ORIGINAL

Tucson Electric Power Company
4350 E. Irvington Road, Post Office Box 711
Tucson, Arizona 85702

February 9, 2006

Docket Control
Arizona Corporation Commission
1200 West Washington Street
Phoenix, AZ 85007

Re: Compliance Filing due pursuant to A.A.C. R14-2-1618, paragraph D
Docket No. **RE-00000C-00-0377**, Decision No. 63486

Docket Control:

Tucson Electric Power Company is required by A.A.C. R14-2-1618, paragraph D to file reports on sales and portfolio power demonstrating the output of portfolio resources, the installation date of portfolio resources, and the transmission of energy from those portfolio resources to Arizona consumers. Please find enclosed an original and thirteen copies of the required reports for the year ended 2004. Also enclosed is an additional copy of the filing that the Company requests you date-stamp and return in the self-addressed, stamped envelope for our files.

If you have any questions, please do not hesitate to contact me at 520-884-3680.

Sincerely,

Jessica Bryne

Jessica Bryne
Regulatory Services

Cc: Brian Bozzo, ACC
Carmela Leon, ACC
Dave Couture, UNS

Tucson Electric Power Company

ENVIRONMENTAL PORTFOLIO STANDARD PROGRAMS

EXECUTIVE SUMMARY

The ACC has mandated under the Environmental Portfolio Standard ("EPS"), R14-2-1618, that any Load Serving Entity shall derive a percentage of its total retail energy sold from new solar resources or environmentally-friendly renewable electricity technologies whether that energy is purchased or generated by the seller. The percentage changes each year, increasing to a maximum of 1.1% in 2007 and remaining the same through the life of the standard. In 2004 the percentage is 0.8% of which at least 60% must be derived from solar electric generation.

At the ACC Staff meeting on January 6, 2004, the Commissioners directed the ACC Staff to hold a series of workshops to consider four issues related to the EPS Rules (A.A.C. R14-2-1618). The four issues identified by the Commissioners were:

1. A discussion of increasing EPS funding levels.
2. Elimination of the EPS expiration Date.
3. Restoration of DSM funding.
4. Allocation of funding among various technologies.

The ACC Staff commenced the workshop series on March 5, 2004. The last and fifth workshop was June 25, 2004. An ACC Staff report proposing changes to the EPS was issued January 21, 2005. Comments were due to the Commission on February 17, 2005 for a possible rulemaking process. The EPS will likely be revised in the future.

Renewable Generating Capacity

This report covers TEP's progress for January 1, 2004 through December 31, 2004, and includes cumulative reporting from January 1, 1997. As of December 31, 2004, TEP had installed or supported installation of a total of **10,739 kW** of renewable generating capacity, which has generated **212,803,454 kWh** of renewable energy and generated **347,095,555 kWh** of renewable credits using the appropriate multiplying factors in the EPS since January 1, 1997. The following tables will summarize capacity, program costs and requirements of the EPS.

EPS Program Results Summary

Since 1999, TEP has spent $31,531,552 on renewable energy development programs in support of developing renewable generation resources to meet the annual energy percentage goals of the EPS. In return, TEP has received revenues of $19,731,123 for these programs. Thus, TEP has spent $11,800,429 more than revenues received in its best effort to meet the annual solar energy percentage goals of the EPS. EPS surcharge collections effectively began in March 2001, and the annual retail energy reported for EPS purposes has been prorated to a 10-month year in 2001 for the purpose of this report.

TEP has successfully met the EPS requirement for "Other" credits every year of the EPS and carried a surplus of 143,745,032 kWh of "Other" credits into 2005. However, TEP was only able to meet **45.32%** of its "Solar Electric" goals for 2004 and **50.93%** of its "Solar Electric" credit goals for the 46-month period ending December 31, 2004, and carried a deficit of 43,473,590 kWh of Solar credits into 2005. Overall, TEP met **67.19%** of its EPS renewable energy goals for 2004, and has met **73.42%** of its total 46-month EPS renewable energy goals.

The implementation of a multi-year, pay as you build funded EPS allows for development of cookie cutter PV system designs in a size optimized to take advantage of partnering opportunities with the manufacturers of the major components of PV systems to optimize Balance of System ("BOS") costs through both material and installation labor cost reductions. TEP has taken advantage of this intended feature of the EPS by using refined design techniques to effect cost reductions in electrical systems, support structures, inverters, site preparation, grid connection and data acquisition systems. The EPS, as adopted by the ACC, allowed TEP to be assured of multi-year funding and has provided TEP with certainty of financing essential to enter into long-term relationships with specific makers of the primary components of PV systems (PV modules and inverters) to allow for partnering to optimize the BOS design and installation, resulting in BOS costs of less than $1 per DC watt of installed PV capacity in 2003, only the third year of the EPS. This BOS cost level meets a long-term goal of federal renewable energy programs. This benefit would not have been possible with year-to-year EPS funding.

Technical Requirements

In addition to the relatively high initial cost of solar electric generation, there continue to be some technical issues related to the reliability and annual energy production of smaller solar electric generation systems that are a slight hurdle to widespread commercialization of customer-based solar electric generation products. These issues of high initial cost, reduced reliability and reduced annual energy performance are addressed in the Solar PV Resource Development section of this report.

SunShare & Net Metering

TEP offers the SunShare hardware buy-down program, with ACC approval, to its customers. Since the program was offered in 2001, forty-eight customers have purchased our Option 2 package, which is a solar kit offered by TEP at a pass through cost. This accounted for 65 kits delivered for installation, representing 98 kW DC. A total of 71 customers qualified for, and joined, the SunShare Option 1 or Option 3 program through December 31, 2004 with a total installed DC capacity of 228 kWp. The net program total is 119 SunShare participants through December 31, 2004. There is currently 593 kW DC of customer sited, installed PV capacity as part of the SunShare or customer partnering programs. TEP requested, and received on February 10, 2004, ACC approval for changes in the SunShare program for 2004 to allow more customers to qualify for the program while retaining high standards for safety, reliability and performance of systems in the SunShare program. The ACC also approved a revision in the Option 3 subsidy payment from $2 per DC Watt to $3 per DC Watt in August 2004.

In 2001, TEP offered, with Commission approval, a net metering option for owners of PV systems of less than 5 kW AC in size. TEP requested, and the Commission approved in March 2003, an increase in the maximum size of a PV generation system qualifying for net metering to 10 kW AC and expanded the eligible technologies to include wind generation up to that size. As of December 31, 2004, forty-five PV customers have qualified and enrolled in the net metering program. No wind customers have yet enrolled in net metering. These PV customers have a combined installed solar generation capacity of about 100 kW AC.

TEP has expanded the effort of developing a new small, low cost, reliable PV SunShare Option 2 system that meets annual energy output performance expectations in the Tucson climate. TEP is currently testing more than a dozen different PV modules of four different technology types and five different small PV inverters of up to 5 kW in size.

GreenWatts

GreenWatts is an ACC approved TEP green power purchase program that enables interested supporters to pool funds and invest directly in the creation of green power. Each GreenWatt is sold in "blocks" of 20 kWh per month. Revenues from GreenWatts are used for installing more community-based solar generation. At the end of December 31, 2004, TEP had commitments from 1,968 residential customers, amounting to adoption of 4,375 blocks and 43 commercial customers who have adopted 809 total blocks of green energy.

Total revenues produced to date are $46,956 from commercial customers and $185,827 from residential customers for total revenue of $232,784. All of these funds have been, or soon will be, applied to installation costs of additional community-based PV systems installed in the Tucson area, such as at the Tohono Chul Museum, the City of Tucson's Hayden Udall Water Treatment Facility, Reid Park Zoo, Hohokum Middle School, Tucson Botanical Gardens, Safford Middle School and Palo Verde High School, among others.

The number of GreenWatts adopters more than tripled after a membership campaign featuring "Sunny" the GreenWatt was rolled out in the spring of 2002, combined with bulk mailing to all TEP customers. Another membership campaign in November of 2003 increased membership by more than 32%. However, a similar publicity campaign in November 2004 resulted in the addition of less than 100 new GreenWatts participants. However, total membership after five years of program offering is just over 0.57% of all TEP customers, as compared to a national average of about 0.8% where green power purchase options have been offered for eight years or more.

Solar Generation Educational Outreach Efforts

TEP participates in a range of public events, publicizing GreenWatts and SunShare and providing general outreach about solar and renewable energy. In 2004, TEP personnel provided technical information, education and reminder-trinkets to the public at events such as the Earth Day Celebration at the Museum. Sunny, TEP's GreenWatts' mascot, attended events at Tucson Electric Park, and appeared at various school fairs/celebrations geared to children and families, providing visibility and community presence and encouraging kids to think and ask questions about energy.

Sunny the GreenWatt is responsible for additional outreach with school children, as the "spokesperson" in ads in Bear Essential News (a school-focused news magazine for children and teachers) talking about energy conservation and the environment. Sunny is also prominent on TEP's education Web page, where he introduces students and teachers to programs, such as the Energy Patrol, designed to involve youngsters in saving energy at their schools.

In an effort to provide in-depth, technical education to highly motivated consumers about solar energy, TEP co-sponsored and participated in a week-long Solar Electric Institute installation training and a tour, talk and demonstration of local SunShare facilities through the Arizona-Sonora Desert Museum education department. Additional presentations at civic organizations, churches and breakfast clubs have helped spread the word about GreenWatts, SunShare and TEP's Community Solar program.

Public events surrounding the dedication of TEP's Community Solar Program, funded by GreenWatts contributions, provided new opportunities to call attention to a variety of solar installations. For example, a celebration at Tohono Chul Park introduced visitors to a small, highly visible solar-powered fan in a Ramada on the Park grounds, and a training for more than 50 docents provided details about the array atop the Park's Education Building. Two schools joined the list of opportunities for outreach and solar-related curriculum in 2004. The Civano Community School (2 kW) in the Vail School District, and Hohokam Middle School (4 kW), which is not only in the TUSD, but also is on the Pascua Yaqui reservation, held celebrations to dedicate their PV systems. These events also generated significant media coverage.

TEP's community outreach focused on these community partnerships will continue with plans for installations at the Tucson Botanical Gardens' New Pavilion (3 kW), the Vail District's new Empire High School (4 kW) and TUSD's Davison School (4 kW) and Project MORE, an alternative high school (15 kW), Tucson Audubon Society (2 kW) and TUSD's Davidson Elementary School (4 kW integrated into a walkway canopy), as well as Reid Park Zoo (4-5 kW), among others. The school installations are coupled with an educational component, as are the other municipal and non-profit locations where collaborations are in the planning stages. TEP began working in 2003 on a 2004 project in partnership with the City of Tucson, Pima County and Pima Community College, the Clements (Recreation) Center. Work progresses with the architect on an expansion of the current multi-purpose center that will feature 4 kW on the roof of the gymnasium.

In 2004, members of the TEP solar group made numerous presentations to civic, educational and neighborhood groups ranging from 15 - 250 people on topics that focused on TEP's solar and renewable programs. These appearances included high-level presentations by TEP Vice President and Technical Advisor, Thomas Hansen, to groups ranging from the NARUC Natural Resources and Energy Committee to classroom lecture/demonstrations at the University of Arizona, as well as a presentation to the Northern Arizona Council of Governments and at UPEx. Also in 2004, Mr. Hansen made renewable energy presentations at a Department of Energy Inverter Technology Workshop in Baltimore, Maryland, Power Gen Renewable Energy Conference in Las Vegas, Nevada, the Arizona State Legislature and the Arizona Corporation Commission. Others on the TEP team spoke at community gatherings, providing more general presentations about solar and renewable energy.

TEP sponsored several energy efficiency events and organizations throughout the year in an effort to reinforce our message throughout the community. For example, TEP is a financial supporter of the Arizona Solar Center, a renewable energy Web site dedicated to providing renewable energy information specific to Arizona. TEP was also an underwriter of the Solar Adventure put on by the Coalition for Solar, and provided a sponsorship, speaker and display at a renewables workshop sponsored by Women in Sustainable Technologies.
In the fall of 2004, TEP and Global Solar Energy, Inc, ("Global Solar") teamed up to become primary sponsors of Luminarias del Pueblo, a city-wide project presented by the Tucson Pima Arts Council, this year featuring 35 original sculptures (Luminarias) with lighting provided by the sun, via individual solar systems. Throughout the fall, TEP personnel trained artists to learn about solar energy and helped advise them how to maximize the lighting supplied by their system (a Global Solar 17-watt panel, a 15-volt battery and a controller/timer, LED lamps). The sculptures will be auctioned to buyers at a gala event on April 2, 2005. The proceeds of the sale of each Luminaria will benefit a different local non-profit organization.

The GreenWatts.com Web site sponsored by TEP provides educational information about solar generation and the TEP renewables programs, including the "SunSite-FunSite," a color splashed interactive Web zone with easy to learn lessons about the technology and terminology of solar energy for both the young and the not-so-young explorers. To enhance TEP's offerings for younger children, K-3, plans are underway for a solar component in the new Energy Efficiency Exhibit at the Museum that will debut in spring 2005. In 2004, the GreenWatts.com Web site was updated with current information on all of TEP's community projects including photos and overviews. TEP also added information on requirements for participation and consideration. In 2004 TEP launched a "real time" solar tracker to the Web site which is used as both an educational and research resource. The Solar tracker, updated every two minutes, shows actual energy output from the Springerville Generating Station ("SGS") Solar Array.

General communications were completed with a Renewables Progress Report in the spring of 2004 that identified dollars raised through TEP's program and the way that TEP has spent those dollars to support solar installations to benefit the community. In addition, an electric bill insert was sent to all customers (350,000) in the fall encouraging support of our environmental programs and again informing customers about the community projects that investments in GreenWatts have supported.

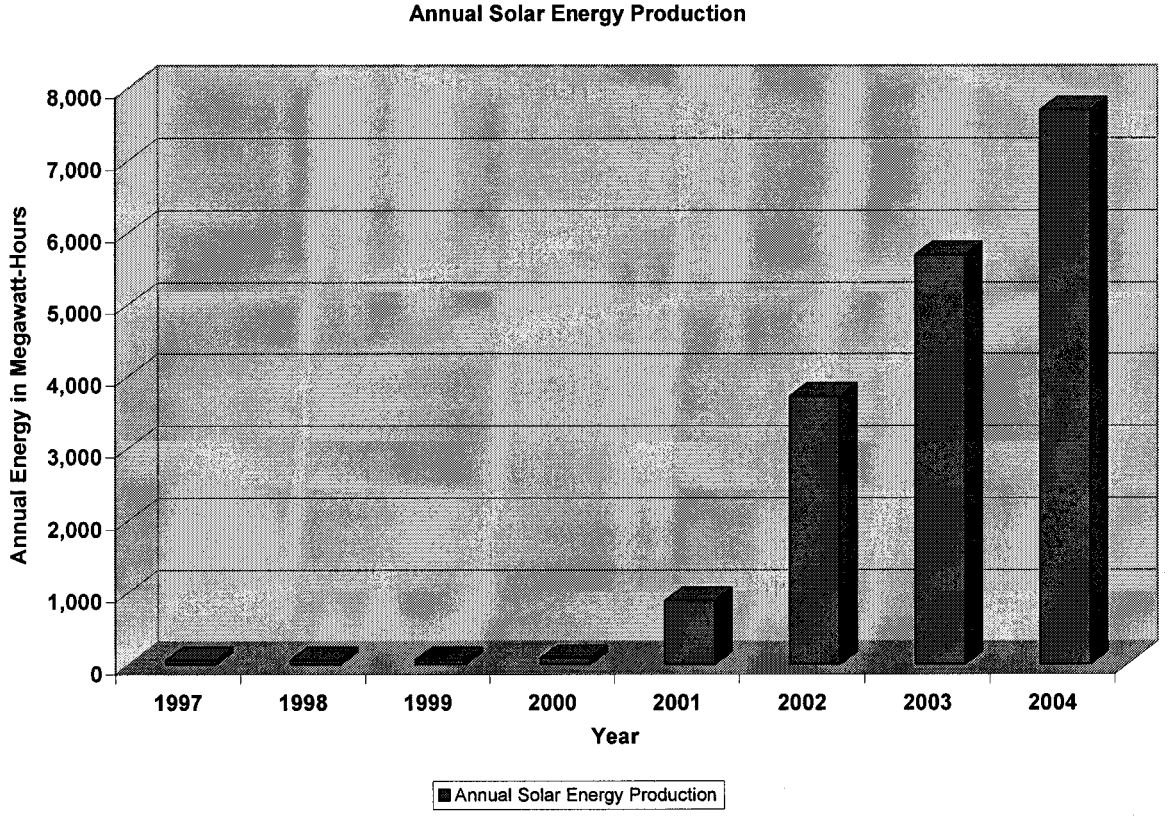
TEP has also been working with the City of Tucson in developing PV model plans to help streamline the development review and permitting process for local PV installers. These model plans will enable the installers to perform an expedited walk-through process for new customer installations.

TEP also supplied a PV system to enable four University of Arizona seniors to develop a solar test program. While TEP supplied the hardware to the group, they are designing the system, picking the components, installing it and developing the test program around design boundaries TEP prescribed. Although it is physically in the solar test yard at TEP's Operating Headquarters ("OH") location, it is a partnership that not only assists industry developments, but also yields valuable knowledge for our future projects.

Renewable Energy Resources and Renewable Resource Survey Systems

TEP continues to operate a system of 15 renewable resource survey systems. This system includes eight 40-meter high fixed wind survey towers at locations in Arizona. TEP continues to evaluate a wide range of renewable energy options for the future, including landfill gas, biomass, wind, digester gas, geothermal and solar thermal electric conversion.

TEP installed 944 kWp DC of solar PV electric generation in 2004, including additions of 810 kW at the Springerville Generating Station Solar System ("SGSSS"), 12 kW DC of solar electric generation at OH in Tucson and 122 kWp DC rating of SunShare systems. TEP's annual solar energy electricity production has increased with each year of the EPS program per the following graph. In 2004, nearly 0.1% of annual retail electricity was produced by solar PV generation.



Past Environmental Resource Development Goals

TEP reached its goal of having 5 MW of renewable generating capacity by the end of the year 2000, which was derived from the ACC's 1992 Integrated Resource Planning Procedures.

SUMMARY OF RENEWABLE GENERATION AND CAPACITY

Type of Generation	kW Capacity	Cumulative Generation, kWh	Cumulative Extra Credits, kWh	Cumulative Renewable Credits, kWh
Landfill Gas	5,500	194,169,923	108,735,157	302,905,081
Solar PV	5,239	18,633,531	25,556,943	44,190,474
Solar Trough	0	0	0	0
Small Hydro-Electric	0	0	0	0
Wind Generation	0	0	0	0
Total Other	5,500	194,169,923	108,735,157	302,905,081
Total Solar Electric	5,239	18,633,531	25,556,943	44,190,474
Total Solar Electric & Other	10,739	212,803,454	134,292,101	347,095,555

SUMMARY OF EPS REQUIREMENTS

Description	Cumulative Thru 6/30/04	Reporting Period 6/30/04 - 12/31/04	Cumulative Thru 12/31/04
Retail Sales, kWh	27,094,300,039	4,574,729,035	31,669,029,074
TEP EPS Requirement (0.8% of retail sales for 2004), kWh	126,941,213	36,597,832	163,539,045
"Other" Credits Needed To Meet EPS Requirements (40% in 2004)	63,831,314	14,639,133	78,470,447
"Solar Electric" Resource Credits Needed to Meet EPS Requirements.	66,645,216	21,958,699	88,603,915
Landfill Gas Project "Other" Credits	278,913,295	18,541,793	297,455,088
"Solar Electric" Resource Credits	34,505,547	9,684,927	44,190,474
Wind Credits Purchased	13,073	1,354	14,427
"Other" Credits Purchased	0	0	0
"Solar Electric Manufacturing" Credits Obtained from Global Solar, kWh	680,360	250,869	931,229
Sales of "Other" Credits, kWh	75,254,036	0	75,254,036

SUMMARY OF PROGRAM EXPENDITURES

Program	Program Costs		
	Thru 12/31/03	Period1/01/04 through 12/31/04	Life of Program
Solar Electric	$26,049,971	$4,657,510	$30,707,481
Solar Thermal	$0	$0	$0
Geothermal	$0	$0	$0
Landfill Gas	$0	$85,000	$85,000
Wind	$149,319	$3,200	$152,519
Hydro	$0	$0	$0
Other Technologies	$0	$0	$0
Marketing **	$121,541	$115,100	$236,641
Hardware Buydown Program - Option 1,3 **	$87,100	$168,276	$255,376
Solar Buyback Program - Option 2 **	$118,000	$109,946.00	$227,946
SunShare Option 2 Revenue	N/A	-$82,300.00	-$82,300.00
SunShare Materials Cost	$527,829	$357,436	$1,029,639
Total TEP Renewables Program	$27,053,760	$5,558,542	$31,531,552

** Cost included in solar electric costs

SUMMARY OF PROGRAM REVENUES

Description	Period Thru 12/31/03	Period 1/01/04 thru 12/31/04	YTD Retail Energy Sales MWh	Life of Project
GreenWatts Total	$157,628	$75,156	-	$232,784
Allocation of SBC Total	$7,740,000	$2,450,000	-	$10,190,000
Residential Surcharge Total	$3,429,762	$1,296,748	3,549,750	$4,726,510
Small Commercial Surcharge Total	$3,440,123	$1,269,365	3,321,085	$4,709,488
Large Commercial Surcharge Total	$88,775	$23,568	1,762,155	$112,343
Renewables Surcharge Total	$6,958,660	$2,589,681	8,542,990	$9,548,341
Total EPS Program Revenues	$14,856,288	$5,114,837		$19,971,125

INSTALLATION PROGRESS

Project	Install Date	kWp DC Capacity	kWh, AC Output - Thru 12/31/04	Initial Costs	Total Operating Cost 12/31/04	$/kWh for Project
Community Projects						
Reid Park Zoo ASE/TR 840w Xtal	Mar-00	0.84	3,713	$7,400	$6,669	N/A
Pima Air Museum ASE/TR 1200w Xtal	Jun-00	1.2	5,992	$7,099	$200	$0.1356
UofA Agriculture Station	Jan-02	5.62	28,789	$120,000	$129	$0.4302
Hayden/Udall # 1 ASE/TR 21.6 KW Xtal	2002	21.6	83,996	$142,975	$498	$0.1394
Hayden/Udall # 2 ASE/TR 21.6 KW Xtal	2002	21.6	82,251	$142,050	$441	$0.1321
3131 S. Naco Vista	Apr-99	0.75	6,352	$6,944	$200	$0.1410
Tohono Chul BPSX140U/SB - 2800w Xtal	Dec-02	2.8	9,836	$23,286	$200	$0.1654
Civano Vail School MST50/TR 3000w Xtal	2004	3	2170.00	$15,990	$400	$0.1259
Hohokam TUSD BP3160Q/FR 4480w Xtal	2004	4.48	1240.00	$21,584	$200	$0.2928
Ft Huachucha Solar ASE/OMN 30 KW Xtal	1997	30	205,249.50	$180,000	$2,500	$0.1355
SunShare						
Sun Share Reported 1999	1999	0	44,937	$50,000	$100	$0.2024
Sun Share Reported 2000	2000	0	11,764	$25,000	$100	$0.1696
Sun Share Reported 2001	2001	39	42,076	$79,110	$2,300	$0.3114
Sun Share Reported 2002	2002	89	158,532	$266,532	$5,100	$0.1020
Sun Share Reported 2003	2003	76	120,544	$295,820	$6,155	$0.1220
Sun Share Reported 2004	2004	122	125,074	$773,278	$6,800	$0.1919
Utility (TEP)						
SGS-125C-1 ASE/XN 135 KW Xtal	Jul-01	135	737,174	$1,125,637	$3,820	$0.1719
SGS-125C-2 ASE/XN 135 KW Xtal	Jul-01	135	772,454	$848,927	$3,820	$0.1266
SGS-125C-3 ASE/XN 135 KW Xtal	Aug-01	135	728,180	$779,470	$4,063	$0.1171
SGS-125C-4 ASE/XN 135 KW Xtal	Aug-01	135	718,342	$885,503	$3,820	$0.1336
SGS-125C-5 ASE/XN 135 KW Xtal	Nov-01	135	691,128	$891,576	$3,820	$0.1355
SGS-125C-6 ASE/XN 135 KW Xtal	Nov-01	135	701,770	$830,314	$3,820	$0.1232
SGS-125C-7 ASE/XN 135 KW Xtal	Oct-02	135	548,554	$896,984	$3,432	$0.1332
SGS-125C-8 ASE/XN 135 KW Xtal	Oct-02	135	559,540	$896,332	$3,432	$0.1318
SGS-125C-9 ASE/XN 135 KW Xtal	Oct-02	135	552,662	$900,199	$4,887	$0.1364
SGS-125C-10 ASE/XN 135 KW Xtal	Oct-02	135	548,341	$910,976	$4,887	$0.1322
SGS-125C-11 ASE/XN 135 KW Xtal	Jun-02	135	600,472	$899,885	$4,887	$0.1321
SGS-125C-12 ASE/XN 135 KW Xtal	Jun-02	135	546,463	$901,081	$4,887	$0.1367
SGS-125C-13 ASE/XN 135 KW Xtal	Jun-03	135	351,281	$866,453	$2,865	$0.1287
SGS-125C-14 ASE/XN 135 KW Xtal	Jun-03	135	348,603	$866,190	$2,865	$0.1295
SGS-125C-15 ASE/XN 135 KW Xtal	Aug-03	135	333,802	$867,159	$2,865	$0.1295
SGS-125C-16 ASE/XN 135 KW Xtal	Aug-03	135	338,528	$860,732	$2,865	$0.1267
SGS-125C-23 ASE/XN 135 KW Xtal	Jul-04	135	99,857	$813,735	$431	$0.1359
SGS-125C-24 ASE/XN 135 KW Xtal	Jul-04	135	100,391	$799,027	$431	$0.1327
SGS-125C-25 ASE/XN 135 KW Xtal	Jun-04	135	114,108	$825,208	$589	$0.1212
SGS-125C-26 ASE/XN 135 KW Xtal	Jun-04	135	126,563	$789,255	$589	$0.1157
SGS-125C-27 ASE/XN 135 KW Xtal	Jun-04	135	126,155	$710,986	$589	$0.1047

Project	Install Date	kWp DC Capacity	kWh, AC Output - Thru 12/31/04	Initial Costs	Total Operating Cost 12/31/04	$/kWh for Project
SGS-125C-28 ASE/XN 135 KW Xtal	Jun-04	135	119,862	$781,116	$589	$0.1222
SGS-125C-29 ASE/XN 135 KW Xtal	Nov-03	135	274,282	$849,606	$589	$0.1268
SGS-125C-30 ASE/XN 135 KW Xtal	Nov-03	135	272,023	$724,018	$589	$0.1072
SGS-125C-31 ASE/XN 135 KW Xtal	Aug-03	135	324,564	$856,574	$2,865	$0.1269
SGS-125C-32 ASE/XN 135 KW Xtal	Aug-03	135	314,590	$856,552	$2,865	$0.1314
SGS-125TF-1 FS/XN 134.4 KW Cd-Tl	Sep-01	135	719,869	$737,815	$16,262	$0.1108
SGS-125TF-2 FS/XN 134.4 KW Cd-Tl	Sep-01	135	643,111	$620,396	$15,016	$0.0936
SGS-125TF-3 FS/XN 134.4 KW Cd-Tl	Jun-03	135	360,775	$759,114	$1,360	$0.1177
SGS-125TF-4 FS/XN 134.4 KW Cd-Tl	Jun-03	135	367,757	$759,122	$1,360	$0.1115
SGS-125TF-5 BP/XN 129 KW a-si	Oct-01	135	668,333	$760,802	$1,678	$0.1302
SGS-125TF-6 BP/XN 129 KW a-si	Oct-01	135	706,890	$760,717	$1,678	$0.1259
SGS-125TF-7 BP/XN 129 KW a-si	Oct-01	135	675,070	$736,514	$1,678	$0.1240
SGS-125TF-8 BP/XN 129 KW a-si	Oct-01	135	676,119	$741,162	$1,678	$0.1240
OH ASE/SB - 1200w Xtal	Jul-01	1.2	4,746	$8,563	$0	$0.1602
OH ASE/TR - 1200w Xtal	Aug-01	1.2	6,569	$8,369	$0	$0.1125
OH BPMST-50/TR - 1500w a-si	Sep-01	1.5	6,162	$6,666	$840	$0.1199
Solar Trailers ASE/TR 5000w Xtal	Jun-05	5	32,120	$70,000	$490	$0.4161
OH Gate 2A Solarex/TR - 2500w Xtal	Mar-00	2.5	18,682	$10,250	$358	$0.1273
OH3 20KW ASE/TR 21.6 KW Xtal	Sep-00	20	147,264	$146,342	$652	$0.1394
OH4 20KW ASE/TR 21.6 KW Xtal	Oct-00	20	152,594	$110,534	$126	$0.1020
OH 5KW BP/MST50/Beacon a-si	Feb-04	7.5	8,155	$29,574	$0	$0.1037
St Johns Test	Sep-00	0	3,512	$11,517	$0	No kWh Data
SGS 20 KW ASE/TR 21.6 KW Xtal	Oct-00	21.6	139,805	$135,060	$526	$0.1316
DMP 1 ASE/OMN 108 KW Xtal	Dec-00	108	687,650	$589,020	$2,602	$0.1169
DMP 2 ASE/OMN 108 KW Xtal	Dec-00	108	672,306	$527,199	$1,020	$0.1114
Test Trees	Jun-01	0	8,214	$1,500	$0	N/A
OH Global Solar Test/TR - 1440w CIGS	2002	1.4	4,012	$13,447	$431	$0.2455
OH Global Solar Slimline/TR 1656w CIGS	2004	1.66	362	$18,720	$0	$0.8623
OH BP SX140U/TR-1400w Xtal	2002	1.4	4,473	$8,237	$0	$0.1204
OH Sharp 165/SB - 1320w Xtal	Mar-03	1.32	2,512	$7,476	$448	$0.1879
OH Sharp 165/TR - 1320w Xtal	Mar-03	1.32	3,447	$8,223	$358	$0.1414
OH Kyocera 158/TR - 1422w Xtal	Apr-03	1.422	3,518	$8,236	$0	$0.1318
OH Sanyo 167HIT/SB - 1336w Xtal/a-si	May-03	1.336	3,576	$8,962	$594	$0.1487
OH Unisolar 64/Trace - 1536w Xtal/a-si	Jun-03	1.536	4,223	$10,228	$0	$0.1240
OH BP SX150U/TR-1500w Xtal	May-03	1.5	3,457	$8,714	$0	$0.1261
OH Sanyo 180HIT/SB - 1440w Xtal/a-si	Jul-03	1.44	3,697	$8,955	$0	$0.1192
OH Shell 40/Tr-1440w a-si	Sep-03	1.44	3,482	$9,244	$297	$0.1090
OH Shell 150/Sharp-3000w Xtal	Sep-03	3	5,220	$16,991	$0	$0.1424
OH Shell 150/TR - 1500w Xtal	Feb-04	1.5	1,994	$8,414	$0	$0.1225
OH AstroPower/TR - 1500w Xtal	May-04	1.485	1,649	$8,532	$0	$0.1176
TOTALS		5,238.869	18,633,531	32,065,180	152,596	$0.1275

* Portion installed after January 1, 1997.

** Includes customer expenses for these systems.

*** Estimated after grant removal.

Renewable Generation Option Analysis

TEP has analyzed a number of possible options of renewable generation resources available to meet the implementation of a 10% renewable energy portfolio standard. The scenarios assume that all new renewable generation would be pure, that is not a mix of different resources. The scenarios are based on the actual 2004 hourly retail loads in the TEP service territory, modeled 2004 hourly wholesale electric prices at Palo Verde based on actual daily peak and off-peak prices, actual hourly solar electric generation at Springerville and Tucson sites and hourly wind resources at a northern Arizona monitoring site applied to a Vestas wind turbine. For comparison, the average wholesale electric price at Palo Verde in 2004 was $40.27 per MWh. The results of the pure Wind and pure Solar PV cases are summarized in the following table:

	All Fueled Generation	Apache County Wind Generation with Fueled Generation	Springerville Solar Generation with Fueled Generation	Tucson Solar Generation with Fueled Generation
Installed Renewable Energy Capacity - MW	0	586	582	582
Installed Renewable Cost at 2004 Prices - $M	$0	$703	$2,910	$3,056
Maximum Hourly Renewable Generation Capacity during 2004 - AC MW	0	586	527	501
Annual Renewable Energy Production - MWh	0	935,712	979,874	952,037
Renewable Energy Production Wholesale Energy Value - $	$0	$40,636,468	$42,684,139	$41,643,340
Average Renewable Energy Value - $/MWh	$0	$43.43	$43.56	$43.74
Annual TEP System Load Required Fueled Generation Minimum Demand - MW	609	58	369	390
Annual TEP System Load Required Maximum Fueled Generation Demand - MW	2,088	2,015	2,049	1,965
Effective System Capacity Support from Renewables - MW	0	73	39	123
Percent of Annual System Energy from Renewable Energy Resources	0%	9.56%	10.01%	9.72%

Note: Additional information about these scenarios is available in graphical format in the Wind and Solar PV sections of this report.

SOLAR THERMAL ELECTRIC GENERATION

PROGRAM DESCRIPTION

The purpose of the Solar Thermal Electric Generation Development Program is for technology review and economic assessment of the use of large scale solar thermal electric generators both in combination with existing thermal generating stations and in stand alone generating station applications. This includes solar resource assessment at a couple of possible solar trough sites in Arizona.

TEP reviewed the addition of Thermal Solar Trough produced heat to the condensate cycle of Springerville Generating Station Unit #1 ("SGS #1") and Unit #2 ("SGS #2").

In addition, during 2002, TEP received and evaluated a proposal for installation of a solar dish generation system and an opportunity to install a stand alone solar trough generation system.

There has been no significant testing activity in this area in 2004, but interest from private developers for a large solar thermal generation project in Arizona or a neighboring state has been increasing based on a number of contacts with potential developers.

PROGRESS AND PARTICIPATION

Testing has been performed on the extraction heaters of SGS to determine the steady state response to additional heat input in the condensate cycle. The test results were successful and subsequent review indicates that the installation of a solar trough system for SGS #1 and SGS #2 should be technically feasible. Detailed economic and constructability was reviewed in 2004 given the solar resource data taken at the site since 1999. It is not clear, at this time, that solar trough integration into SGS has a life cycle cost advantage over large-scale PV installations. This is primarily due to the temperature and wind extremes of the Springerville area, coupled with the general type of cloud patterns native to the area that do not support tracking concentrator type solar technologies. They do however support fixed plane PV applications. The solar trough system concept will be reviewed again in 2005 and 2006 as an option for installation at a southern Arizona location.

Detailed evaluation of the solar dish system for the Springerville site indicated the life cycle cost economics of the system being proposed was not yet competitive with the life cycle cost economics of large scale PVs. To a large degree, long-term operating costs were the driving force on the economics, but it was also found that the installed cost of a small solar dish system is not competitive with PV installations of a similar size. Performance history considerations were also part of the evaluation. Additional solar dish installations are proposed by APS. This data will be essential for evaluations of future solar dish proposals. The opportunity for installation of this type system was declined in 2003 and sufficient operating reliability and energy production data was not provided to make an informed decision for the 2004 or 2005 installation phase. The full detailed evaluation material was provided to the vendor proposing this project for its use in reducing the costs that have a strong influence on life cycle economics.

High level evaluation of the installation of a stand alone solar trough proposal indicated the initial cost was competitive with large scale PV installations. However, long-term operating costs adversely influenced the life cycle cost economics of single, relatively small, stand alone solar trough systems, which result in a higher life cycle cost than large scale PV systems. Consequently, this system opportunity was not chosen for installation in 2003, 2004 or 2005. The high level economic evaluation of this system was not provided to the vendor.

Solar resource assessment at SGS indicates that while the cool, windy site is ideal for solar generation from fixed plane PVs, the same factors are not beneficial to economic production of solar thermal electricity, where tracking concentrators are required. The gathering of solar thermal support data will continue at Springerville. Data is also being gathered from sites in Tucson as a possible future location of a thermal trough electric generation system.

CHALLENGES/BARRIERS

The installation of a new Digital Control System ("DCS") to include condensate, feedwater, boiler and turbine controls, and associated modeling and tuning was completed at SGS. This system will provide a better opportunity for modeling the transient reaction of the power generation cycle with condensate cycle solar heat input. However, given the results of the solar resource and climate review at Springerville, and the general incompatibility with solar concentrating technologies, this project analysis may not continue.

Both solar dish and solar trough generation technologies find it difficult to compete with the more "mature" technology of PV in small-scale installations. Small scale is likely being defined as less than roughly 20 MW. It is also difficult to raise the capital needed to install a large scale thermal solar generation system, given the somewhat poor reliability and performance history of that technology in Arizona. Also, thermal concentrator electrical generation technologies do not transfer to customer sited distributed generation applications as does the development of large scale PV. Arizona Public Service ("APS") is helping to overcome this barrier by assuming the technical and financial risk of installing additional solar dish and solar trough generation systems. TEP's renewable energy development program is directed at understanding the role and economics of PV deployment in Arizona, and will include thermal solar electric generation when those technologies are economically competitive with PV in the appropriate size increments.

No problems were encountered during this period.

PROGRAM CHANGES FOR 2005

There are no changes planned for 2005. Resource and system economics evaluation will continue.

LANDFILL GAS AND BIOMASS PROJECT

PROGRAM DESCRIPTION

The purpose of the Landfill Gas and Biomass Project program is to develop existing landfill gas and biomass / biogas resources into reliable, cost effective environmentally sensitive electric generation fuel sources. The program's purpose is also to find and economically use existing biomass / biogas resources to produce electric energy.

PROGRESS AND PARTICIPATION

In August 1999, TEP and the City of Tucson started electric production from the installation of a nominal 5 MW Landfill Gas System at the Los Reales Landfill in Tucson, Arizona. The landfill gas is piped from the landfill to the Sundt Unit 4 Generating Station where it is co-burned with coal and/or natural gas. During the very dry year of 2003, the average energy produced from landfill gas was 3,741 kW, and in 2004 the average energy production from landfill gas was 3,679 kW. However, based on previous generating performance exceeding a monthly average of 6,000 kW during periods of normal atmospheric moisture, and an expectation that repairs and improvements to the landfill gas collection system will be made by the landfill gas vendor in 2005, TEP is claiming 5,500 kW of landfill gas capacity in the Executive Summary.

To date (1999 through December 31, 2004) the project has displaced the use or production of the following:

Tons of Coal Not Burned	88,251
Tons of CO2 Not Produced	129,435
Tons of SO2 Not Produced	777

There were no costs beyond those expected of normal fueled generation from the operation of the landfill gas to energy system in 1999, 2000, 2001, 2002, 2003 or 2004. Thus, there are no expenses against the EPS surcharge or other sources of renewable generation revenue. EPS credits produced have been reported by TEP to meet EPS annual credit requirements, sold to other utilities providing additional revenue for solar generation development or banked for the future. The current status of EPS landfill gas generation production credits are reported in the EPS Programs Executive Summary.

In 2004 alone, landfill gas production displaced the use of 14,388 tons of coal, 21,103 tons of CO2 and 127 tons of SO2.

2004 Landfill Gas Generation Summary

	January	February	March	April	May	June	July	August	September	October	November	December	Year to Date
Landfill Gas Burned-Mscf From Operating Summary	59	46	57	52	50	57	46	52	56	59	57	59	650
Landfill Gas Ave Btu/scf From Operating Summary	489	495	494	488	478	469	477	494	516	536	515	515	497
Landfill Gas Heat Input-MMBtu Calculated From Op Summary	28,266	23,211	28,158	25,376	23,900	26,733	21,942	25,688	28,896	31,624	29,355	30,385	323,534
Unit 4 Net Heat Rate From Operating Summary	10,149	10,169	10,038	10,378	10,920	10,155	10,742	11,213	11,362	10,797	10,380	10,823	10,594
MMBtu of Landfill Gas From Invoice	28,873	22,792	28,152	25,394	23,914	26,745	21,931	25,676	28,887	31,601	29354	30392	323,711.00
Landfill Gas Generation in kWh Calculated From Data Above	2,844,911	2,241,322	2,804,543	2,446,907	2,189,927	2,633,678	2,041,612	2,289,842	2,542,422	2,926,832	2,827,938	2,808,094	30,598,027
Monthly U4 Service Hours From Operating Summary	744.00	606.87	735.77	702.27	640.85	720.00	585.27	683.50	714.42	738.68	705.40	740.37	8,317
Average Landfill Generation Capacity in kW - Calculated	3,824	3,693	3,812	3,484	3,417	3,658	3,488	3,350	3,559	3,962	4,009	3,793	3,679
Cumulative 2004 Landfill Gas Generation in kWh - Calculated	2,844,911	5,086,232	7,890,775	10,337,682	12,527,609	15,161,287	17,202,899	19,492,741	22,035,163	24,961,995	27,789,933	30,598,027	30,598,027
Unit #4 Coal Heat Value HHV in Btu/lb - Operating Summary	11,566	11,587	11,495	10,600	11,355	10,179	11,292	11,582	11,582	11,408	11,242	11,254	11,262
Coal Displaced by Landfill Gas, in Tons, Calculated	1,248.2	983.5	1,224.5	1,197.8	1,053.0	1,313.7	971.1	1,108.4	1,247.1	1,385.0	1,305.6	1,350.3	14,388
2004 Cumulative Coal Displaced By Landfill Gas in Tons	1,248.2	2,231.7	3,456.2	4,654.1	5,707.1	7,020.8	7,991.9	9,100.3	10,347.4	11,732.4	13,038.0	14,388.3	14,388
CO_2 Emissions Deferred by Burning Coal in Tons - 40% Fixed Carbon	1831	1442	1796	1757	1544	1927	1424	1626	1829	2031	1915	1980	21,103
2004 Cumulative CO_2 Emissions Deferred by Burning Coal - Tons	1831	3273	5069	6826	8370	10297	11721	13347	15176	17208	19122	21103	21,103
SO_2 Emissions Deferred by Burning Coal in Tons - 0.44% Sulfur	11	9	11	11	9	12	9	10	11	12	11	12	127
2004 Cumulative SO_2 Emissions Deferred by Burning Coal - Tons	11	20	30	41	50	62	70	80	91	103	115	127	127
Hours Available	744	696	744	720	744	720	744	744	720	744	720	744	8,784
On Line Availability Hours	744	606.87	735.77	702.27	640.85	720	585.27	683.5	714.42	738.68	705.4	740.37	8,317
Percentage on Line	100.00%	87.19%	98.89%	97.54%	86.14%	100.00%	78.67%	91.87%	99.23%	99.28%	97.97%	99.51%	94.69%

CHALLENGES/BARRIERS

The output of the Landfill Gas declined from 46,445,118 kWh in 2001 to 31,661,430 kWh in 2002, to 27,742,486 kWh in 2003, and increased slightly to 30,598,027 kWh in 2004. Although the average energy production from landfill gas was slightly higher in 2003 as compared with 2004, Sundt Unit 4 had an overhaul in January and February 2003, reducing the amount of time available for burning landfill gas. Consequently, average annual energy production declined in 2004 although total production increased.

1. The gas production rate is strongly related to the moisture in the landfill as well as the moisture introduced through atmospheric purge air; the wetter the season, the greater the gas production. The years 2002, 2003 and 2004 have been three of the driest years in recent history. Because of the drought, the gas output of the system was reduced.
2. Some of the gas capture wells and collection piping have been damaged due to bulldozers and other large vehicles running over the wells and collection piping resulting in no or low gas output from those wells. Repairs to some damaged items were made during the summer of 2002, and although eight new wells were scheduled to be placed in the existing landfill cells in 2004 to replace production lost from damaged collector pipes, that work and additional collection capacity from new landfill gas cells is now scheduled by the landfill gas vendor for mid 2005.

Generation of electricity from forest waste and numerous other biomass / biogas sources is being investigated with a number of interested Arizona based parties. Samples of various biomass sources have been collected and sent to selected companies for experimental gasification. Results of these tests indicate that while the materials tested are capable of being gasified by a small number of different processes, some materials are more prone to plug the new technologies than other materials. While these technical issues are a concern, they also increase the cost of production and economic considerations are currently the primary impediment to effective use of this resource. Harvesting costs alone for forest waste, if unsubsidized, are about four cents per kWh. Biomass transportation costs can add another two to three cents per kWh, depending on the material and distance of transport.

ANALYSIS AND EVALUATION

Optimization of landfill methane production is ongoing. During one month in 2001, the system produced an average of more than 6.5 MW. However, lower atmospheric moisture and rainfall levels in 2002, 2003 and 2004 have reduced the moisture introduced to the landfill from inlet purge air. Consequently, waste decay rates have reduced along with output of landfill gas and methane. As moisture introduced to the landfill through purge air is varied by atmospheric conditions, adjustments in purge air rates and landfill gas removal rates will be made to maintain a constant methane content percentage of about 50%. This adjustment will continue for the life of the landfill gas extraction.

A beneficial meeting to discuss landfill gas production issues, both short and long term, was held in December 2002 with the landfill gas vendor US Energy, the City of Tucson and TEP. Discussions of landfill gas improvements continued through 2003 and 2004 among the three interested parties. Information on long-term needs and opportunities was presented, landfill operational constraints noted, and more specific plans for future development of additional landfill gas resources introduced. Dialog between the three parties continued on a more frequent basis in 2003 and 2004 resulting in planned landfill gas capacity enhancement projects to be implemented in 2005.

PROGRAM CHANGES FOR 2005

TEP continues to review additional landfill gas to energy projects as well as a number of biomass/ biogas waste-to-energy opportunities. An ongoing technology search continues to find efficient technologies to convert a number of biomass products into electricity in a safe, reliable, cost-effective manner. The search will continue to locate technically feasible, economically advantageous and environmentally appropriate methods for converting forest waste, biogas and agricultural by-products into electricity. Landfill gas production enhancements will be installed in 2005 at the Los Reales Landfill in Tucson.

WIND RESOURCE DEVELOPMENT

PROGRAM DESCRIPTION

The purpose of the Wind Resource Development Program is for wind resource information gathering, technology review and economic assessment of the use of wind energy for electric generation both in combination with existing generating stations and in stand alone generating station applications.

Wind monitor stations have been installed by TEP throughout Arizona. At the end of December 2004, TEP was receiving data from eight, 40 meter survey towers and ground level wind data at an additional five fixed and two mobile monitor installations. While initial plans were to develop sites for an additional six monitor stations, results of the wind data collected from the existing monitor sites has left some doubt about the economic viability of the wind in the vicinity of the monitor sites, so the planning for development of additional monitor sites is on hold pending receipt of more wind data from the existing sites. The bulk of the monitoring is being performed in eastern Arizona around SGS. However, as customers have indicated an interest in development of wind resources in their area, TEP has monitored those areas showing signs of promise.

TEP participated with APS and Salt River Project in funding, through Northern Arizona University in collaboration with National Renewables Energy Laboratories ("NREL"), the development of a new high-resolution wind model for Arizona. The final wind model was issued for public use in August 2003. The new model indicates that wind capacity in the state of Arizona is likely to be viable in a few selected areas in the eastern and northern part of the state and on ridges and mountaintops, generally a great distance from Arizona's primary population centers. TEP provided NREL with wind data from all but one of its monitoring stations to use in verifying the wind model prior to public issue. The first seven months of wind resource monitoring activities in one of the areas predicted by the model to be a Class 5 wind regime have indicated the wind resource is likely closer to a Class 3 regime. However, the monitor station was installed just after the typical springtime windy season and the seven months of data taken indicate the site is better than any other TEP has monitored in Arizona. In general, Arizona's potential wind resource is not as plentiful or as geographically widespread as the Arizona solar resource. The wind in northern Arizona does have a positive correlation with the loads in the population centers in that the wind tends to blow in northern Arizona when the sun is shining in central and southern Arizona. That correlation of wind and electrical load does not exist for the site monitored in southern Arizona. The magnitude of the Arizona wind resource is significant and harvest of the wind resource must be given serious technical, economic and policy review. The next step in this review is to gather additional information for the installation of a planned grid of wind monitor towers. Development of additional transmission resources to move the wind energy to the population centers is a high priority once the locations of the economically viable wind resources are accurately determined.

PROGRESS AND PARTICIPATION

In 1997, TEP completed its first two-year monitoring period for wind and solar resources at seven locations in Arizona. Since that time an additional 22 sites have been chosen for monitoring. These sites have not yet included locations such as high ridges and mountain tops upon which the installation of wind turbines could have a scenic impact from the construction of roads to allow access to the ridges and mountaintops and the transmission lines that will need to be added to move the electricity to market and the operation of the wind turbines themselves.

One site a short distance west of Springerville, Arizona, has wind of very marginal economics, about 11% annual capacity factor. One site located northeast of Springerville had wind of even less economic value, as did a site in southern Arizona near Rain Valley. All three monitoring sites located on the property of SGS completed four years of data monitoring at the end of 2004, and monitor of the fourth site was discontinued as it did not show promise as a successful wind farm location. Of these sites, the best location has exhibited at best a 20% annual capacity factor, when corrected for elevation and temperature, not normally considered sufficient for development of a wind farm.

Three other sites completed a two-year monitor period at the end of July 2003, at which time the data was analyzed to determine the economic viability of wind generation at those sites. Data indicates one of those sites with a marginally economic level of wind resource at roughly 20% annual capacity factor, when corrected for elevation and temperature, given the newer models of wind turbines capable of operation at lower wind speeds. Two valley type sites that have been monitored for a year or more do not have an economically viable wind resource as compared to other sites. The monitor towers at both of these sites were relocated to new sites. The second monitor site in southern Arizona has exhibited a poor wind resource and its proximity to a canyon yielded a very shallow wind with little overall energy content during most hours of the year. This tower was relocated in late 2003 to another southern Arizona location, which the new wind model indicates may have promise. The year of data collected in 2004 does show a wind regime of marginally viable economics at this location.

TEP plans to continue monitoring wind data and is currently waiting for the one year results of the survey towers installed a great distance west of Springerville, Arizona, before continuing negotiations for use of up to an additional 12 wind survey sites in Arizona. These towers would be planned for installation in the first half of 2006. TEP will need to plan for permits to be issued as these sites are on state land. To date, TEP has spent $152,519 on wind survey tower installation and data analysis.

The following charts show basic wind speed and forecast capacity factor information for the six monitor sites for which a full year of data is available and wind speed only seven months of data for the two towers west of Springerville. The 2004 wind duration curve is also shown for each of the full year of data sites. Note the higher capacity factor values for peak daylight hours and generally for peak summer hours. Site 0513 is located in southern Arizona, the others are in northern Arizona. The 40 meter wind speed sensor of 0513 was disabled by lightning after two months of operation. The wind power frequency plots assume an installed capacity of 586 MW of wind generation at each site using wind generators with a hub height of 70 meters.

2004 Wind Survey Data Summary in MPH

Site:	40 M	30 M	20 M	10 M
0301	11.53	10.88	10.41	9.34
0302	11.21	10.12	9.73	8.73
0304	11.53	9.81	10.09	8.43
0501	12.01	9.59	8.62	9.20
0513	BAD	11.27	10.97	10.04
0601	12.71	12.64	11.86	9.62
0602	13.14	13.05	12.68	12.49
0603	13.50	13.18	12.62	11.83

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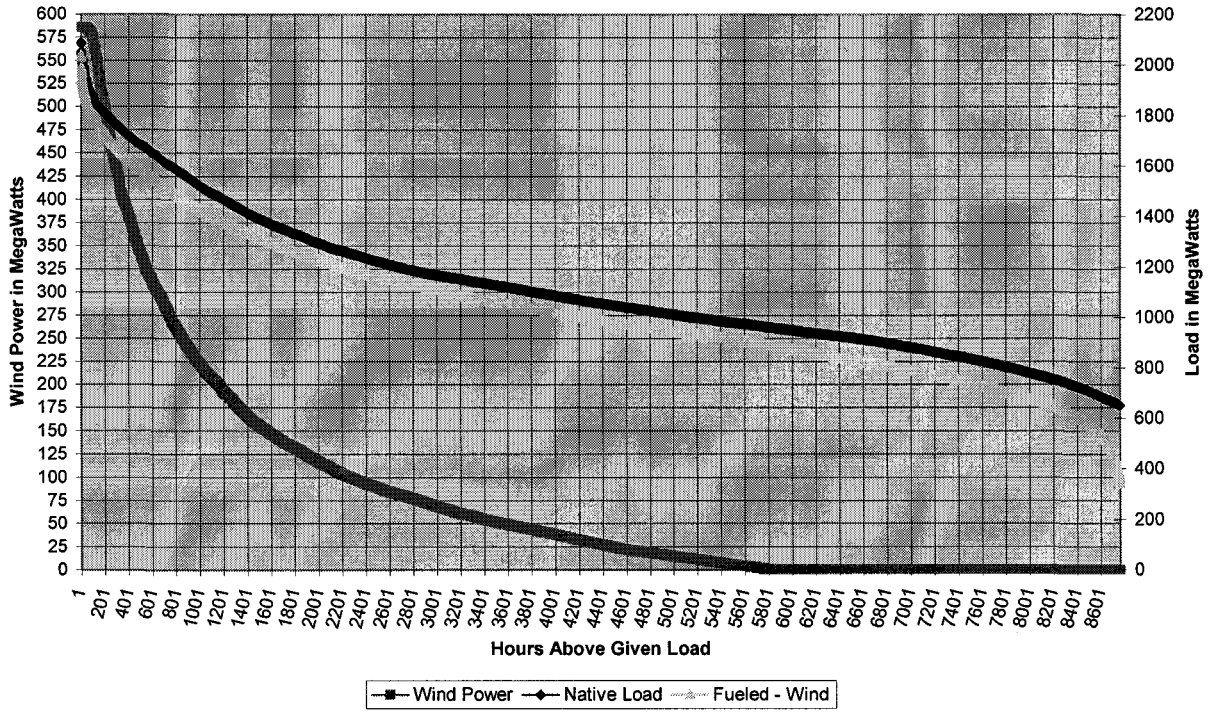
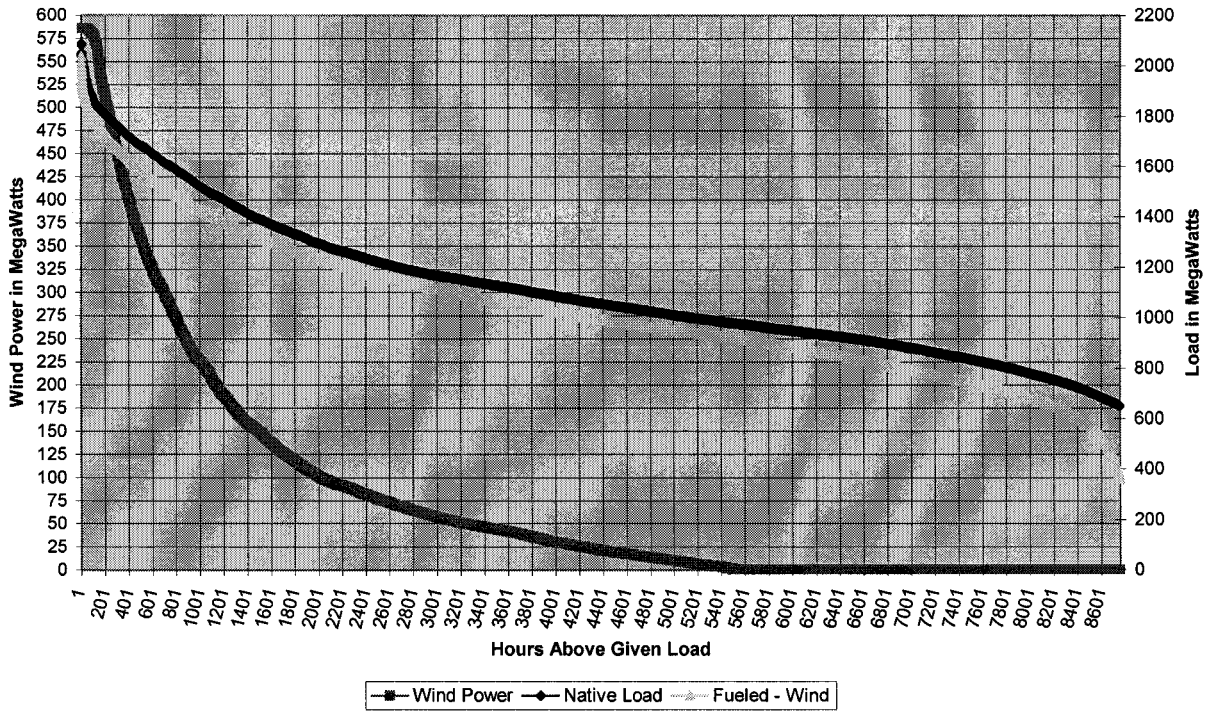
Site 0301 Capacity Factors			
	All Hours	Peak Hours	Summer Peak Hours
Average	13.80%	20.84%	22.83%
Max MW	586.0	586.0	579.6
Min MW	0.0	0.0	0.0

0301 - 2004 Wind Power Frequency Plot



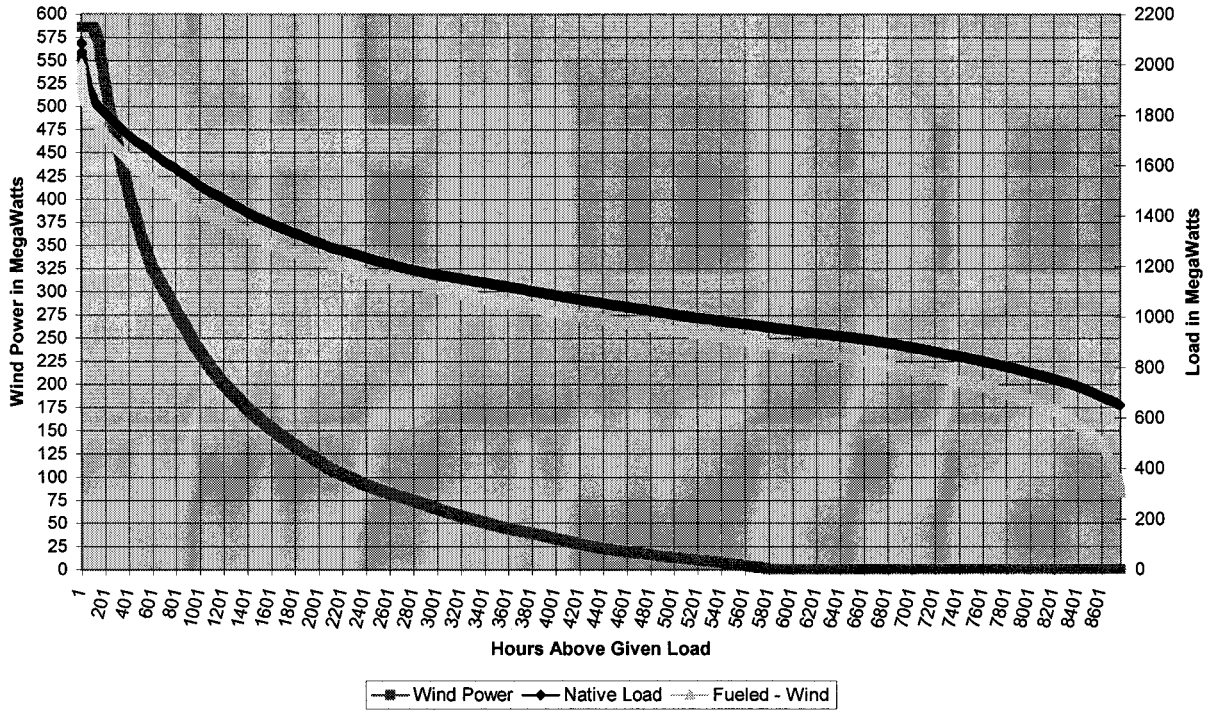
Site 0302 Capacity Factors			
	All Hours	Peak Hours	Summer Peak Hours
Average	13.31%	20.17%	24.00%
Max MW	586.0	586.0	582.3
Min MW	0.0	0.0	0.0

0302 - 2004 Wind Power Frequency Plot



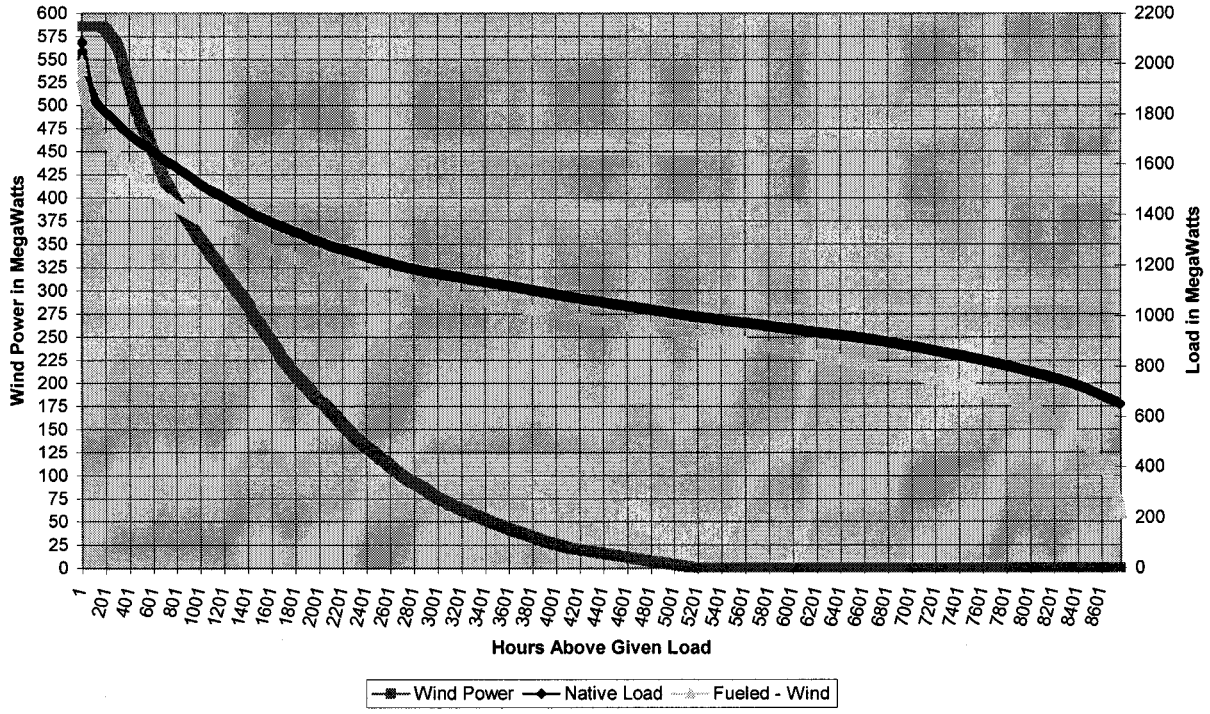
Site 0304 Capacity Factors			
	All Hours	Peak Hours	Summer Peak Hours
Average	14.08%	20.77%	22.19%
Max MW	586.0	586.0	564.1
Min MW	0.0	0.0	0.0

0304 - 2004 Wind Power Frequency Plot



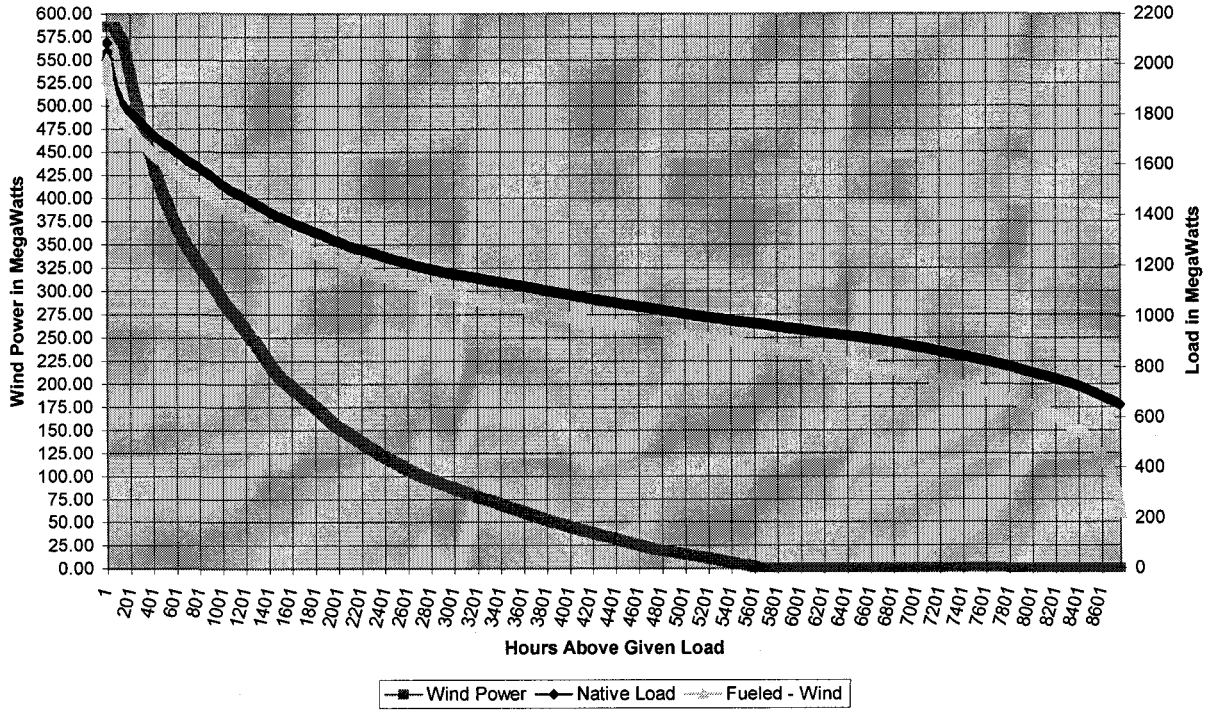
Site 0501 Capacity Factors			
	All Hours	Peak Hours	Summer Peak Hours
Average	18.23%	26.32%	32.83%
Max MW	586.0	586.0	586.0
Min MW	0.0	0.0	0.0

0501 - 2004 Wind Power Frequency Plot



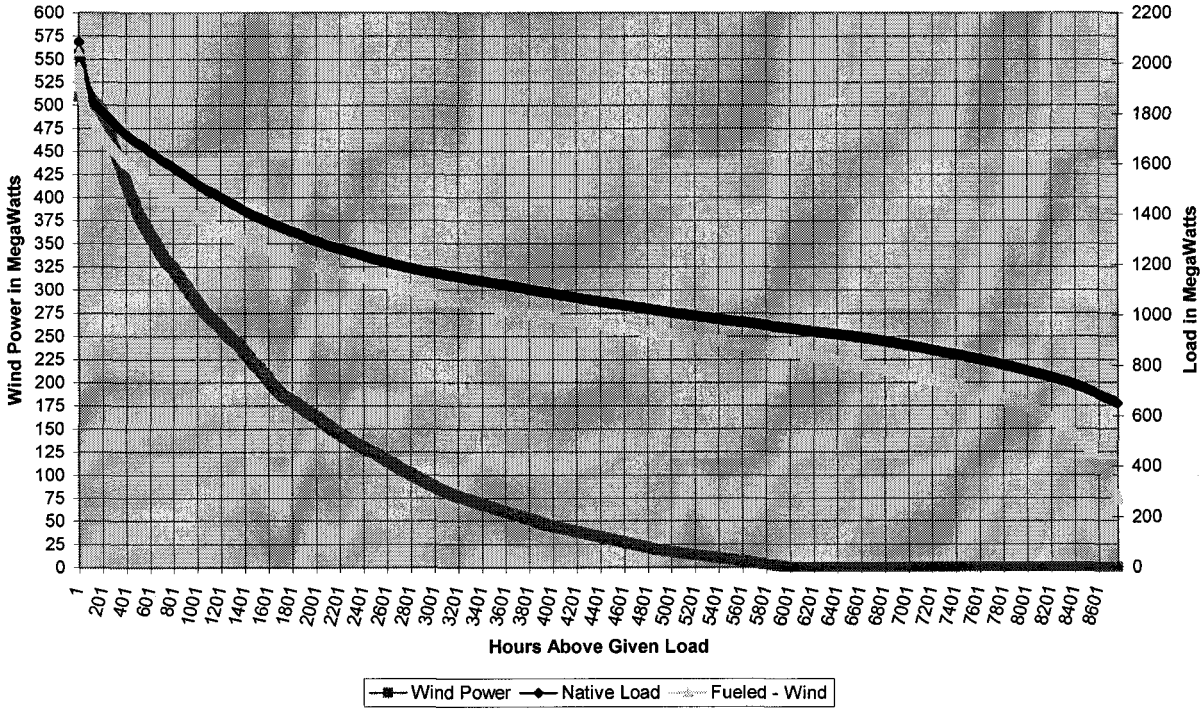
Site 0513 Capacity Factors			
	All Hours	Peak Hours	Summer Peak Hours
Average	16.60%	19.06%	15.96%
Max MW	586.0	586.0	564.4
Min MW	0.0	0.0	0.0

0513 - 2004 Wind Power Frequency Plot

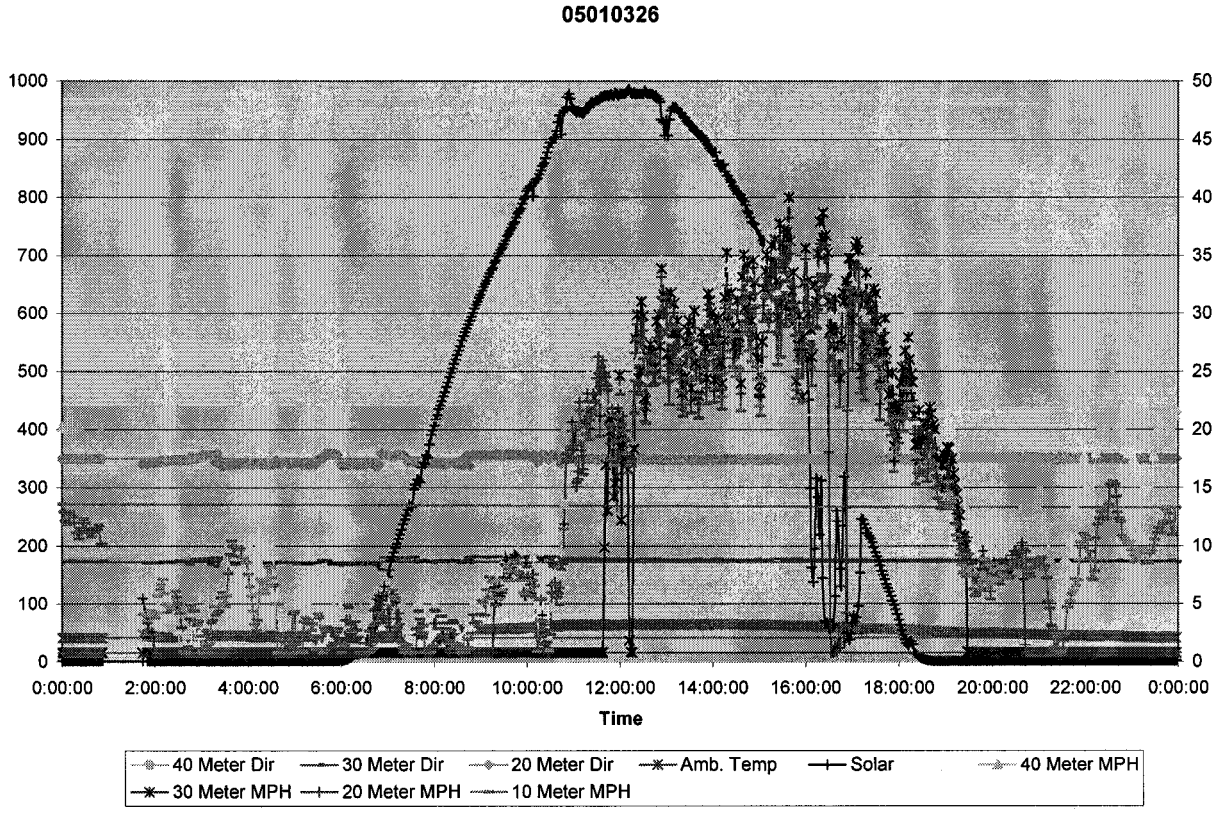


Site 0601 Capacity Factors			
	All Hours	Peak Hours	Summer Peak Hours
Average	19.09%	23.66%	27.80%
Max MW	586.0	586.0	580.8
Min MW	0.0	0.0	0.0

0601 - 2004 Wind Power Frequency Plot



The wind is moderately to heavily turbulent in Arizona and has significant variability throughout the day. The graph below indicates a typical spring daily wind regime in northern Arizona. The points represent average two minute samples. The maximum daily standard deviation for one second samples within the two minute sample windows was 7.15 mph and the average one second standard deviation in the two minute windows for the day was 1.80 mph. This indicates a very variable wind regime.



CHALLENGES/BARRIERS

It is at times difficult to obtain permits for wind monitor tower erection in a timely manner. There have been times when TEP waited for more than a year for permits for survey tower installations on state land. However, discussions with the State Land Department have resulted in a better understanding of the permit process and procedures have been developed to streamline the process in the future.

Reliability of wind direction instrumentation continues to be a problem on towers of heights greater than 20 meters. In addition to more than a dozen wind direction sensor failures in the past, TEP monitor towers have also experienced failure of seven anemometers. The manufacturer addressed these concerns with new sensor models, but two of the failures were with the new model anemometers. TEP now installs two anemometers at the 40 meter level to allow for failure of anemometers and wind direction sensors at all four instrumented elevations. No new sensor failures have been experienced in 2004.

Just as there is a need to develop PV equipment that is well suited for operation in the Arizona climate, there is a need to develop wind generation machines that will operate reliably and efficiently in the Arizona climate. The low air density that results from high ambient air temperatures and/or high elevations must be considered in the selection of appropriate wind generators for use in Arizona as must the relatively high wind turbulence encountered at many times of the year. There is some good work being performed in developing low speed wind regime turbines at the national laboratory level. This work should result in commercial wind turbines appropriate for use in Arizona in the 2007 to 2010 timeframe.

The new Arizona wind resource map shows the best wind resources located on mountain ridges and tops. The citizens of Arizona have been protective of the scenic vistas of their mountain ranges. The proposed installation of wind turbines on Arizona mountain ranges may bring conflict with residents during the permitting phase, which TEP experienced in Huachuca City, Arizona. Preliminary data taken from survey sites on the gently sloping plains of eastern Arizona indicate that while wind generation is technically viable in those plain locations, due to lower average wind speed regimes in these locations the cost of electricity will be higher than if the wind generators were located on mountain ridges. The cost of developing these wind resources with needed transmission is still likely to be less than 10 cents per kWh, but more than seven cents per kWh. Preliminary evaluation of the scope of resources required for development of this large wind resource indicates the need for additional transmission capacity between northern Arizona and the population centers of Arizona. At this time, the necessary transmission capacity upgrades have not been quantified since the geographic scope of the best wind regimes has not been determined definitively.

The data that has been gathered over the past nine years indicates that the wind regime at the monitor sites in Arizona is not fully predictable and is highly variable with numerous periods of very high rates of change. Integration of generation from this variable wind regime will require the use of fueled generation and/or energy storage technology to offset the variations in wind generation to maintain compliance with the NERC CPS-2 grid Average Control Error reliability standard. TEP will continue to study and analyze wind data to determine tools for use in mitigating adverse effects to the stability and reliability of the electrical grid when using large amounts of wind generation in the future.

An informal request for wind turbine pricing in 2003 resulted in budgetary quotes that were 40% higher for the wind turbine machines alone than are reported as installed costs by wind developers for wind turbines installed in other states. In 2004, TEP requested proposals for wind power from three wind developers, and at the end of 2004 had received only general proposals from two parties. TEP expects to issue a Request for Proposals ("RFP") in early 2005 for the possible purchase of wind energy.

PROGRAM CHANGES FOR 2005

TEP plans to continue evaluating the data from existing wind survey sites, reviewing geographic information to predict new potential wind resource sites and licensing sites for installation of wind and solar resource monitor instrumentation. This data will be used for evaluation of possible wind generation locations and for evaluation of bids received in response to a wind energy RFP in early 2005. The data will also be used to find tools for mitigating the effect on the reliability and stability of the electrical grid from the intermittency of wind generation. While summary wind speed and projected capacity factor data was presented in this report, detailed wind speed data will be shared upon request with entities like NREL and other wind energy development entities under terms of non-disclosure agreements. However, data from sites that have demonstrated poor wind economics will be shared upon request with all others to reduce duplicate expenditures in low yield areas.

RESULTS AND FORECASTS

The following is a graph of the TEP 2004 hourly native retail load, overlaid by the hourly energy produced by 586 MW of hypothetical wind generation located at the area of one of the TEP monitor stations and the effect on fueled generation demand reduction (73 MW) from the application of 586 MW of wind capacity. The 586 MW of wind capacity was chosen as the level needed to produce 9.56% of the TEP annual retail energy sold from new renewable generation sources in 2004, which is about the proposed national renewable portfolio standard of 10%. The reduction of the need for fueled generation is shown by the displacement between the red points and the yellow points. Where they are coincident, there is no displacement of fueled generation from wind.

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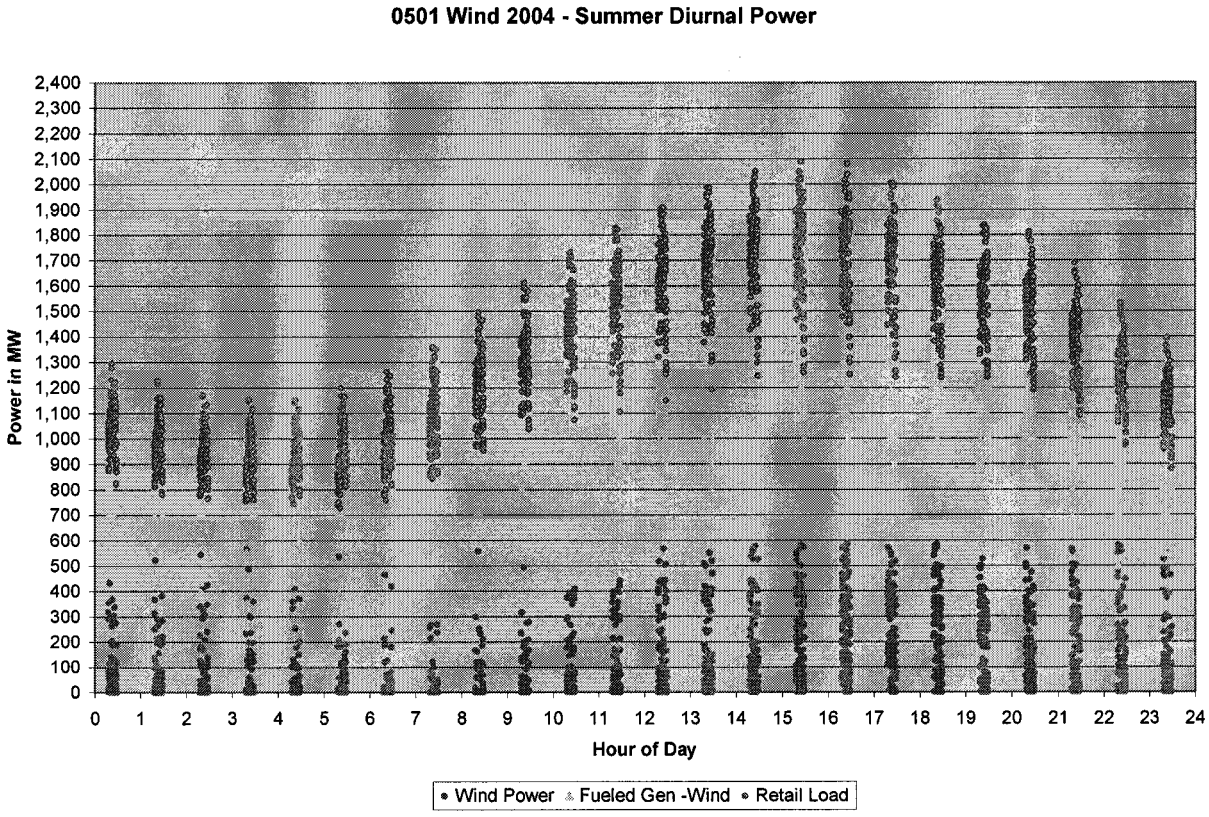

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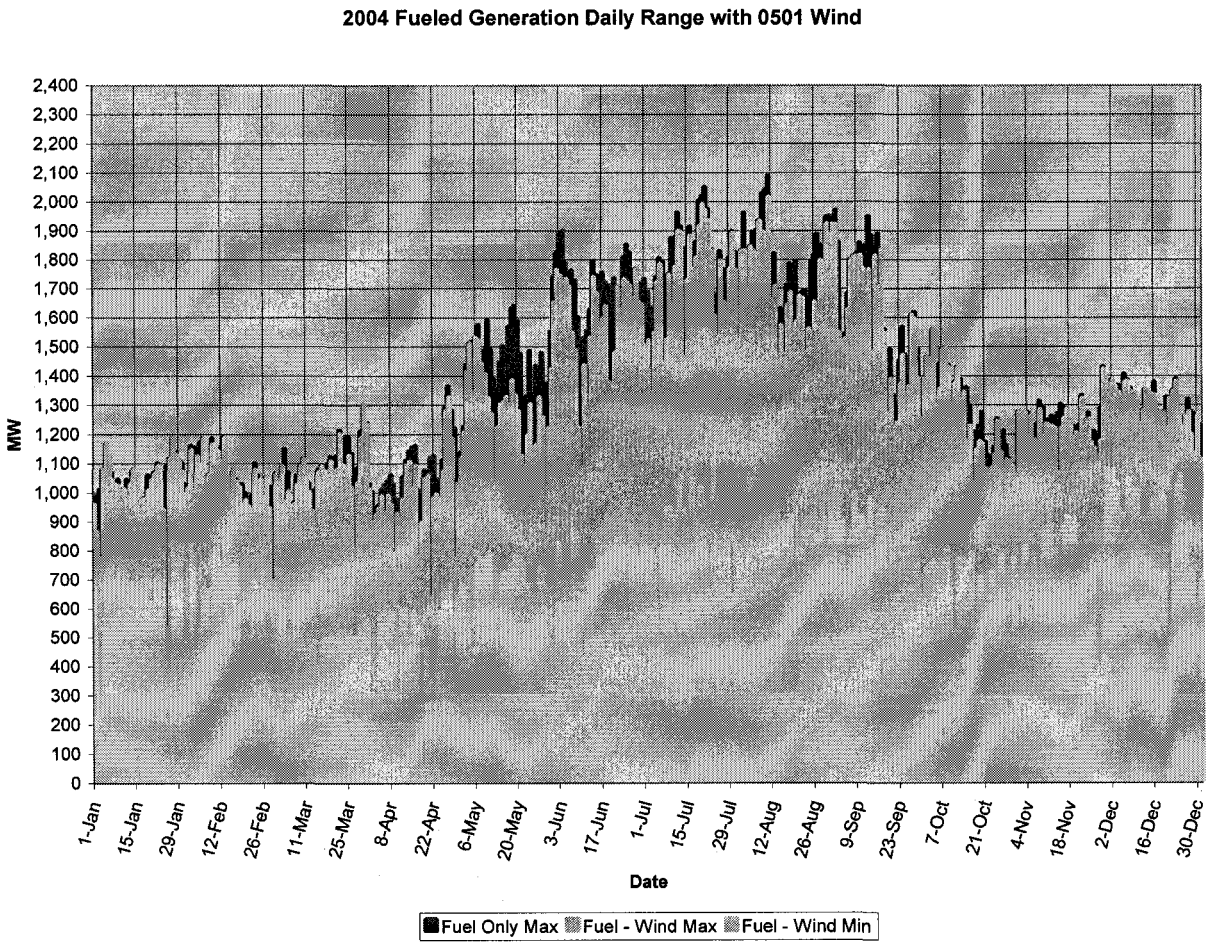
Below is a graph of the TEP 2004 hourly daily maximum and minimum native load generation demand as if provided by:

1. Maximum daily demand met by fueled generation only, in red;
2. Maximum daily demand met by fueled generation as reduced by 586 MW of wind generation, in pink; and
3. Minimum daily demand met by fueled generation as reduced by 586 MW of wind generation, in blue.

Minimum daily loads are much more difficult to predict with a significant amount of wind generation as part of the generation resource base. Displacement of peak fueled capacity needs by wind energy is indicated where the red shows through the pink areas. Displacement of fueled generation by wind energy at minimum loads is indicated where the pink show through the blue areas.



GEOTHERMAL ELECTRIC DEVELOPMENT

PROGRAM DESCRIPTION

The purpose of the Geothermal Electric Development Program is for exploration and basic research into the location and extent of high thermal level geothermal resources in Arizona. If the results of the research indicate a high probability that such resources exist, with a reasonable opportunity of development success and low electricity production costs, the second phase of the program will be development of the most appropriate generation technologies given the need for appropriate economic viability and minimal, if not zero, environmental impact.

PROGRESS AND PARTICIPATION

Several meetings were held in Arizona in 2002, 2003 and 2004 to determine locations of possible geothermal resources, potential output power, interconnection points to the electric grid and associated development costs. To date, there have not been any geothermal generators installed in Arizona. Review of the NREL geothermal maps indicates that Arizona does not have significant amounts of high thermal level geothermal resources like our neighbors Nevada, Utah and California. Last decade there was an exploratory geothermal resource well bored near Nutrioso, Arizona, using Department of Energy funding. The results of this exploratory well were made available for review by TEP. The review indicated a lack of sufficient thermal gradient to justify any further review of that site or the surrounding related geology for geothermal development.

No funds were expended by TEP on geothermal generation projects in 2002, 2003 or 2004. However, some time was spent attending meetings regarding potential geothermal opportunities in Arizona. TEP also reviewed significant amounts of background information on geothermal resources, such as volcanic intrusions in Arizona, and evaluated the technologies used for geothermal generation in other states. In addition, time was devoted to reviewing state of the art geothermal generation technologies applicable to Arizona. Project economics indicates that capital costs of high thermal level wet geothermal generation projects, of a size below 20 MW, are prohibitive to the development of the project when compared to the generation costs of other Arizona renewable resources. Development of dry hot rock resources is prohibitive in Arizona at any size, given current geothermal generation, drilling and reservoir encapsulation technologies and environmental issues specific to Arizona. It has been the general belief at some meetings attended by TEP that commercial development of a geothermal resource will require sufficient energy resource to sustain at least 50 MW of generation for 24 by 7 operations for a period of at least 50 years.

GeoPowering America has taken a lead in the identification of Arizona geothermal resources along with significant involvement of many professors at Northern Arizona University.

Two major volcanic intrusions have been identified in Arizona. The one with greater promise is located north of Flagstaff, Arizona, but is primarily located under National Forest land, much of which has been declared as protected habitat. The second volcanic intrusion is located north of Springerville, Arizona, but is an older intrusion, which may not have as much high level thermal energy remaining to be tapped. In both cases, it is expected that the geothermal heat resource will be found at a depth of at least 5,000 feet below ground surface and could be as much as 10,000 feet below. Consequently, the cost of resource exploration could be significant.

Other work in geothermal exploration for electric power generation and thermal heating applications is being performed in southeastern Arizona. A promising opportunity is being explored by Arizona utilities and private entities near Clifton, close to the site of a known hot spring.

CHALLENGES/BARRIERS

There are high capital costs and low success risk factors associated with past exploration efforts for geothermal resources in Arizona. Currently there are very few federal or state grant funding sources available to share the financial risk of exploration for these projects. In the past, a number of geothermal resources were identified in the southwestern U.S. and developed with generation systems, only to find the resource was not sustainable. Unfortunately, this resulted in cancellation of the construction projects or closure of operating plants. In the 1990s the largest known U.S. resource of geothermal energy at The Geysers in California was oversubscribed and energy output declined. Since that time better methods for determining the long-term sustainable energy production of a geothermal resource have been developed as well as more efficient generation technologies. Advanced technologies have been implemented for handling significant amounts of somewhat mineral laden water, with full respect for environmental compatibility. Permitting challenges still remain once a geothermal resource is identified in or near inhabited areas or those with protected habitat.

PROGRAM CHANGES FOR 2005

At this time, TEP has no plans to continue involvement in GeoPowering America meetings. Given the high development risk and somewhat limited range of potential geothermal resources available for power generation in Arizona, our focus will be placed elsewhere. Mainly, our attention will be directed towards developing other Arizona renewable resources, which at this time appear to have lower risk and development costs. Accordingly, this will be the last report regarding geothermal development activities.

SOLAR PV RESOURCE DEVELOPMENT

The TEP Solar PV program is designed to develop large utility scale distributed PV generation systems as well as provide incentives and support for TEP customers to install PV on their premises in a safe, economical manner, which maximizes electrical production from the sun. The large utility scale installations provide the opportunity to provide cost savings through long-term purchases from specific manufacturers and to reduce the cost of solar components through bulk purchasing for the customer based systems.

The goal of the program is to best meet the annual solar electric generation energy requirements of the EPS within the limited funding provided by the EPS, while providing sufficient long-term PV demand to drive down PV component costs during the term of the EPS, and to provide feedback to PV component makers to help them improve the safety, reliability and performance of their products to help move the PV industry to product maturity.

PROGRESS AND PARTICIPATION

Large Utility Size Distributed Generation

Installation of large utility scale distributed generation PV systems totaling 4,871 kW DC were completed by the end of December 2004 in Tucson and at Springerville. These systems use PV array building blocks of 21.6 kW DC to 135 kW DC in size, and represented 93.15% of the TEP solar generation base at the end of 2004, while producing 94.92% of the solar electricity in 2004. Different PV module technologies have been used, including crystalline silicon, Cad-Tel, CIGS and amorphous silicon. Testing of new module technologies is supported by TEP at the utility scale PV system sites. The results of daily energy production performance are shared with interested manufacturers, and used to identify and correct performance related problems. These systems are heavily instrumented and results are reviewed daily to ensure proper operation of the systems. Effective availability of the largest systems in 2002 was 99.43%, 99.78% in 2003 and 99.72% in 2004, a very high online operational record for any generating system. These have proven to be very cost effective installations using the opportunity provided by the EPS program to eliminate financing charges. Finance charges are a considerable portion of total costs in high capital, low operational cost projects such as PV. Elimination of finance charges to reduce life cycle ownership costs using the "pay as you go" up front funding concept inherent in the EPS mechanism adopted by the ACC has made a significant reduction in life cycle cost of energy generated with PV. Evaluation of life cycle costs given limited experience with long-term operating costs of large scale PV indicate that large utility scale distributed PV generation systems should produce EPS Solar credits at a cost less than produced by small solar generating systems.

In 2003, one partnering manufacturer retested PV modules that had been in service in Tucson for 28 months to test for dirt and time related output degradation. Modules were tested first without cleaning and then after cleaning. Results indicated less than 1% output degradation from dirt on modules that had not been cleaned in two years and overall time related degradation of clean modules much less than that expected.

Module reliability is very good, with replacement of only one ASE module, a number of first generation First Solar modules and 11 BP Solarex modules required at the SGSSS in 2004. The most unreliable parts of the SGSSS are the data collection system and the step up transformers. However, changes were made in early 2004 to address the sensitivity to static of the data collection system and setpoint changes were made to limit the power output of the PV systems during sunsplash conditions to reduce the transformer overloading problem on SCL4.

Analysis was performed on the performance data of the SGSSS PV systems by installation date and module technology comparing 2001 data with 2004 to determine if there has been module performance degradation. The rate of degradation for all three module technologies was within the temperature variant noise in the data created by the Licor solar sensors. In other words, the modules are more stable than the sensors used to measure the solar input, and the data analyzed indicated the module performance of all three technologies had improved with time. Two new stable MSX-01 style solar sensors were installed in late 2003 and will be used for baseline data for the next long-term performance review after 2006 annual data is available.

The units at Springerville experienced numerous failures of the distribution grid during 2004. Some planned, some not planned. In all cases all inverters met their IEEE-929 island detection requirements, even with 34 inverters in parallel on the line and some inductive pump motor load, and disconnected nearly instantaneously. Power factor and harmonic testing at numerous loads indicated all parameters were within specifications. As additional inverters are added and the installed capacity of PV approaches the installed load of the pumps and other loads on the radial line, it will be instructive to monitor the transient response of line faults as verification of correct IEEE-929 compliance. There were numerous events recorded where inverters in Tucson and at Springerville detected a transmission or distribution line disturbance and disconnected the inverter from the grid. In these cases the reasons recorded for disconnect by the inverters were not always consistent. Four events were recorded in 2004 where a grid disturbance in one area triggered a trip of an inverter in a remote area. For example, the loss of all three Palo Verde generators on June 14, 2004 resulted in nearly all Tucson based PV inverters, and one Springerville inverter tripping off line for the required five minutes before automatically reconnecting. Data and documentation of these events continues and TEP is working with one inverter manufacturer and the Sandia National Laboratories to find and test solutions to this grid destabilizing effect that occurs because of the implementation of the IEEE-929 standard.

2004 ANNUAL SOLAR ENERGY PRODUCTION

Category	Installed Capacity	Annual Energy	Energy %
SunShare Systems	239 kWDCp	263 MWh	3.30
TEP Customer Sited	130 kWDCp	142 MWh	1.78
TEP Utility Scale	4,871 kWDCp	7,559 MWh	94.92
TEP Solar Energy	5,240 kWDCp	7,964 MWh	100.00

TEP has sufficient numbers of PV systems of various sizes, locations and technology types to begin making comparisons of these factors on the annual energy production performance of PV systems. These comparisons are made by normalizing the annual energy output by the manufacturers rated power of the total power rating of the PV array modules as measured at the Standard Test Conditions ("STC") by a factory test. Some general trends observed based on 2004 specific annual energy production of systems that had a full year of operation:

- Utility scale PV systems have proven to be more productive than smaller PV systems.
- The cool, windy location of SGSSS has proven more energy productive than Tucson for fixed tilt PV installations.
- Crystalline Silicon modules and some thin film modules have nearly equal specific annual energy production I fixed latitude tilt PV application at Springerville.
- The specific site characteristics including maximum and minimum temperatures, maximum wind speed and the type of clouds normally experienced will in very large part determine which type of solar generation technology is most appropriate for a given site. While fixed latitude tilt PV is an excellent choice for Springerville, tracking PV is more appropriate for a less windy location like Prescott and tracking thermal concentrator solar is more appropriate for the hot desert west of Phoenix.

The concept of installing incremental amounts of solar generation at existing coal power plants to take advantage of existing transmission infrastructure and more effectively use the large amounts of property used as guard space around these plants is being developed as experience is gained in the design and operation of the SGSSS.

Results of the specific performance of the different categories of PV systems in 2004 that had a full year of operation:

2003 AND 2004 ANNUAL SPECIFIC ENERGY OUTPUT IN KWH AC PER KWDCP @ STC

	2003	2004
SunShare Option 2 Average:	1,347	1,316
SunShare All Options Average:	1,375	1,286
TEP Tucson Sited Small Systems Average:	1,429	1,503
TEP "Tucson" Sited Large Systems Average:	1,596	1,585
SGSSS Sited a-si Module Type Average:	1,602	1,567
SGSSS Sited CdTe Module Type Average:	1,664	1,722
SGSSS Sited C-si Module Type Average:	1,743	1,719

- SunShare Option 2 systems are all less than 10 kWDCp in size, amorphous, and crystalline silicon module technology systems, located on customer sites in Tucson.
- SunShare Option 1 and 3 systems are all less than 10 kWDCp in size of various module technologies, primarily crystalline silicon, located on customer sites in Tucson.

- TEP Tucson Sited Small Utility Systems are all less than 10 kWDCp in size of various module technologies, primarily crystalline silicon, located either on customer sites or TEP's OH solar test facility in southeastern Tucson.
- TEP Tucson Sited Large Utility Systems are all larger than 10 kWDCp in size, all of crystalline silicon module technology, located either on customer sites or TEP's property in Tucson and includes the single 22 kWDCp system at the Auto Shop at SGS and the single 30 kWDCp system at Fort Huachuca.
- SGSSS Sited Systems are the systems at the West Well field area of SGS. These systems are distinguished by differences in the module technology used in the various systems. Note that there were array enhancements made to the CdTe systems during late 2003 and during 2004, so the results are not fully comparable to the results of the other SGSSS technologies.

Small Utility Supported Distributed Generation

Installation of small TEP supported distributed generation systems throughout Tucson has been successful in providing energy in support of EPS solar credit goals and in developing public interest in solar energy. To date 331 kW DC of small TEP supported and maintained PV systems have been installed on customer premises or TEP property. These systems represent 2.48% of the TEP solar generation base at the end of 2004, while producing 1.78% of the solar electricity in 2004. These systems do not provide the same economics for production of EPS solar credits as the large scale PV systems, but provide better solar program visibility. Some GreenWatts revenues are used for support of solar installations in the Tucson area, such as at the Tohono Chul Museum, Pima Air Museum, Safford Middle School, Palo Verde High School, Hohokum Middle School, Tucson Botanical Gardens, and Civano School, among others.

Customer Partnering Distributed Generation

TEP has partnered with customers, notably the City of Tucson, to install medium-sized customer owned and sited PV systems totaling 43 kW DC. These systems represent 1.00% of the TEP solar generation base at the end of 2003, while producing 1.23% of the solar electricity in 2003. These systems provide the opportunity for significant leverage of EPS funding and provide EPS Solar credits at the lowest life cycle costs. However, there are a limited number of customers with available funding to support these types of projects. Some GreenWatts revenues are used for support of these installations.

SunShare

TEP offers the SunShare hardware buy-down program, with ACC approval, to its customers. Since the program was offered in 2001, there have been more than 1,265 expressions of interest. To date, there have been 119 participants installing PV systems. Of these participants, 23 have chosen Option 1, 48 have chosen Option 2, and 48 have chosen Option 3. There were 57 customers who installed PV systems in 2004 as part of SunShare, representing 122 kW DC. There is currently 326 kW DC of customer sited, installed PV capacity as part of the SunShare program. These systems represent 4.56% of the TEP solar generation base at the end of 2004, while producing 3.30% of the solar electricity in 2004.

The SunShare program was developed to support EPS program goals with small customer based distributed generation PV systems through hardware buy down payments to customers installing any qualifying PV system of their choice (Option 1), and offer of a pre-qualified PV system at a significantly discounted price as compared to market rates (Option 2).

TEP requested in 2003, and received on February 10, 2004, ACC approval for changes in the SunShare program offerings for 2004, 2005 and 2006, including the offering of a new Option 3, to allow more customers to qualify for the program while retaining high standards for safety, reliability and performance of systems in the SunShare program. In August 2004, the ACC approved an increase in SunShare Option 3 funding from $2 per DC watt to $3 per DC watt with an annual reduction of $0.30 per DC watt.

The SunShare program changes include:

1. Adds Option 3, which provides for a $3.00 per DC watt subsidy payment instead of the $2.00 per AC watt (roughly $1.33 per DC watt) payment of Option 1 or Option 2. Maintenance is not included in this Option, but does include an annual inspection to ensure the equipment is functional and performs as designed. This Option offers more customer choice.
2. Adds a factor for off angle or shaded installations, reducing the subsidy payment by the percentage of the amount of expected annual energy output reduction from the off angle or shading condition. A table defining the percent reduction is included in program documents for easy prediction of the reduction percentage. The percentage reduction affects all three options. The system must face from 90 degrees east of north through south to 90 degrees west of north and have an angle of 10 degrees to 60 degrees from horizontal and be fully unshaded from three hours after sunrise to three hours before sunset to qualify. This should allow more installations to qualify, while retaining an annual energy based subsidy criteria.
3. A minimum of module clearance distance qualification has been added to ensure output is not reduced from overheating due to lack of natural convective cooling.
4. Increases the maximum qualifying PV system size from 5 kW AC to 10 kW AC, or what is typically about 15 kW DC. The minimum size remains at 800 watts AC or about 1200 watts DC. All systems will still be metered, and TEP still supplies the meter and meter socket. This change should allow more systems to qualify and matches the maximum size of a net metered system.
5. Removes the 5 kW system from Option 2, as that system could never be offered due to lack of a qualifying inverter. Limits Option 2 kits to 10 maximum per customer.
6. The program still has an annual cap of 200 kW of qualifying PV installations. The program will be offered in 2004, 2005 and 2006.
7. The Option 1 rating can now be determined either by test or by comparison to historical data of another "equal" system.

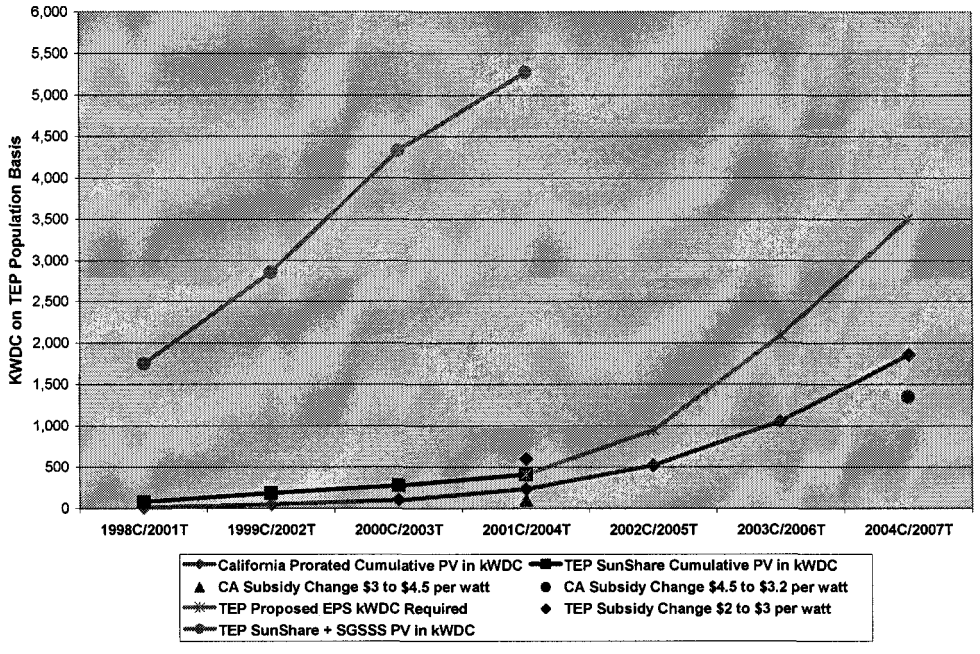
8. Revised the SunShare Annual Report filing date to April 15 to coincide with the DSM/Renewable Report filing date to simplify reporting requirements.

In 2004, a new program was added for UNS Electric, Inc., a subsidiary of UniSource Energy Services, Inc., which provides the same rebate option as TEP's Option 3 program, with an annual cap of 50 kW. This program represents customers in Lake Havasu, Kingman and Nogales service territories.

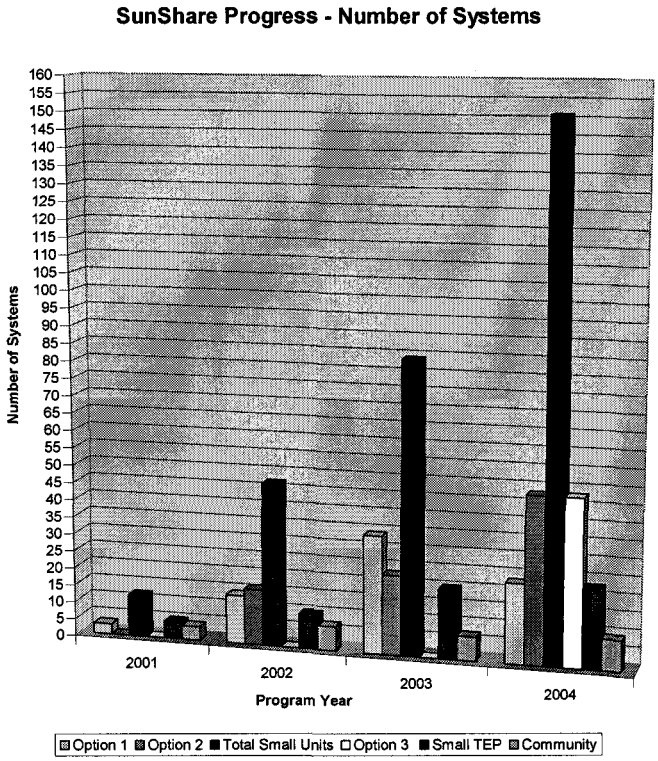
TEP provides extensive outreach and education about the benefits of solar energy, as described in the Executive Summary of this report, for promotion of the SunShare program. Because of the close coordination with customers to build confidence in solar technologies, the SunShare Program has shown steady participation gains in its four years of existence. The first four years of the SunShare program has been more successful than the first four years of the California Emerging Technologies solar programs on a per capita basis.

The following graphs demonstrate that progress. These include the capacity of the City of Tucson's Hayden/Udall Water Treatment Solar Generation system installed in 2002, since TEP does provide maintenance support of the system under a separate agreement similar to the SunShare program maintenance. The graph shows the level of SunShare participation needed to meet the goals in the proposed EPS rules for solar generation (orange line) in years after 2004 as compared to the similar years of the California solar support programs (magenta line) along with the level of solar installation per capita if the utility scale PV systems are included in the TEP totals (green line).

Comparison of California to Tucson Electric Power
Cumulative Distributed PV Generation Capacity Installed



PROGRESS BY YEAR FOR THE SUNSHARE PROGRAM – NUMBER OF PARTICIPATING CUSTOMERS



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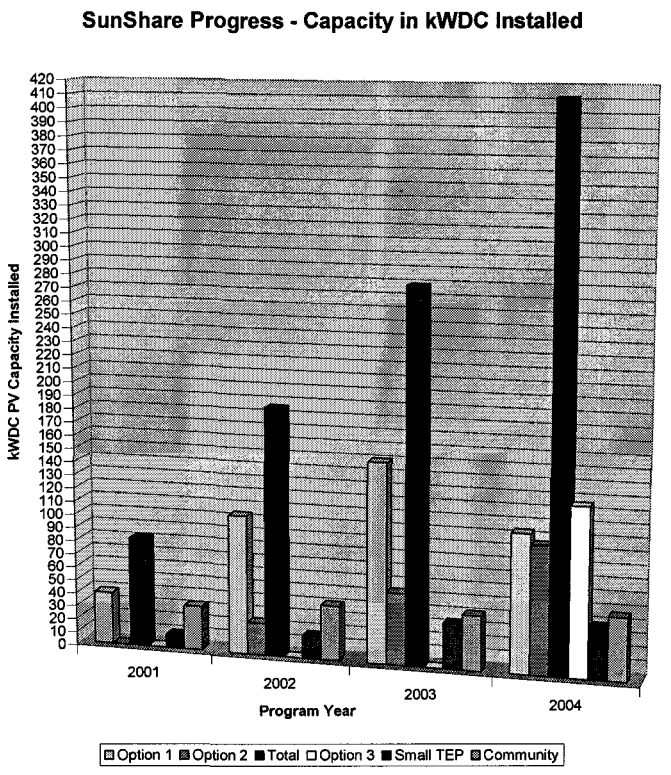
PROGRESS BY YEAR FOR THE SUNSHARE PROGRAM – INSTALLED PV CAPACITY



Net Metering

In 2001, TEP offered, with Commission approval, a net metering option for owners of PV systems of less than 5 kW AC in size. TEP requested, and the Commission approved in March 2003, an increase in the maximum size of a PV generation system qualifying for net metering to 10 kW AC and expanded the eligible technologies to include wind generation up to that size. As of December 31, 2004, forty-five PV customers have qualified and enrolled in the net metering program. No wind customers have yet enrolled in net metering. These PV customers have a combined installed solar generation capacity of over 100 kW AC. To further simplify customer sited PV and wind installations, in addition to net metering, TEP also offers simple interconnection requirements for small customer located PV and wind systems.

Solar Water Heating System Evaluation

In late 2004, TEP evaluated various domestic solar hot water systems with regard to economic and penetration feasibility in the Tucson service territory. Since there were hundreds of systems available for consideration, this review focused on a sampling of systems that would be most suited for the Arizona climate. The evaluation was conducted as a preliminary review of systems and programs, targeting the experience of local contractors and other existing utility programs in place. The intent of this review was to assist TEP in determining a course of action for possible implementation of a solar hot water system program for TEP.

TEP reviewed both open loop and closed loop systems, involving older batch, ICS, recirculating, thermosiphon and other closed loop active systems. From the information available for Arizona systems, open loop recirculating and open loop thermosiphon systems are generally not used or have limited application due to their scaling problems, lack of freeze protection, or low efficiency. Contractors generally prefer ICS and various closed loop systems, active and passive, which have provided the best overall performance in the Arizona climate.

In order to adequately fund a domestic hot water program for TEP, DSM and/or other EPS incentives need to cover all expenses incurred by the utility for program costs. The experience of other programs surveyed indicated many utility programs have operated only partially funded, and have been forced to eliminate needed maintenance or inspection tasks, and have generally reduced any efforts that require significant employee time. Other impediments to program success consist of engaging the utility in extensive program management. It is the consensus of many utilities evaluated that a simple rebate program, with discount, loans or other incentive provisions, will provide an effective program.

Local solar hot water system contractors support the idea of TEP providing a targeted program for customers, and TEP will continue to review the feasibility of initiating a program possibly in 2006. Further study is needed to ensure that all initial, O&M, and life cycle costs are considered in the total cost of ownership for the customer when considering a new program for TEP.

Summary of PV Programs

In summary, the TEP Solar PV program, in response to ACC's EPS annual renewable energy production requirements, has effected the installation or assisted in the development of 5,239 kW DC of solar PV generating resources in Arizona.

Installations, capacity, energy production and costs of these systems are summarized below:

INSTALLATION PROGRESS

Project	Install Date	kWp DC Capacity	kWh, AC Output - Thru 12/31/04	Initial Costs	Total Operating Cost 12/31/04	$/kWh for Project
Community Projects						
Reid Park Zoo ASE/TR 840w Xtal	Mar-00	0.84	3,713	$7,400	$6,669	N/A
Pima Air Museum ASE/TR 1200w Xtal	Jun-00	1.2	5,992	$7,099	$200	$0.1356
UofA Agriculture Station	Jan-02	5.62	28,789	$120,000	$129	$0.4302
Hayden/Udall # 1 ASE/TR 21.6 KW Xtal	2002	21.6	83,996	$142,975	$498	$0.1394
Hayden/Udall # 2 ASE/TR 21.6 KW Xtal	2002	21.6	82,251	$142,050	$441	$0.1321
3131 S. Naco Vista	Apr-99	0.75	6,352	$6,944	$200	$0.1410
Tohono Chul BPSX140U/SB - 2800w Xtal	Dec-02	2.8	9,836	$23,286	$200	$0.1654
Civano Vail School MST50/TR 3000w Xtal	2004	3	2170.00	$15,990	$400	$0.1259
Hohokam TUSD BP3160Q/FR 4480w Xtal	2004	4.48	1240.00	$21,584	$200	$0.2928

Project	Install Date	kWp DC Capacity	kWh, AC Output - Thru 12/31/04	Initial Costs	Total Operating Cost 12/31/04	$/kWh for Project
Ft Huachucha Solar ASE/OMN 30 KW Xtal	1997	30	205,249.50	$180,000	$2,500	$0.1355
SunShare						
Sun Share Reported 1999	1999	0	44,937	$50,000	$100	$0.2024
Sun Share Reported 2000	2000	0	11,764	$25,000	$100	$0.1696
Sun Share Reported 2001	2001	7.2	42,076	$79,110	$2,300	$0.3114
Sun Share Reported 2002	2002	63.5	158,532	$266,532	$5,100	$0.1020
Sun Share Reported 2003	2003	68	120,544	$295,820	$6,155	$0.1220
Sun Share Reported 2004	2004	100.07	125,074	$773,278	$6,800	$0.1919
Utility (TEP)						
SGS-125C-1 ASE/XN 135 KW Xtal	Jul-01	135	737,174	$1,125,637	$3,820	$0.1719
SGS-125C-2 ASE/XN 135 KW Xtal	Jul-01	135	772,454	$848,927	$3,820	$0.1266
SGS-125C-3 ASE/XN 135 KW Xtal	Aug-01	135	728,180	$779,470	$4,063	$0.1171
SGS-125C-4 ASE/XN 135 KW Xtal	Aug-01	135	718,342	$885,503	$3,820	$0.1336
SGS-125C-5 ASE/XN 135 KW Xtal	Nov-01	135	691,128	$891,576	$3,820	$0.1355
SGS-125C-6 ASE/XN 135 KW Xtal	Nov-01	135	701,770	$830,314	$3,820	$0.1232
SGS-125C-7 ASE/XN 135 KW Xtal	Oct-02	135	548,554	$896,984	$3,432	$0.1332
SGS-125C-8 ASE/XN 135 KW Xtal	Oct-02	135	559,540	$896,332	$3,432	$0.1318
SGS-125C-9 ASE/XN 135 KW Xtal	Oct-02	135	552,662	$900,199	$4,887	$0.1364
SGS-125C-10 ASE/XN 135 KW Xtal	Oct-02	135	548,341	$910,976	$4,887	$0.1322
SGS-125C-11 ASE/XN 135 KW Xtal	Jun-02	135	600,472	$899,885	$4,887	$0.1321
SGS-125C-12 ASE/XN 135 KW Xtal	Jun-02	135	546,463	$901,081	$4,887	$0.1367
SGS-125C-13 ASE/XN 135 KW Xtal	Jun-03	135	351,281	$866,453	$2,865	$0.1287
SGS-125C-14 ASE/XN 135 KW Xtal	Jun-03	135	348,603	$866,190	$2,865	$0.1295
SGS-125C-15 ASE/XN 135 KW Xtal	Aug-03	135	333,802	$867,159	$2,865	$0.1295
SGS-125C-16 ASE/XN 135 KW Xtal	Aug-03	135	338,528	$860,732	$2,865	$0.1267
SGS-125C-23 ASE/XN 135 KW Xtal	Jul-04	135	99,857	$813,735	$431	$0.1359
SGS-125C-24 ASE/XN 135 KW Xtal	Jul-04	135	100,391	$799,027	$431	$0.1327
SGS-125C-25 ASE/XN 135 KW Xtal	Jun-04	135	114,108	$825,208	$589	$0.1212
SGS-125C-26 ASE/XN 135 KW Xtal	Jun-04	135	126,563	$789,255	$589	$0.1157
SGS-125C-27 ASE/XN 135 KW Xtal	Jun-04	135	126,155	$710,986	$589	$0.1047
SGS-125C-28 ASE/XN 135 KW Xtal	Jun-04	135	119,862	$781,116	$589	$0.1222
SGS-125C-29 ASE/XN 135 KW Xtal	Nov-03	135	274,282	$849,606	$589	$0.1268
SGS-125C-30 ASE/XN 135 KW Xtal	Nov-03	135	272,023	$724,018	$589	$0.1072

Project	Install Date	kWp DC Capacity	kWh, AC Output - Thru 12/31/04	Initial Costs	Total Operating Cost 12/31/04	$/kWh for Project
SGS-125C-31 ASE/XN 135 KW Xtal	Aug-03	135	324,564	$856,574	$2,865	$0.1269
SGS-125C-32 ASE/XN 135 KW Xtal	Aug-03	135	314,590	$856,552	$2,865	$0.1314
SGS-125TF-1 FS/XN 134.4 KW Cd-Tl	Sep-01	135	719,869	$737,815	$16,262	$0.1108
SGS-125TF-2 FS/XN 134.4 KW Cd-Tl	Sep-01	135	643,111	$620,396	$15,016	$0.0936
SGS-125TF-3 FS/XN 134.4 KW Cd-Tl	Jun-03	135	360,775	$759,114	$1,360	$0.1177
SGS-125TF-4 FS/XN 134.4 KW Cd-Tl	Jun-03	135	367,757	$759,122	$1,360	$0.1115
SGS-125TF-5 BP/XN 129 KW a-si	Oct-01	135	668,333	$760,802	$1,678	$0.1302
SGS-125TF-6 BP/XN 129 KW a-si	Oct-01	135	706,890	$760,717	$1,678	$0.1259
SGS-125TF-7 BP/XN 129 KW a-si	Oct-01	135	675,070	$736,514	$1,678	$0.1240
SGS-125TF-8 BP/XN 129 KW a-si	Oct-01	135	676,119	$741,162	$1,678	$0.1240
OH ASE/SB - 1200w Xtal	Jul-01	1.2	4,746	$8,563	$0	$0.1602
OH ASE/TR - 1200w Xtal	Aug-01	1.2	6,569	$8,369	$0	$0.1125
OH BPMST-50/TR - 1500w a-si	Sep-01	1.5	6,162	$6,666	$840	$0.1199
Solar Trailers ASE/TR 5000w Xtal	Jun-05	5	32,120	$70,000	$490	$0.4161
OH Gate 2A Solarex/TR - 2500w Xtal	Mar-00	2.5	18,682	$10,250	$358	$0.1273
OH3 20KW ASE/TR 21.6 KW Xtal	Sep-00	20	147,264	$146,342	$652	$0.1394
OH4 20KW ASE/TR 21.6 KW Xtal	Oct-00	20	152,594	$110,534	$126	$0.1020
OH 5KW BP/MST50/Beacon a-si	Feb-04	7.5	8,155	$29,574	$0	$0.1037
St Johns Test	Sep-00	0	3,512	$11,517	$0	No kWh Data
SGS 20 KW ASE/TR 21.6 KW Xtal	Oct-00	21.6	139,805	$135,060	$526	$0.1316
DMP 1 ASE/OMN 108 KW Xtal	Dec-00	108	687,650	$589,020	$2,602	$0.1169
DMP 2 ASE/OMN 108 KW Xtal	Dec-00	108	672,306	$527,199	$1,020	$0.1114
Test Trees	Jun-01	0	8,214	$1,500	$0	N/A
OH Global Solar Test/TR - 1440w CIGS	2002	1.4	4,012	$13,447	$431	$0.2455
OH Global Solar Slimline/TR 1656w CIGS	2004	1.66	362	$18,720	$0	$0.8623
OH BP SX140U/TR-1400w Xtal	2002	1.4	4,473	$8,237	$0	$0.1204
OH Sharp 165/SB - 1320w Xtal	Mar-03	1.32	2,512	$7,476	$448	$0.1879
OH Sharp 165/TR - 1320w Xtal	Mar-03	1.32	3,447	$8,223	$358	$0.1414
OH Kyocera 158/TR - 1422w Xtal	Apr-03	1.422	3,518	$8,236	$0	$0.1318
OH Sanyo 167HIT/SB - 1336w Xtal/a-si	May-03	1.336	3,576	$8,962	$594	$0.1487
OH Unisolar 64/Trace - 1536w Xtal/a-si	Jun-03	1.536	4,223	$10,228	$0	$0.1240
OH BP SX150U/TR-1500w Xtal	May-03	1.5	3,457	$8,714	$0	$0.1261
OH Sanyo 180HIT/SB - 1440w Xtal/a-si	Jul-03	1.44	3,697	$8,955	$0	$0.1192
OH Shell 40/Tr-1440w a-si	Sep-03	1.44	3,482	$9,244	$297	$0.1090
OH Shell 150/Sharp-3000w Xtal	Sep-03	3	5,220	$16,991	$0	$0.1424

Project	Install Date	kWp DC Capacity	kWh, AC Output - Thru 12/31/04	Initial Costs	Total Operating Cost 12/31/04	$/kWh for Project
OH Shell 150/TR - 1500w Xtal	Feb-04	1.5	1,994	$8,414	$0	$0.1225
OH AstroPower/TR - 1500w Xtal	May-04	1.485	1,649	$8,532	$0	$0.1176
TOTALS		5,238.869	18,633,531	32,065,180	152,596	$0.1275

CHALLENGES/BARRIERS

Initial Cost

The current high cost of PV modules and inverters is the primary barrier to use PV as a widespread generating technology. This high initial cost also raises those operating costs associated with value, such as property taxes and insurance. While PV module costs were very high in 2001 and 2002, due in some part to excessively high subsidies for PV in neighboring states, the costs had been decreasing in late 2002 and continuing into 2003. However, the high demand for PV in Germany during 2004 has resulted in price increases and long delivery times for PV modules.

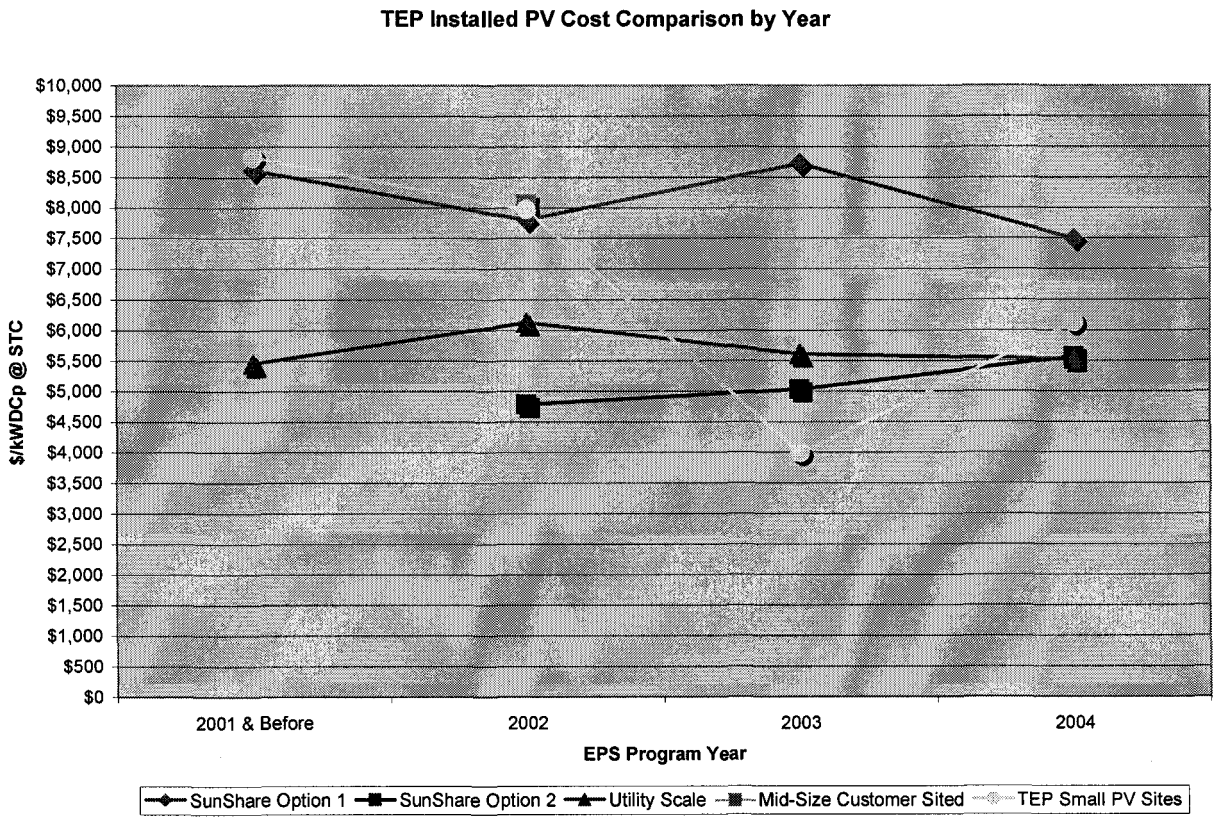
Competition in the inverter market is driving improvements in quality, reliability and price, which are reducing the life cycle cost of PV ownership through reduced initial and maintenance costs as well as increased energy output. However, based on information presented at the Department of Energy Inverter Workshop in October 2004, much work remains to produce residential size PV inverters with the same reliability, performance and low cost per watt factors as utility scale PV inverters.

The implementation of a multi-year, pay-as-you-build funded EPS allows for development of cookie cutter PV system designs in a size optimized to take advantage of partnering opportunities with the manufacturers of the major components of PV systems to optimize BOS costs through both material and installation labor cost reductions. TEP has taken advantage of this intended feature of the EPS by using refined design techniques to effect cost reductions in electrical systems, support structures, inverters, site preparation, grid connection and data acquisition systems. The EPS, as adopted by the ACC, allowed TEP to be assured of multi-year funding and has provided TEP with certainty of financing essential to enter into long-term relationships with specific makers of the primary components of PV systems (PV modules and inverters) to allow for partnering to optimize the BOS design and installation, resulting in BOS costs of less than $1 per DC watt of installed PV capacity in 2003, only the third year of the EPS. This BOS cost level meets a long-term goal of the federal government renewables programs. This benefit would not have been possible with a "year-to-year" type of EPS.

TEP PV program cost and customer PV cost trend data is shown below. These costs assume that no subsidies or grant funds were used to reduce the cost to the customer. In reality, customers did effectively pay less than this amount as a result of TEP subsidies, federal tax credits, state tax credits and grants from a number of sources.

SMALL PV CUSTOMER INSTALLED COST BEFORE SUBSIDY IN $/KWDCP @ STC

Average SunShare Option 1 & 3 Cost 2001 through 2004:	$7,872
Average SunShare Option 2 Cost 2001 through 2004:	$5,315
Average TEP Small PV System Cost 1999 through 2004:	$6,797



Performance & Reliability

While the TEP fleet of large scale PV systems had a very high percentage of effective availability in 2002, 2003 and 2004 (more than 99.4% when only PV related factors are included)there are challenges remaining in maintenance of PV systems, both large and small. There were 30 separate incidents in 2004 requiring some level of human response to restore the large PV systems to full operation, although 16 of those responses were to resolve data collection issues, not PV related items. Less than half of these incidents were the result of a PV related item. Most were data collection failure, human error or distribution system outage related items. These incidents were only identified because of the instrumentation and communications that is economically viable on large scale systems. The software of the data collection system was

updated near the end of 2003 to allow a grid power failure to be reset automatically instead of requiring human intervention, which eliminated the need for 12 trips to the station. These upgrades included changes to allow the data collection system to resolve its own problems, in most cases, without on-site human intervention. The system now also allows remote reset of an inverter to resolve a transitory nuisance problem.

The Hayden/Udall Water Treatment Solar Generation system required a number of visits by TEP personnel in 2004 to fix inverter problems and a data collection battery problem.

During 2004, TEP personnel made 65 visits to 48 different customer sited PV systems. Thirty-one of the visits found the PV system to be operating properly and no corrective action was required. The other 34 visits resulted in some level of corrective action required to allow the PV system to operate properly. In most cases the repair work could be completed on the spot during the inspection visit. However, a significant number of the repairs required subsequent visits for replacement of inverters or PV modules. In some cases the inspection was a performance check prior to SunShare program acceptance and the repair work was completed by the PV system installer. The 2004 annual specific energy production of the small PV systems in the SunShare program was 34% less than the large SGS crystalline systems, to a certain degree because a SunShare system failure was generally not found until TEP made an inspection. One customer with an inoperative 7 kW DC system for nearly eight months was a large part of the lower annual energy performance of the smaller systems. The problem was discovered during the TEP annual inspection. Small systems need to have the capability to notify the customer when attention is needed, without adding any significant cost to the price of the system. Two problems with smaller utility scale systems occurred in the Tucson service territory in 2004 that involved inverter problems. At TEP's DeMoss Petrie generating plant site, four–year-old inverter fans failed, which put both 108 kW DC systems at reduced power for a couple of weeks. At the Irvington test yard site, one four-year-old inverter failed near the end of 2004, which is still currently out of service and pending repair. At Springerville, the 20 kW system four-year-old inverter failed and was replaced with a spare which failed two months later. The sixth inverter failure (of five inverters) at Fort Huachuca of the 7-year-old 30 kW system occurred and is currently out for repair.

SunShare equipment in service has exhibited relatively few incidents in 2004, relative to the quantity of systems in service. A table of SunShare, Community and Small Utility-scale corrective maintenance occurrences is shown below:

2004 Corrective Maintenance – Tucson Service Territory

System	Inverter Problems	Panel Problems	Meter Problems	Wiring/Misc. Problems
SunShare	4	4	0	10
Community	1	0	0	1
Small Scale Utility	2	0	3	0

In all cases above, equipment was either replaced or repaired and returned to service.

The Future

In 2004, TEP installed two additional systems of 2,688 First Solar modules. TEP has confidence that the issues found with the pre-production modules are being resolved. The 2003 systems are also test units, but have two additional years of development behind them and a much stronger performance standard to meet than the initial two units. Specific annual energy production of the First Solar arrays was actually better than the crystalline arrays in 2004. There are no plans to install any more a-si units at SGS. TEP also installed eight ASE systems in 2004. TEP expects to install a Copper Indium Gallium Selenide ("CIGS") system at SGS at some time in the not too distant future. There are two CIGS systems in test in Tucson, alongside similarly sized a-si and crystalline systems. In 2004, five test installations, in the 1000+ AC watt size, have been installed in Tucson. These systems are made up of various combinations of manufacturer's components and are testing the equipment tolerances to the manufactures performance specifications. This side-by-side testing will provide accurate, comparable data, in Tucson's climate. Five additional test systems will be installed during 2005.

TEP will continue to evaluate the reams of solar production data taken during the four years of our solar development program. By this time next year, with more stable solar sensors, TEP should have additional insight into some of the items raised on voltage response with respect to temperature for all thin-film and crystalline materials in test. This data will be shared with inverter and PV module manufacturers and other interested solar industry participants to provide needed feedback for use in developing mature, reliable, predictable and low cost solar consumer products in the future.

PROGRAM CHANGES FOR 2005

The 2005 renewable program includes planned installation of 5 kWp DC at TEP's OH in Tucson and an expected minimum of 100 kWp DC in SunShare systems and customer partnering opportunities. TEP will use 2005 to evaluate the new PV offerings while waiting for a temporary increase in PV module prices to decline as manufacturing capacity increases to meet the world wide demand for PV systems fueled in part by the German solar feed in tariff. Revisions to the current EPS are also under review by the ACC, which will likely affect the PV installed capacity requirements in 2005 and beyond.

SUNSHARE PROGRAM DETAILS

In 2004, TEP acquired 62 SunShare customers representing 122 kW DC. This amounted to approximately 81 – 1.5 kW DC systems. Of those, 25 customers purchased a total of 65 TEP systems under Option 2. Option 3 customers totaled 37 in 2004. Of the original 33 Option 1 systems, 14 did not initially qualify due to inverter, wiring or module problems. After repairs, the 14 were retested and qualified for the SunShare program. Ten Option 1 customers converted to TEP's new Option 3 program during 2004. All together, there have been 13 PV module problems, 15 wiring problems and 21 inverter problems found by TEP during acceptance testing.

SYSTEM PERFORMANCE TESTING

TEP has developed a test program for different manufacturers' small PV systems to gather performance data on their operation in the Tucson environment. This testing is a two-fold effort; 1) develop operating experience of the different systems to pass on to solar installers, manufactures and our customers, and 2) offer the best performing most economical systems to our Option 2 SunShare customers. This testing provides invaluable information that is not normally available to the home owners and others interested in investing in solar energy. Presently, TEP is testing 19 systems, using a combination of 17 different manufacturers' inverters and modules. TEP is in the process of installing five additional systems of different manufacturers' products.

Below is a table of the systems presently in test.

Test Station	Panel Manufacturer/ Model No.	Cell Type	Inverter Manufacture	Total Installed Cost per Watt	System KWdc Rating
Inverter/Module					
OH SB/Sanyo 167	Sanyo 167 HIT	Amor/Cryst	Sunny Boy 1800 SBD	$6.71	1336
OH Tr/Shell 40/1600	Shell ST40	CIS Thin Film	Trace 1500	$5.78	1600
OH Tr/Shell 40/1440	Shell ST40	CIS Thin Film	Trace 1500	$6.01	1440
OH Tr/Shell 40/1440	Shell ST40	CIS Thin Film	Trace 2500	$6.01	1440
OH TR/Unisolar	Unisolar 64	Triple Junct. Sil	Trace 1500	$6.66	1536
Tohono Chul	Bp SX140U	Multi-Crystal	Sunny Boy 2500	$5.48	2800
OH Tr/BP150	BP SX 150U	Multi-Crystal	Trace 1500	$5.81	1500
OH SB/Sharp	Sharp 165	Multi-Crystal	SunnyBoy 1100	$5.66	1320
OH Tr/Sharp	Sharp 165	Multi-Crystal	Trace 1500	$6.23	1320
OH Tr/Kyocera	Kyocera 158	Multi-Crystal	Trace 1500	$5.79	1422
OH Tr/BP 140	Bp SX140U	Multi-Crystal	Trace 1500	$5.88	1400
OH SB/Shell 150	SP 150-PC	Multi-Crystal	SB/2500	$5.06	3000
OH Sharp/Shell 150	SP 150-PC	Multi-Crystal	Sharp 3500	$5.66	3000
OH Sharp/Shell150/MST50	MST50	Asi	Sharp 3500	$6.88	1500
Global Solar Test	GS-45	CGIS	Trace 1500	$7.99	1440
OH SB/Sanyo 180	Sanyo 180 HIT	Amor/Cryst	Sunny Boy 1800 SBD	$6.22	1440
OH Fronius/Sanyo 180	Sanyo 180 HIT	Amor/Cryst	Fronius IG 2000	$6.53	1440
OH Tr/MST 50	BP MST 50	Asi	Trace 1500	$4.44	1500
OH Tr/MST 50	BP MST 50	Asi	Trace 2500	$4.44	1500
OH Tr/Shell 150	SP 150-PC	Multi-Crystal	Trace 2500	$5.61	1500
OH Beacon/MST50 (5kW)	BP MST 50	Asi	Beacon M5	$3.94	7500
OH Trace/Astr Power 165	Asto Power 165	Single Cystal	Trace 2500	$5.75	1485
OH Trace/Slimline	Global Solar	CIS Thin Film	Trace 2501	$11.30	1656

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Presently TEP is collecting data manually but as the number of test systems has grown will need to install an automated data logger system. TEP expects to have this in place by the end of 2005. Below is a table of performance results from our testing.

PV TEST SYSTEM COMPARISONS

Test Station Inverter/Module	Panel Manufacturer	Inverter Manufacture	System KWdc Rating	Ave Monthly KwH/Kw Rated	DC Watts Actual/Rated	Volts(mpp) Actual/Rated
OH SB/Sanyo	Sanyo 167 HIT	Sunny Boy 1800	1336	143.53	0.87	0.85
OH Tr/Shell	Shell ST40	Trace 2500	1600	139.74	0.87	0.96
OH TR/Unisolar	Unisolar 64	Trace 1500	1536	155.73	0.91	0.92
OH Tr/BP	BP SX 150U	Trace 1500	1500	124.56	0.77	0.83
OH SB/Sharp	Sharp 165	SunnyBoy 1100	1320	93.78	0.81	0.88
OH Tr/Sharp	Sharp 165	Trace 1500	1320	140.91	0.80	0.87
OH Tr/Kyocera	Kyocera 158 G	Trace 1500	1422	124.64	0.74	0.83
OH Tr/BP 0	Bp SX140U	Trace 1500	1400	129.58	0.80	0.88
OH Sharp/Shell	SP 150-PC	Sharp 3500	1500	104.07	0.87	0.91
OH Sharp/Shell/**BP**	BP MST 50	Sharp 3500	1500	123.33	0.71	N/D
Global Solar Test	GS-45	Trace 1500	1440	121.60	0.73	0.77
OH SB/Sanyo	Sanyo 180 HIT	Sunny Boy 1800	1440	139.90	0.90	0.88
OH Tr/MST 50	BP MST 50	Trace 1500	1500	116.44	0.75	0.83
OH Tr/Shell	SP 150-PC	Trace 2500	1500	138.44	0.80	0.90
OH Beacon/MST 50	BP MST 50	Beacon M5	7500	113.00	0.75	0.78
OH Trace/Astr Power	Asto Power 165	Trace 2500	1485	148.15	0.83	0.86

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The following Table on SunShare installations provides specific data on the systems installed to date.

SUNSHARE INSTALLATIONS THROUGH DECEMBER 2004
(Includes all maintenance from program inception)

DC KW	Installed Cost	In service Date	Inverter Problems	Wiring Problems	Panel Problems
1.440	$10,820.00	4-Nov-02			X
1.500	$4,500.00	2-May-03	X		
1.500	$6,000.00	29-May-03			
3.000	$8,500.00	5-Jul-02			
3.300	$19,582.00	7-Dec-02			
1.500	$6,100.00	27-Dec-02			
1.440	$10,500.00	5-Feb-04			
1.500	$5,100.00	15-Oct-02			X
1.500	$6,000.00	25-Jul-02			
1.440	$11,820.00	15-Feb-03	X	X	
1.200	$10,200.00	1-Jun-01	X		
1.440	$12,500.00	20-Oct-03	X		
3.000	$8,500.00	5-Nov-02	X		X
1.500	$6,000.00	3-Mar-03			
2.400	$17,000.00	4-May-01			X
1.500	$6,000.00	27-Jun-02			X
1.440	$11,820.00	5-Feb-01	X		X
1.440	$18,000.00	4-Nov-03			
1.440	$11,820.00	4-Nov-02			X
1.500	$6,200.00	12-Jan-04		X	X
1.440	$11,820.00	5-Oct-02	X	X	X
1.500	$6,500.00	4-Feb-04			
2.600	$16,890.00	20-Mar-01			
1.440	$10,500.00	4-Sep-03			
1.500	$4,500.00	28-Dec-02		X	
1.500	$5,000.00	11-Jun-03			
1.500	$6,000.00	7-Nov-02			
9.000	$36,000.00	21-Oct-03		X	
1.680	$21,000.00	10-Apr-02	X	X	
3.000	$12,500.00	15-Oct-03			
3.000	$12,500.00	15-Oct-03		X	
1.500	$5,000.00	6-Feb-03			
1.440	$10,500.00	12-Aug-03			
2.400	$21,000.00	15-Sep-03			
1.500	$6,000.00	12-Jul-02	X	X	
4.800	$16,000.00	30-May-01	X		
1.800	$6,500.00	15-Sep-03			
1.500	$6,500.00	1-Jul-02	X	X	X
1.400	$10,500.00	12-Aug-03	X		
1.440	$11,820.00	4-Nov-02	X	X	X

DC KW	Installed Cost	In service Date	Inverter Problems	Wiring Problems	Panel Problems
1.500	$4,500.00	5-Aug-02			
3.000	$10,500.00	6-Jan-04			
4.800	$25,000.00	15-Jun-00	X	X	
1.500	$6,000.00	30-Aug-02		X	
1.440	$11,820.00	4-Nov-02			X
1.440	$10,500.00	20-Oct-02	X		
2.580	$23,000.00	30-Dec-03			
1.500	$5,000.00	3-Jun-03			
2.200	$23,500.00	31-Dec-02	X		
2.400	$18,500.00	3-Oct-02			
1.500	$4,000.00	16-Sep-02			
1.200	$7,200.00	12-Oct-01	X		
6.200	$23,500.00	1-Dec-99	X		
2.580	$21,000.00	17-Sep-03			
1.500	$5,150.00	30-Jul-02			
6.000	$18,000.00	15-Aug-03	X		
1.376	$6,500.00	25-Oct-02	X		
1.500	$10,835.00	20-May-04		X	
1.500	$10,835.00	1-Jun-04		X	
4.800	$45,000.00	30-May-01	X		
3.200	$9,700.00	18-Aug-04		X	
3.000	$7,000.00	20-May-04			X

RESULTS AND FORECASTS:

TEP has calculated the value of solar energy production by using an hourly wholesale spot market model based on real hourly on-peak and off-peak pricing at Palo Verde as multiplied by the actual hourly solar electricity production at both Springerville and Tucson locations. As expected, the closer coincidence of the Tucson loads with the solar input makes Tucson produced energy slightly more valuable than Springerville based solar energy on an annual $ per MWh basis. Again, due to coincidence between area electrical loads and solar influx, the average annual value for solar energy at both locations is higher than the Round the Clock average annual electricity value:

VALUE OF SOLAR ENERGY AT 2003 & 2004 WHOLESALE SPOT MARKET RATES

	2003	2004
Around the Clock Market Value:	$41.97	$40.27 per MWh
Solar Generation at SGSSS:	$47.69	$43.56 per MWh
Solar Generation at TEP OH:	$48.36	$43.74 per MWh

TEP plans to continue the analysis of the effects of time variance of solar energy production on the effects of energy value and capacity value.

The following is a graph of the TEP 2004 hourly native retail load, overlaid by the hourly energy produced by 582 MW of hypothetical solar generation located at SGS and the effect on fueled generation demand reduction (- 39 MW) from the application of 582 MW of solar capacity. The 582 MW of solar capacity was chosen as the level needed to produce 10.01% of the TEP annual retail energy sold from new renewable generation sources in 2004, which is about the proposed national renewable portfolio standard of 10%. The reduction of the need for fueled generation is shown by the displacement between the red points and the yellow points. Where they are coincident, there is no displacement of fueled generation from solar energy. More detail about this scenario is provided in the Executive Summary section of this report.

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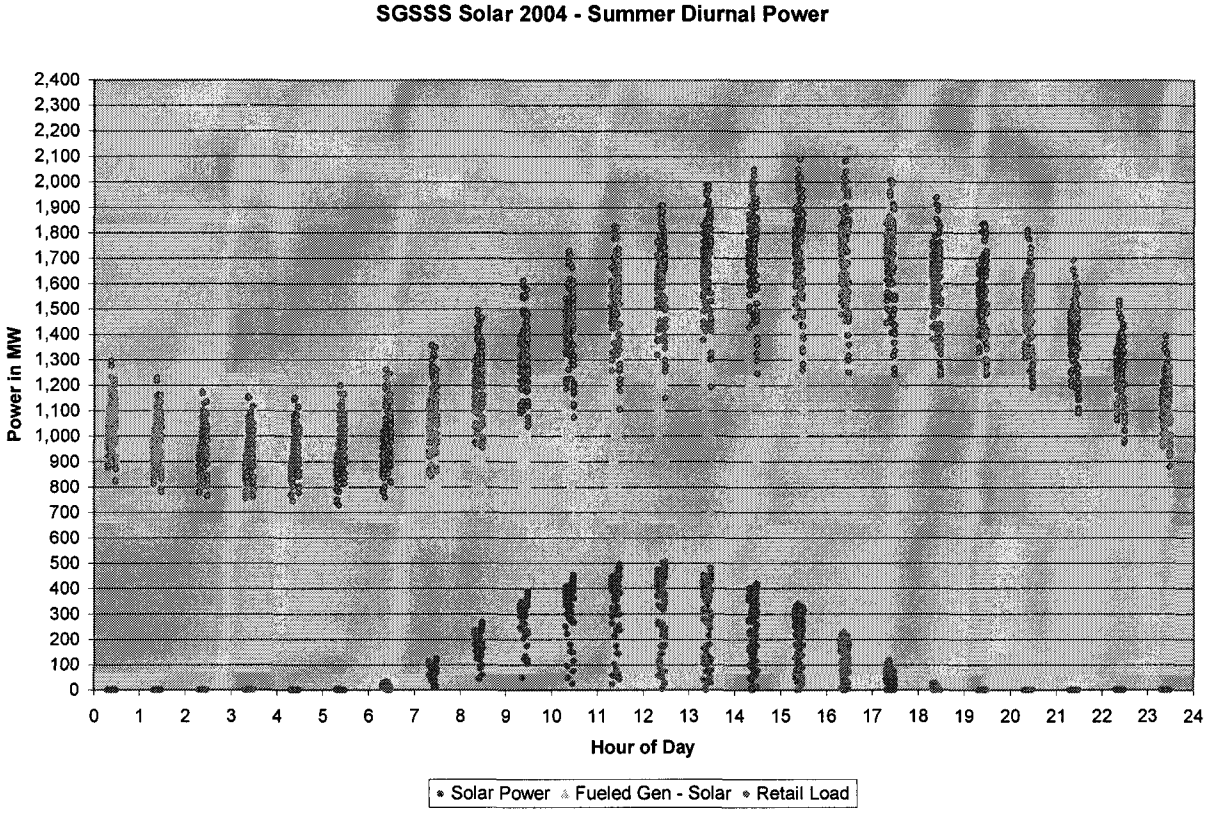

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On the next page is a graph of the TEP 2004 hourly daily maximum and minimum native load generation demand as if provided by:

1. Maximum daily demand met by fueled generation only, in red;
2. Maximum daily demand met by fueled generation as reduced by 582 MW of SGS located solar generation, in pink; and
3. Minimum daily demand met by fueled generation as reduced by 582 MW of SGS located solar generation, in blue.

Displacement of peak fueled capacity needs by solar energy is indicated where the red shows through the pink areas. Displacement of fueled generation by solar energy at minimum loads is indicated where the pink show through the blue areas. More detail about this scenario is provided in the Executive Summary section of this report.

It must be noted that a lesson was learned from scheduling an outage of SGSSS in the afternoon of July 21, 2004. That day turned out to be the third highest peak load day for TEP of 2004, and also a perfectly clear day at the SGSSS. Had the outage been scheduled in the winter, the capacity value of the solar at SGSSS in 2004 would have been increased to more than 110 MW instead of 39 MW. A lesson learned for future solar plant maintenance scheduling.

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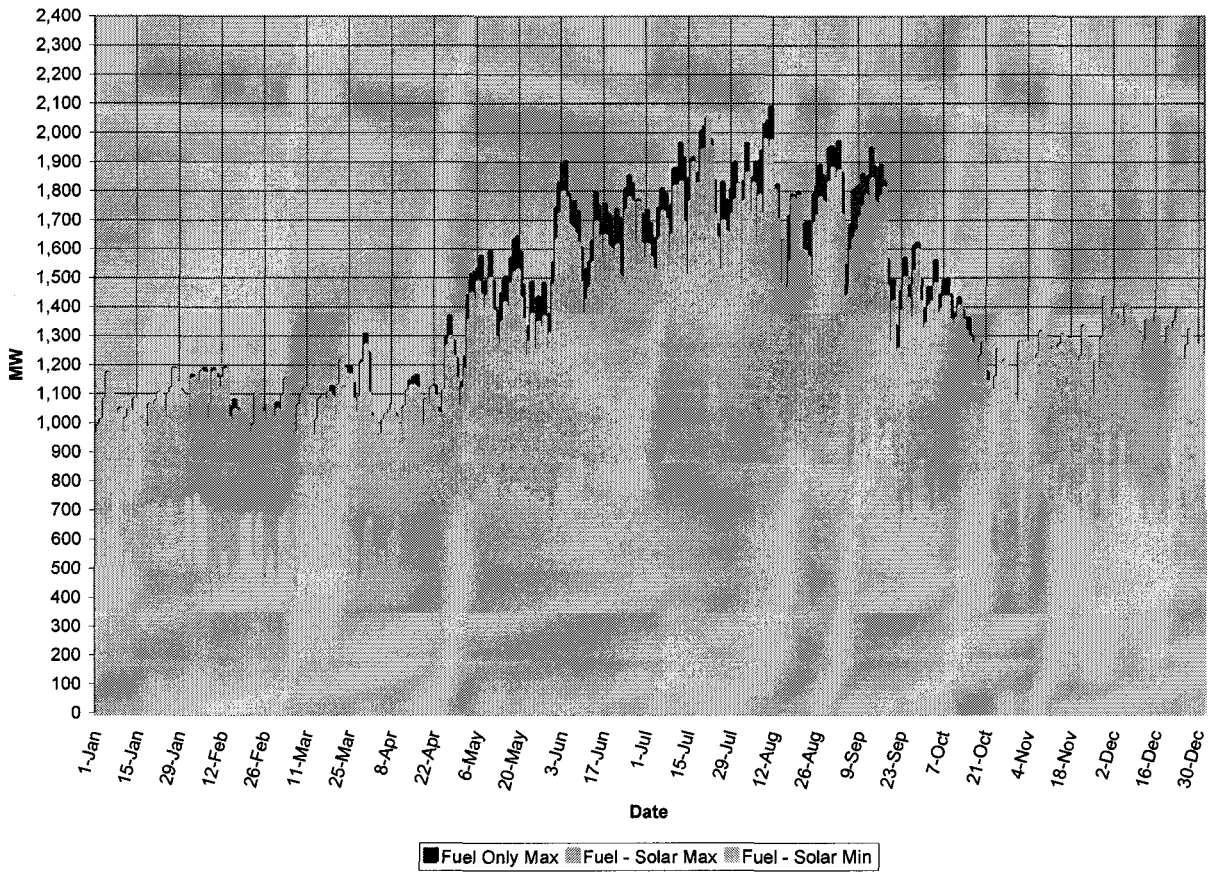
2004 Fueled Generation Daily Range with SGS Solar



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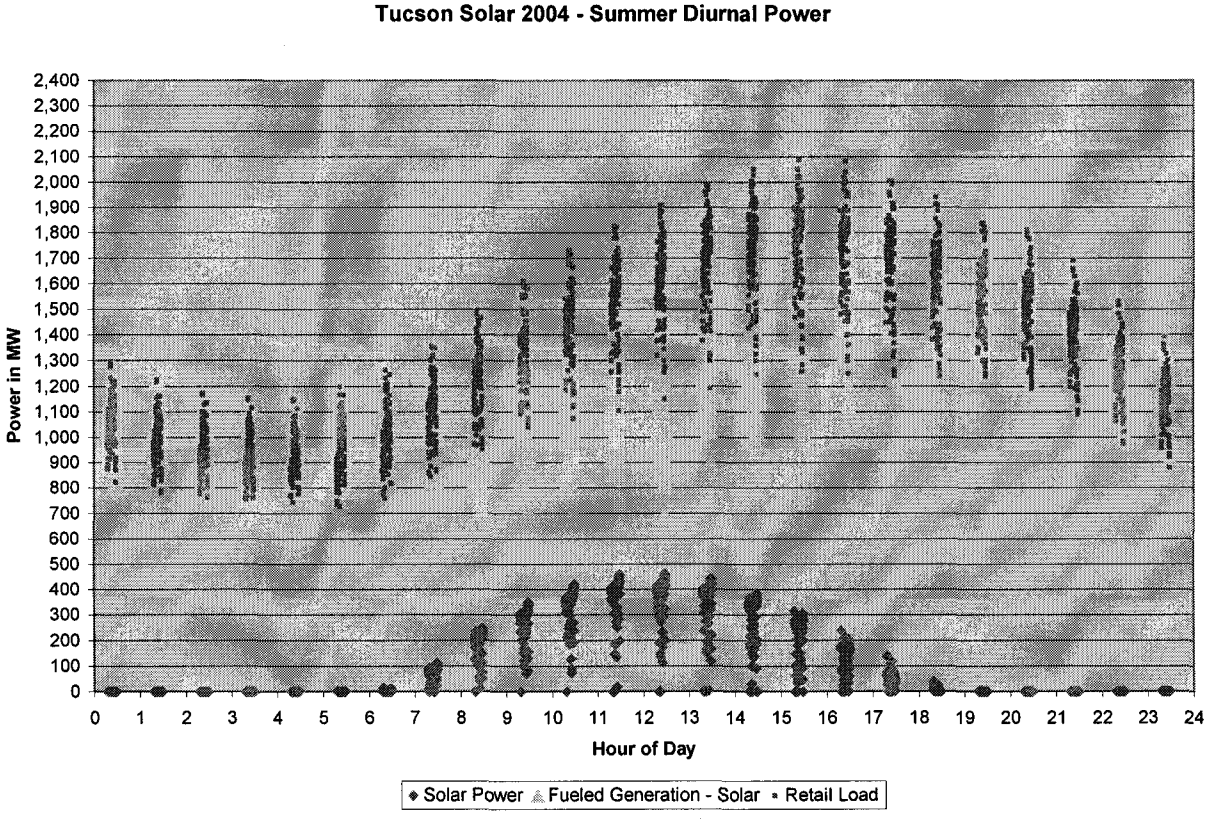
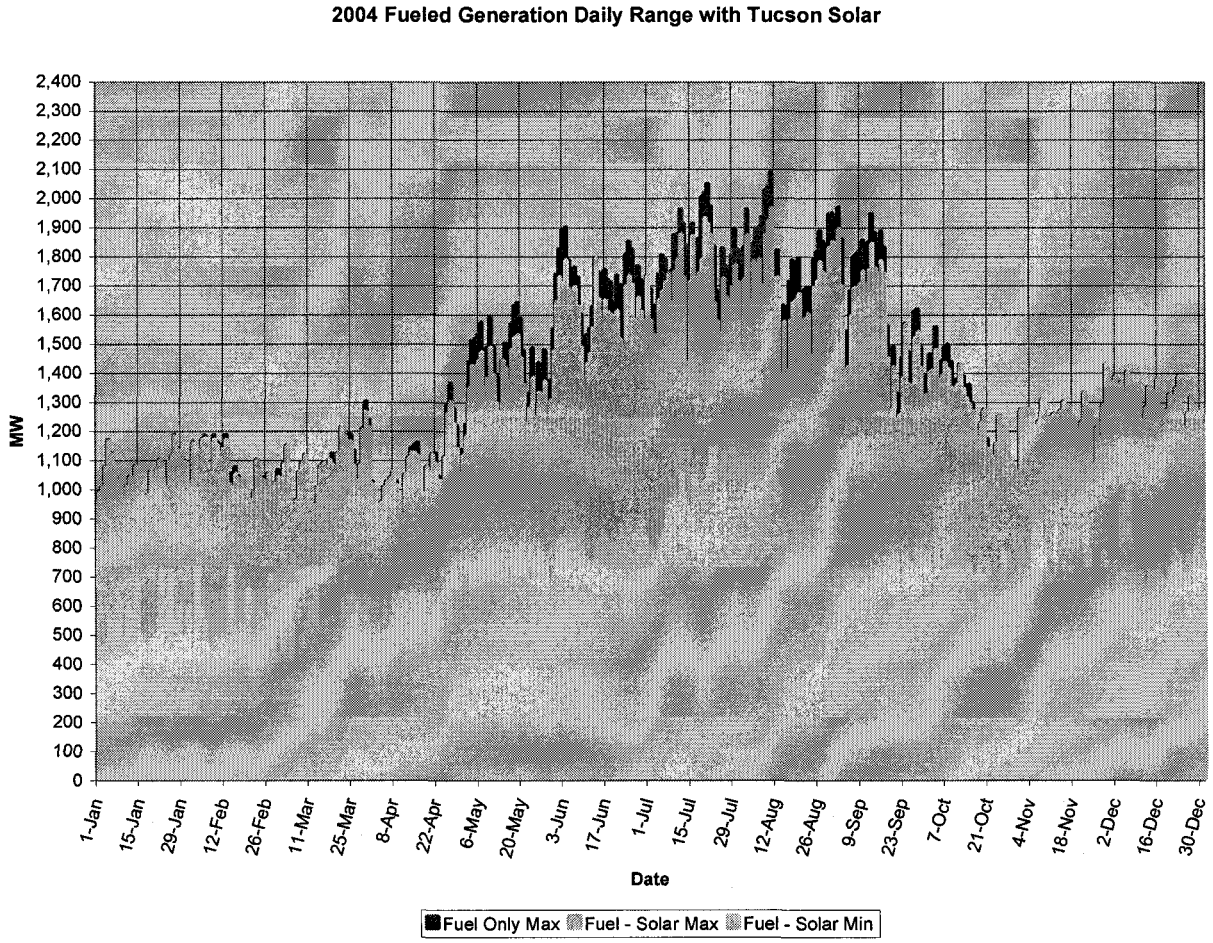
Below is a graph of the TEP 2004 hourly native retail load, overlaid by the hourly energy produced by 582 MW of hypothetical solar generation located at TEP's OH in Tucson and the effect on fueled generation demand reduction – 123 MW – from the application of 582 MW of solar capacity. The 582 MW of solar capacity was chosen as the level needed to produce 9.72% of the TEP annual retail energy sold from new renewable generation sources in 2004, which is about the proposed national renewable portfolio standard of 10%. The reduction of the need for fueled generation is shown by the displacement between the red points and the yellow points. Where they are coincident, there is no displacement of fueled generation from solar energy. More detail about this scenario is provided in the Executive Summary section of this report.



Following is a graph of the TEP 2004 hourly daily maximum and minimum native load generation demand as if provided:

1. Maximum daily demand met by fueled generation only, in red;
2. Maximum daily demand met by fueled generation as reduced by 582 MW of TEP's OH in Tucson located solar generation, in pink; and
3. Minimum daily demand met by fueled generation as reduced by 582 MW of OH - Tucson located solar generation, in blue.

Displacement of peak fueled capacity needs is indicated where the red shows through the pink areas. Displacement of fueled generation at minimum loads is indicated where the pink show through the blue areas. More detail about this scenario is provided in the Executive Summary section of this report.



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GLOBAL SOLAR JOINT VENTURE

PROJECT DESCRIPTION

Advanced Energy Technologies, Inc. ("AET") is an Arizona corporation that is a wholly-owned subsidiary of Millennium Energy Holdings, Inc. ("Millennium"). Millennium is a wholly-owned subsidiary of UniSource Energy Corporation ("UniSource Energy"), the parent company of TEP. AET is a developer of distributed power systems and a producer of flexible thin-film PV modules through its 87%-owned affiliate, Global Solar. Global Solar has built an advanced manufacturing facility in Tucson, Arizona to produce copper indium Gallium diselenide ("CIGS"), thin-film PV modules on flexible substrates. The many potential applications for this unique technology include use in advanced military, aerospace and commercial applications. Global Solar's principal office and place of business is 5575 S. Houghton Road, Tucson, Arizona 85747, and AET's principal office and place of business is One South Church Avenue, Tucson, Arizona 85701.

THE PRODUCTION FACILITY

Global Solar's production facility in Tucson, Arizona is ramping up its production of CIGS PV products, with a view towards rapidly expanding the annual production capacity to meet the growing commercial demand.

IMPORTANCE OF THIN-FILM PV TECHNOLOGIES

Crystalline technology currently dominates the PV industry because it is a proven product with a mature manufacturing process. The cost reductions needed to make this technology more commercially viable are difficult to achieve because the principle raw material utilized (silicon) is increasingly expensive and the manufacturing process is both labor and capital intensive.

The most credible means of reducing PV manufacturing costs is through the development of thin-film PV. Thin-film PV modules are commonly comprised of a very thin layer of PV material affixed to a supporting structure -- usually rigid and, most commonly, glass. Thin-film modules are less expensive to manufacture due to their reduced labor, lower material, energy, handling and capital costs. In contrast, Global Solar is commercializing continuous roll-to-roll deposition of thin-film PV on a flexible substrate.

COPPER INDIUM GALLIUM DISELENIDE

Global Solar's PV material utilizes an absorber layer primarily composed of CIGS.

The distinct advantage of CIGS is that the light-absorbing band gap of this thin-film most closely matches that of natural ambient light. As a result, CIGS has achieved much higher conversion efficiencies than all other thin-film PV technologies to date. Unlike other low-cost thin-film options, CIGS also possesses higher device efficiency and longer-term stability comparable to silicon. This is an important point because efficiency and long-term stability drive the sizing of a given PV system and, hence, its attendant cost.

Unlike silicon devices where size is severely restricted by the availability of large silicon wafers, CIGS device size is only limited by the size of the vacuum chamber and deposition system used in the manufacturing process. Global Solar's production cost is minimized by utilizing low-cost, industrially-proven, thin-film deposition technologies similar to those used to apply reflective coatings on eyeglasses, food packages and plate glass in commercial buildings. Moreover, Global Solar will employ a high degree of automation and intelligent processing control to improve product yield. Furthermore, CIGS has a demonstrated ability to pass appropriate environmental certification and regulated waste-handling issues.

UNIQUENESS OF GLOBAL SOLAR'S PV PRODUCTS

The literal flexibility of Global Solar's thin-film PV coupled with certain proprietary design characteristics ensures an extremely durable product. In addition, this PV product is highly portable and can be rolled or folded into compact packages for shipping. This ability to provide compact storage and damage tolerance is a significant advantage for numerous military, space, consumer and commercial applications and makes it ideal for, among other things, satellites, portable or remote stationary communication equipment, low-cost housing and remote agricultural irrigation.

Global Solar is currently delivering products to domestic and international markets. Such products include Portable Power Packs™, small solar power systems that fold into small, lightweight packages. These small 28 watt and 46 watt Power Packs can be used to power radios, computers, and other compact power needs and can replace or complement traditional batteries.

COST RECOVERY AND RENEWABLE RESOURCE COMMITMENT

Since UniSource Energy is investing in Global Solar as a "for profit" subsidiary, expenses associated with Global Solar are not included as part of TEP's recoverable $1,800,000 per year expenditure commitment to renewables. However, Global Solar's production capacity will be applied towards TEP's 5 MW commitment to implement renewable resources.