Technical Studies Task Force. The task force is comprised of members from the following companies: Arizona Public Service Company El Paso Electric Company Public Service Company of New Mexico Salt River Project Southern California Edison Company Tucson Electric Power Company Verified by 1999 OTC studies.
System Conditions:	Flows on this transfer path have historically been east to west due to the large amount of generation located in northwestern New Mexico. This generation is partly owned by entities west of the New Mexico border. The 2325 MW nominal limit was determined due to voltage deviation, and thermal constraints.
Study Criteria:	Same as WSCC Reliability Criteria for Transmission System Planning.
Remedial Actions Required:	None

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Formal Operating Procedure:	None
Allocation:	The transfer capability is divided among the following utilities: Arizona Public Service Company owns all rights on the Four Corners-Cholla 345 kV lines. Southern California Edison Company owns all the rights on the Four Corners-Moenkopi 500 kV line.
Interaction w/Other Transfer Paths:	None
Contact Person:	Rex Stulting Arizona Public Service Company P. O. Box 53999, Station 2259 Phoenix AZ 85072-3999 (602) 250-1644 (602) 250-1155 - fax rstultin@apsc.com

Revised February 1998

47. Southern New Mexico (NM1)

Accepted Rating ☒
Existing Rating ☐
Other ☐

Location:	Southern New Mexico
Definition:	Sum of the flows on the following transmission lines: Line — Metered End West Mesa-Arroyo 345 kV — West Mesa 345 kV Springerville-Luna 345 kV — Springerville 345 kV Greenlee-Hidalgo 345 kV — Greenlee 345 kV West Mesa-Belen 115 kV — West Mesa 115 kV
Transfer Limit:	Simultaneous firm: 925 MW Non-simultaneous: 1048 MW
Critical Disturbance that limits the transfer capability:	Either the Springerville-Luna 345 kV or Greenlee-Hidalgo 345 kV lines.
When:	Simultaneous firm accepted rating established by Post-PST New Mexico Operating Procedure and non-simultaneous accepted rating established by WSCC Peer Review Group in 1995.
System Conditions:	Ratings are independent of transfer levels between major WSCC areas. Ratings were established for a heavy summer system and are dependent upon Arroyo phase shifter schedules, generation levels, area power factors and reactor levels in southern New Mexico.
Study Criteria:	Local New Mexico pre-disturbance voltage levels between 0.95 p.u. and 1.05 p.u. Post-transient voltage deviation no greater than 7% from base case levels on southern New Mexico 345 kV buses and 6% on northern New Mexico 345 kV buses. WSCC criteria applied for systems outside New Mexico area.
Remedial Actions Required:	For double contingencies on the 345 kV lines defined above, WSCC Operating Procedure EPE-1 is implemented.
Formal Operating Procedure:	Post-PST New Mexico Operating Procedure, effective 9/1/95.
Allocation:	EPE, PEGT, PNM, TNP
Interaction w/Other Transfer Paths:	Interaction with Northern New Mexico Transfer Path (NM2) is controlled with the Arroyo phase shifter.
Contact Person:	Dennis Malone El Paso Electric Company P. O. Box 982 El Paso, TX 79960 (915) 543-5757 (915) 521-4763 - fax dmalone@whc.net

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48. Northern New Mexico (NM2)

Accepted Rating ☒
Existing Rating ☐
Other ☐

Location:	Northern New Mexico
Definition:	Sum of flows on the following transmission elements: Element — Metered End Four Corners-West Mesa 345 kV line — Four Corners San Juan-BA 345 kV line — San Juan San Juan-Ojo 345 kV line — San Juan McKinley/Yah-Ta-Hey 345/115 kV trans — Yah-Ta-Hey Bisti-Ambrosia 230 kV line — Bisti Less the following flows: Belen-Bernardo 115 kV line — Belen West Mesa-Arroyo 345 kV line — West Mesa
Transfer Limit:	The transfer import limit is 1450 MW to 1692 MW. This limit is dependent upon operating parameters described in the 1995 Northern New Mexico Heavy Summer Contingency Study.
Critical Disturbance that limits the transfer capability:	Four Corners-West Mesa or San Juan-BA 345 kV lines.
When:	The rating was established in 1995 by joint operating studies of the New Mexico Power Pool. A subsequent accepted path rating request accompanied by a comprehensive study, date May 31, 1996, mailed to PCC and TSS for approval, established the NM2 base and incremental ratings. Series compensation was the subject of that path rating request. By letter dated November 8, 1996, PCC granted an accepted rating to the Rio Puerco Series Capacitor Project.
System Conditions:	The transfer limit is independent of transfer levels between major WSCC areas. Limits were developed on a heavy summer system and are dependent upon several operating parameters including generation levels, capacitor and reactor configurations, Arroyo phase-shifting transformer flows, and overall system VAR demand.
Study Criteria:	Local New Mexico criteria included pre-disturbance voltage levels between 0.95 and 1.05 p.u., post transient voltage deviation no greater than 6% in northern New Mexico and 7% in southern New Mexico, or not less than a 5% reactive margin at critical 345 kV buses in northern New Mexico.
Remedial Actions Required:	An operating procedure called the N-H procedure exists to relieve overloads on certain northern New Mexico transmission elements. A PLC controlled reactor tripping scheme is utilized to improve post-transient voltage stability. The transfer limits are dependent upon these actions.
Formal Operating Procedure:	Post-PST New Mexico Transmission Operating Procedure, effective September 1, 1995.

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Allocation:	PNM and PGT. Several entities have the rights to use the transfer capability on this path.
Interaction w/Other Transfer Paths:	Interacts with transfers over path NM1, but is controlled by the Arroyo phase-shifting transformer.
Contact Person:	Gregory C. Miller Public Service Company of New Mexico Alvarado Square, MS 0604 Albuquerque, NM 87158 (505) 241-4570 (505) 241-4363 - fax gmiller@mail.pnm.com

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49. East of the Colorado River (EOR)

Accepted Rating ☒
Existing Rating ☐
Other ☐

Location:	Western Arizona
Definition:	Sum of the flows on the following transmission lines: Line — Metered End Navajo-Crystal-McCullough 500 kV — Navajo Moenkopi-Eldorado 500 kV — Eldorado Liberty-Mead 345 kV — Liberty Palo Verde-Devers 500 kV — Palo Verde Palo Verde-North Gila 500 kV — Palo Verde Perkins-Mead 500 kV — Perkins
Transfer Limit:	East to West: 7550 MW (Non-simultaneous) West to East: Not rated The present east to west, non-simultaneous EOR rating is 7550 MW and assumes a 'normal' operating system with all lines in service and full series compensation levels in the Navajo, Palo Verde, and Mead-Phoenix Project (MPP) transmission systems. The rating increased from 7365 MW to 7550 MW subsequent to achieving an accepted rating for the 7550 MW East-of-the-River Path Rating project.
Critical Disturbance that limits the transfer capability:	The 7550 MW non-simultaneous limit is due to the continuous rating of the series capacitors at the Palo Verde end of the Palo Verde-Devers and Palo Verde-N.Gila 500 kV lines. The transfer capability is limited under normal (all-lines-in-service) conditions. However, various EOR line outages may result in 97-99% loading of emergency ratings on various EOR lines.
When:	The non-simultaneous transfer rating was established in 1996 by the Western Arizona Transmission Systems (WATS) Task Force. The Task Force was comprised of members from the following companies: Arizona Public Service Company El Paso Electric Company DOE-Western Area Power Administration Imperial Irrigation District Los Angeles Department of Water and Power Nevada Power Company Public Service Company of New Mexico Salt River Project San Diego Gas and Electric Company Southern California Edison Company Southern California Public Power Authority Tucson Electric Power Company SDG&E sponsored studies conducted within a WSCC Review Group that led to approval of the Accepted Rating Report, and was granted Accepted Rating Status by the August 5, 1996 letter from the PCC Chairman.

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System Conditions:	Flows on this transfer path have historically been east to west due to the large amount of joint participation plants located in Arizona and New Mexico which are partly owned by southern California and Nevada entities.
Study Criteria:	WSCC Reliability Criteria for Transmission System Planning
Remedial Actions Required:	None
Formal Operating Procedure:	None
Allocation:	The 7550 MW transfer capability allocation can be shown in parts according to the previous 5700 MW rating, the 1300 MW increase, and the subsequent 365 MW and 185 MW increases. The 5700 MW portion of the transfer capability is divided among the following entities: Southern California Edison Co. 2232 MW Los Angeles Dept. of Water & Power 1229 MW Western Area Power Administration 527 MW Nevada Power Company 353 MW San Diego Gas & Electric Co. 914 MW Salt River Project 160 MW Imperial Irrigation Project 153 MW Arizona Public Service Co. 132 MW 5700 MW The 1300 MW transfer capability is divided among the following entities: Southern California Public Power Authority 238 MW Salt River Project 236 MW Arizona Public Service 236 MW Modesto-Santa Clara-Redding 150 MW Vernon 28 MW Western 412 MW 1300 MW Allocation of the 365 MW and 185 MW increases are not yet finalized.
Interaction w/Other Transfer Paths:	The simultaneous transfer limit into southern California is governed by the Southern California Import Transmission (SCIT) Nomogram, and is partly a function of the EOR flow. The SCIT Nomogram varies seasonally and is limited by post transient and transient conditions.
Contact Person:	Rex Stulting Arizona Public Service Company P. O. Box 53999, Station 2259 Phoenix AZ 85072-3999 (602) 250-1644 (602) 250-1155 - fax rstultin@apsc.com

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50. Cholla - Pinnacle Peak

Accepted Rating ☐
Existing Rating ☒
Other ☐

Location:	Northern Arizona
Definition:	Sum of the flows on the following transmission lines: Line — Metered End Cholla-Pinnacle Peak 345 kV #1 — Cholla Cholla-Pinnacle Peak 345 kV #2 — Cholla
Transfer Limit:	East to West: 1200 MW West to East: Not rated
Critical Disturbance that limits the transfer capability:	The critical disturbance is loss of one of the Cholla-Pinnacle Peak 345 kV lines which causes the remaining Cholla-Pinnacle Peak 345 kV line to reach the emergency rating.
When:	The 1200 MW rating was established in the early 1980's by the Four Corners Technical Studies Task Force. The task force is comprised of members from the following companies: Arizona Public Service Company El Paso Electric Company Public Service Company of New Mexico Salt River Project Southern California Edison Company Tucson Electric Power Company Verified by 1999 OTC studies.
System Conditions:	Flows on this transfer path have historically been east to west due to the large amount of generation located in northwestern New Mexico and Cholla.
Study Criteria:	Same as the WSCC Reliability Criteria for Transmission System Planning.
Remedial Actions Required:	None
Formal Operating Procedure:	None
Allocation:	The transfer capability is wholly owned by APS.
Interaction w/Other Transfer Paths:	None
Contact Person:	Rex Stulting Arizona Public Service Company P. O. Box 53999, Station 2259 Phoenix AZ 85072-3999 (602) 250-1644 (602) 250-1155 - fax rstultin@apsc.com