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BEFORE THE ARIZONA CORPORATION COMMISSION

CARL J. KUNASEK  
CHAIRMAN  
JIM IRVIN  
COMMISSIONER  
RENZ D. JENNINGS  
COMMISSIONER

IN THE MATTER OF THE COMPETITION IN )  
THE PROVISION OF ELECTRIC SERVICES )  
THROUGHOUT THE STATE OF ARIZONA. }

DOCKET NO. U-0000-94-165

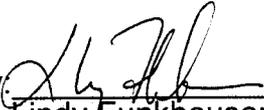
NOTICE OF FILING

Staff of the Arizona Corporation Commission hereby files a report submitted by the Solar Portfolio Standard Subcommittee, which was part of the Unbundled Services and Standard Offer Working Group, in the above-captioned matter.

RESPECTFULLY SUBMITTED this 1<sup>st</sup> day of October, 1997.

ARIZONA CORPORATION COMMISSION

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Arizona Corporation Commission

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Original and ten copies of the foregoing filed this 1<sup>st</sup> day of October, 1997.

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

Copy of the foregoing mailed this 1<sup>st</sup> day of October, 1997 to:

All parties on the service list for Docket No. U-0000-94-165

  
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**SOLAR PORTFOLIO STANDARD SUBCOMMITTEE REPORT**

**Presented to**

**UNBUNDLED SERVICES AND STANDARD OFFER WORKING GROUP**

**For Review and Inclusion in**

**The Working Group Final Report**

**September 26, 1997**

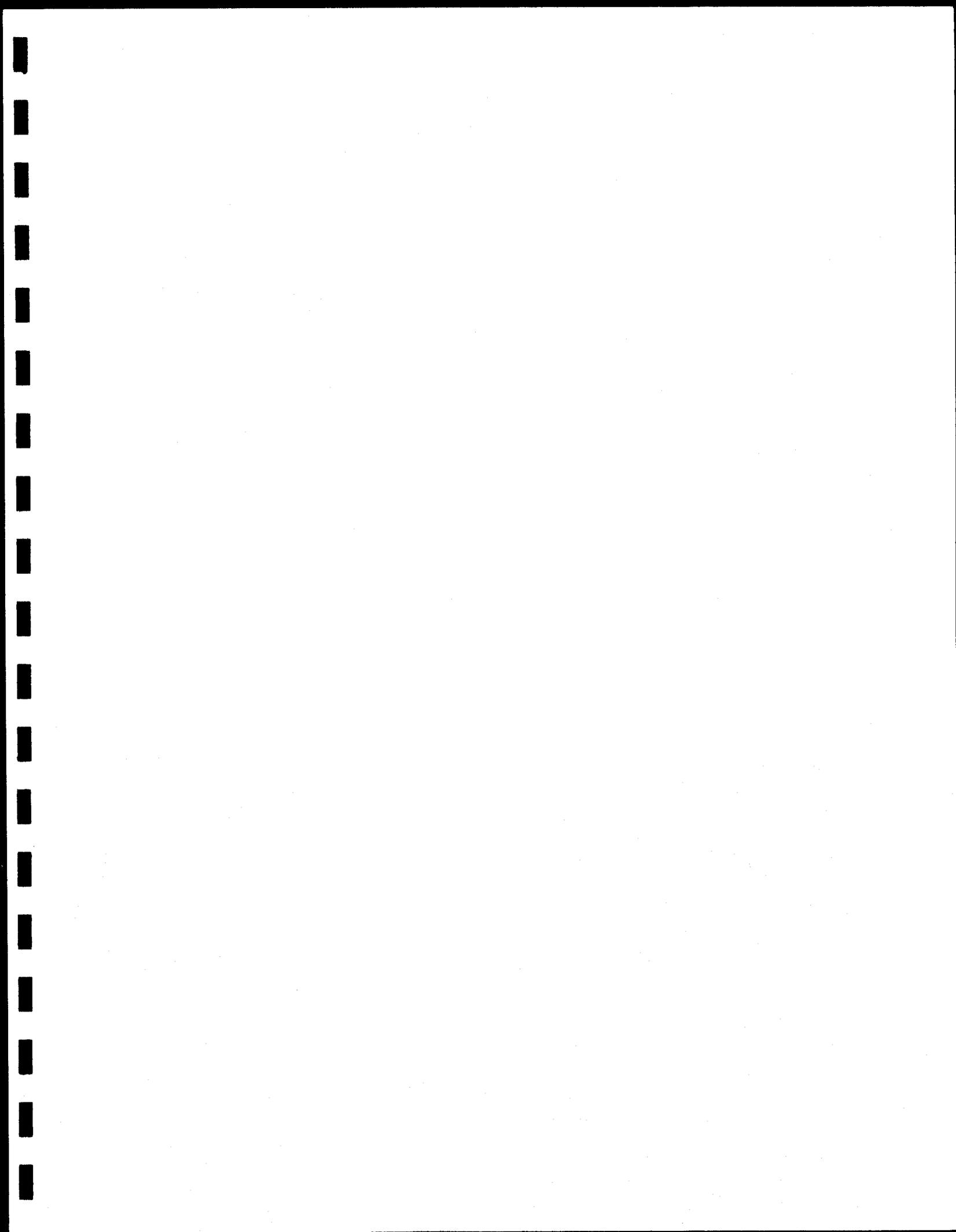
**Retail Electric Competition  
Working Group Process**

**Docket No. U-0000-94-165**

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## I. BACKGROUND

The Commission has supported development of renewables by utilities in Arizona for a number of years. In the first two cycles of Integrated Resource Planning (IRP), the Commission encouraged Arizona utilities to diversify their generation mix by adding renewable resources. Very little in renewable resource generation has resulted from the IRP orders. Now, through the Retail Electric Competition Rule, the Commission has required that all Electric Service Providers must provide part of their competitive electricity from solar.

### A. Staff Analysis of the Solar Portfolio Standard

Solar electric technologies are the most applicable renewables in Arizona. The phase-in program extends the Commission's interest in renewables by requiring that suppliers in the competitive market obtain at least one half of one percent of the total retail electric energy sold competitively from solar resources, whether that solar energy is purchased or generated by the seller. Solar resources include photovoltaic resources and solar thermal resources (for example, dish-Stirling generation). After December 31, 2001, the Commission may change the solar portfolio percentage; if it does not act, the percentage increases to one percent of electric energy sold competitively.

Solar resources may be built and operated by sellers of electricity in the competitive market. However, it is expected that some of the solar energy will be supplied by firms specializing in solar resources which sell their electric output to competitive suppliers under contract. The rule indicates that the solar resources must be new, i.e., installed on or after January 1, 1997. The purpose of the requirement is to foster advances in technology, encourage economies of scale in manufacturing, and gain greater experience with applying solar resources. Sellers must report regularly on their compliance with the standard; they must clearly demonstrate the output of solar resources, the installation date of solar resources, and the transmission of energy from those solar resources to Arizona consumers.

The rule encourages early development of solar resources through a "double credit provision." Any company certificated under the provisions of the rule can credit two times the electric energy generated before January 1, 1999 using solar electric resources installed in Arizona on or after January 1, 1997 to the percentage requirement cited above.

Competitive market consumers and suppliers will pay for the solar portfolio standard. The costs will be shared by both consumers and suppliers reflecting the price elasticities of demand and supply. Further, among consumers, a large share of the costs are likely to be borne by those competitive market consumers who desire "green power." That is, those consumers who value solar power the most are likely to bear a large fraction of the costs of the solar portfolio standard and they will satisfy their demand for solar electricity. In another section of the Retail Electric Competition rule (R14-2-1604 E3) there is a provision that allows customers who receive at least 10% of their electricity from solar resources to be automatically eligible for competitive electric service.

The percentage standard was selected in order to balance the interest in encouraging solar power and the higher costs of solar power relative to conventional generation. The cost impact of the solar portfolio standard is expected to be smaller than the savings which can occur through competition, especially as stranded cost recovery concludes.

With a solar portfolio standard of 0.5 percent and with 20 percent of the market served competitively, about 21 MW of solar generation capacity would be needed if SRP is included; if SRP were excluded, solar generation requirements would be about 13 MW.

The percentage standard is consistent with the utilities' planned generating capacity additions, as reported in the 1995 Resource Planning filings. By 2003, the year full competition is to start, the utilities have planned to add 377 MW of generating capacity; by 2004 they have planned to add 602 MW of generating capacity. These figures should be regarded as estimates. Including SRP, a solar portfolio standard of 1 percent of competitive kWh sales would result in solar capacity additions of 256 MW by 2004. The solar generating capacity would be in addition to the renewable goals established for utilities in the most recent Integrated Resource Planning order.

There are four solar technologies that could meet the needs of competitors in the Arizona phase-in: photovoltaics, solar dishes, solar troughs, and solar central receivers.

#### B. Staff Objectives of the Arizona Solar Portfolio Standard

In developing the details of the Solar Portfolio Standard, the Corporation Commission Staff was guided by the following objectives:

- Encourage the use of solar electric technologies to increase the fuel diversity in the electricity generation mix.
- Increase utility and electric service provider expertise and experience in the procurement, installation, and operation of solar electric systems or in the purchase and transmission of solar electricity from other sources.
- Encourage new solar electric technologies as a reasonable percentage (1/2 to 1% of competitive retail electric sales) that is significantly less than the annual growth (2-3% per year) of demand for electricity. (This allows utilities and other electric service providers free choice of the technologies for 99-99.5% of electricity generation.)
- Encourage the use of modest-sized, distributed solar generators to reduce the loading on existing transmission lines and also reduce the need to build new, expensive transmission lines as the demand for electricity increases in the future.
- Contribute to the commercialization of solar electric technologies, which will decrease the cost of solar electricity to Arizona customers in the future.

## II. ACTIVITIES OF THE SOLAR PORTFOLIO STANDARD SUBCOMMITTEE

The Solar Portfolio Standard Subcommittee had its first meeting on May 8, 1997. The second meeting, on June 2, 1997, included a morning workshop and an afternoon meeting. Follow-up meetings were held on July 9, August 1, August 27, and September 12, 1997.

Prior to the first meeting, subcommittee members submitted 27 major issues of concern. At the first meeting, an additional 27 issues were identified. The subcommittee then grouped the 54 issues into eight major issue categories:

### A. Major Issue Categories Related to the Solar Portfolio Standard:

- Goals & objectives of the SPS
- Technology choice (definition of equipment allowed in the Solar Portfolio Standard)
- Costs/timing
- Incentives (reward intended results, discourage unintended results)
- Economic development/solar industry development
- Administration
- Level playing field
- Technical details

B. Objectives. The Subcommittee discussed objectives developed by Staff and, at the August 1 meeting, the Subcommittee developed additional objectives for the Solar Portfolio Standard and slightly modified the wording of the original Staff objectives:

### REVISED OBJECTIVES OF THE SOLAR PORTFOLIO STANDARD

- Encourage the use of solar electric technologies to increase the fuel diversity in the electricity generation mix.
- Increase utility and electric service provider expertise and experience in the procurement, installation, and operation of solar electric systems or in the purchase and transmission of solar electricity from other sources.
- Encourage new solar electric technologies as a reasonable percentage of competitive retail electric sales that is significantly less than the annual growth of demand for electricity.
- Encourage the use of modest-sized, distributed solar generators to reduce the loading on existing transmission lines and also reduce the need to build new, expensive transmission lines as the demand for electricity increases in the future.
- Contribute to the commercialization of solar electric technologies, which will decrease the cost of solar electricity to Arizona customers in the future.
- Contribute to economic benefits throughout Arizona.

- Encourage environmental benefits.
- Encourage a market-based solar electric industry.
- Increase public information/awareness of solar electricity.
- Reach an acceptable cost/benefit point.
- Encourage solar resource development, rather than payment for non-compliance.

C. Suggested Changes to the Solar Portfolio Standard:

Subcommittee members were asked to suggest ideas for changes to the Solar Portfolio Standard. The following suggestions were made by various Subcommittee members:

Arizona Electric Power Cooperative, Inc. (AEPCO) said that the Solar Portfolio Standard is unduly burdensome and that both AEPCO and its members should be excluded from the requirements. AEPCO and its members do not need any new generation until after the turn of the century. The cooperatives are non-profit and member-customer owned, who have no shareholder venture capital to invest in expensive excess capacity. AEPCO does not believe an investment in solar resources according to the SPS timetable would benefit the member-customers that the member-owner cooperatives serve. AEPCO proposed, as an alternative, a portfolio standard that could be phased in as new generation resources are needed to serve the retail competitive load. It should also be noted that, as a precedent, the Nevada Legislature in its competition rules exclude cooperatives from its SPS.

Arizona Public Service Company (APS) suggested that the Solar Portfolio Standard should encourage the local economic development of the solar industry. APS suggests the establishment of a "wires" charge of 30 cents for each solar kWh required for the solar standard, which can be offset, i.e. reduced, by 30 cents for each solar kWh actually provided by the ESP. This avoids the problems with penalties, and assures that the money will be spent on solar and encourage competition to purchase solar energy in the market at the least price available below 30 cents. The charges for solar kWh requirements that are not offset by the ESP would be paid to the regulated "wires" companies for them to purchase solar kWh, or install solar to meet the kWh requirement. If the cost of solar kWh to the "wires" companies exceeds 30 cents, the companies would obtain the maximum kWh possible with the funds. The wires companies would resell the solar kWh and use the revenues to offset or reduce wires charges in the future. This approach would also provide a limit to the cost of the SPS. The .5% portfolio requirement should be kept until 2003 and increased by .1% each year thereafter, until reaching 1% in 2008. A 2-times credit should be given for solar kWh from equipment manufactured and installed in Arizona. The double credit should be good for five years and apply to plants installed through 2008.

ElectriSol Ltd. recommended minor modifications in the gradation of the Solar Portfolio Standard over time to produce (in conjunction with the major step increases in eligible customers in 1999, 2001, and 2003) a more gradual solar increase over years and increasing above 1% in later years. SPS % suggestions were: 1999: .5%; 2000: .75%; 2001: .5%; 2002: .75%; 2003: .5%; 2004: .75%; 2005: 1%; 2006: 1.25%; 2007: 1.5%.

The Arizona Solar Energy Industries Association (ARISEIA) recommended that solar water heaters be included in the Solar Portfolio Standard.

KJC Operating Company recommended that the Solar Portfolio Standard not be limited to modest-sized solar installations. KJC feels that the SPS % should be increased to 1% in 1999 and, after that, increased by at least .5% per year for at least five years.

The Land and Water Fund of the Rockies suggested that a way needs to be found to allocate penalty monies to the installation of solar equipment, possibly in conjunction with the System Benefits Charge programs, rather than having the penalties go back to the General Fund.

Solel Solar Systems Ltd. said that there is a minimum "critical mass" for solar projects of 30-35 MW.

Entech, Inc. suggested rule clarification that would "grandfather" solar systems already installed or solar electricity already contracted for, if the Commission decided at a later date to drop the SPS requirement. This would avoid stranded solar investment.

A Tucson Electric Power Company (TEP) representative suggested starting with a lower SPS % of 1/4 of 1%, increasing to 1/2 of 1% in 2003, 3/4 of 1% in 2005, and 1% in 2007, assuming that the competitive phase-in currently contemplated by the Rules were to be changed in favor of a flash-cut (i.e., 100% competition starting at once) in 2001. TEP suggested adding a credit for solar "Competitive Suppliers" who own or invest in solar manufacturing, system integration, or similar businesses in Arizona. TEP also suggested double credits for early installations.

Enron presented a detailed proposal that would incent parties to enter into power purchase agreements of various terms. To hedge pricing risk associated with such contracts, Enron outlined a series of incentive credits for generated kWhs with larger credits for longer power purchase agreement terms. To the extent that the market share fluctuations and incentive credits create shortages/surpluses of kWh credits, Enron proposed allowing the trading of credits. Enron also recommended that the penalty should be increased to 50 cents per kWh to discourage participants from simply deciding to pay the lower 30 cent penalty. Given the reluctance of energy providers to enter into long-term agreements, the higher prices of "spot" or short term solar energy make the current penalty more appealing than a penalty should be. Enron further recommended that any penalty funds be used to buy down the consumer cost of purchasing distributed solar generation, including solar rooftop systems. To enhance the economic appeal of these rooftop systems, Enron proposed that legislation promoting net metering at retail rates be implemented. Enron believes that the Solar Portfolio Standard should not include DSM, energy efficiency, or other renewable technologies. Enron also recommended that certain technical solar standards and a certification of solar facilities be met by all solar providers.

Both Boeing and York Research Corporation recommended keeping the Portfolio Standard as originally adopted.

Stirling Energy Systems, Inc. recommended that the 1% requirement should be gradually increased to 5% by January 1, 2008.

ASARCO, BHP Copper, Cyprus Climax Metals, Phelps-Dodge, and the Public Interest Coalition on Energy (the Mines & Coalition) object to the imposition of the solar portfolio mandate. The Solar Portfolio mandate will hamper the implementation of retail competition by increasing retail prices and by adding supply-risk to the provision of competitive resources.

#### D. Spreadsheet Analyses of Solar Options

Thanks to funding from the National Renewable Energy Laboratory (NREL), a consultant to NREL, Pacific Energy Group, was able to develop a sophisticated spreadsheet tool to evaluate five options that had been suggested for the Solar Portfolio Standard. A representative of Pacific Energy Group (PEG) made a presentation to the Subcommittee at the August 27 meeting. Based upon input from the Subcommittee, PEG refined the spreadsheet and it was e-mailed to Subcommittee members on September 4, 1997. (See Appendix A for the Major Findings of the Report from the Pacific Energy Group.)

#### E. Energy Efficiency and Renewable Energy Economic Development Impact Study

Several Subcommittee members attended a workshop presented by Economic Research Associates that described the results of a study jointly funded by the National Renewable Energy Laboratory, the Land and Water Fund of the Rockies, and the Arizona Department of Commerce Energy Office. The Study called Arizona Energy Outlook 2010: Energy Efficiency and Renewable Energy Technologies as an Economic Development Strategy presents a scenario that recommends a \$4.8 billion cumulative investment for energy efficiency and renewables for years 1998-2010. Such an investment, representing less than .3% of Arizona's cumulative GSP for the period, would result in energy bill savings of almost \$2 billion, generates a positive benefit-cost ratio of 1.92 and creates 11,100 new jobs. (See Appendix B for the Executive Summary of Arizona Energy Outlook 2010.)

MEMBERS AND PARTICIPANTS OF THE SOLAR PORTFOLIO STANDARD SUBCOMMITTEE

American Hydrogen Association	Mike Loomis
Amoco/Enron Solar Power Development	Jeffrey Golden, Chad Small
Amonix	Vahan Garboushian
Annan, Robert	Robert "Bud" Annan
AZ Department of Commerce, Energy Office	Stephen Ahearn
AZ Electric Power Coop. (AEPCO)	Karen Fenzi, Cliff Cathers
AZ Public Service Co. (APS)	Barbara Klemstine, Herb Hayden, Ed Fox
AZ Solar Energy Ind. Assn. (AriSEIA)	Michael Neary
ASARCO, BHP Copper, Cyprus Climax Metals, Phelps-Dodge, & Public Interest Coalition on Energy (Mines & Coalition)	Kirsten Dyk
Bechtel	Ray Draker
Boeing	Andrew Perez, Dale Rogers
Center for Energy Efficiency and Renewable Technologies (CEERT)	James Caldwell, Jr.
Conservative Energy Systems	Jim Combs
Electrisol Ltd.	Lee Tanner
Enron	Lyndon Taylor, Janel Guerrero, Mona Petrochko, Elliot Mainzer
ENTECH Inc.	Robert Walters
KJC Operating Company	Gilbert Cohen
Kearney and Associates	David Kearney
Land & Water Fund of the Rockies (LAW Fund)	Rick Gilliam, Sam Swanson
Nordic Power	Andy Baardson

MEMBERS AND PARTICIPANTS OF THE SOLAR PORTFOLIO STANDARD SUBCOMMITTEE

P G & E Energy Services	Tom Broderick
Phasor	Tom Lepley
Photocomm, Inc.	Michelle Hart, Julie Lanning, Mike Davis
Photovoltaic Resources International (PVRI)	Bill Kaszeta
PowerMark	Steve Chalmers
Progressive Solar	Gale Proski-Marsland
Residential Utility Consumer Office (RUCO)	Deb Scott
Salt River Project (SRP)	Jana Brandt, Jan Miller, Ernie Palomino
Science Applications Intern. Corp (SAIC)	Barry Butler
Solar Energy Industries Association (SEIA)	Mac Moore
Solel Solar Systems	Avi Brenmiller, Israel Krozier
Stirling Energy Systems	Harry Braun III
Tucson (City)	Vinnie Hunt
Tucson Electric Power Company	David Lamoreaux, Rick Mack
United Solar Systems Corporation (USSC)	Larry Slominski
York Research Corporation	Alphonse Bellac
AZ Corporation Commission Staff	Ray Williamson, Prem Bahl, Roland James
Invited Speakers	Christy Herig (NREL), Craig Tyner (Sandia), Howard Wenger (Pacific Energy Group)

### III. MAJOR AREAS OF AGREEMENT

In its deliberations, the Solar Portfolio Standard Subcommittee developed some major areas of agreement.

**A. ISSUE: Changing the Penalty Provision in the Standard.** The Subcommittee agreed that the penalty provision in the rule was inappropriate, as written. As written, the penalty funds would not ensure the installation of any new solar electricity projects. The penalty funds would return to the General Fund of the State of Arizona. This would not promote the widespread use of solar electric technologies by electric service providers as intended by the Solar Portfolio Standard. The Subcommittee agrees that the penalty wording should be changed to a mechanism whereby the penalty funds are utilized to install solar electricity systems in Arizona. **(There is no agreement on how the penalty should be handled. See Issue F. in the next section.)**

**B. ISSUE: Incentives.** The subcommittee agreed that the Solar Portfolio Standard should include incentives of some type to encourage the electric service providers to take actions which will better meet the objectives of the solar portfolio standard. There is general agreement that the incentive in the existing rule is not substantial enough to encourage a significant number of early solar installations.

**C. ISSUE: Banking and Trading of Solar kWh.** The Subcommittee agreed that Electric Service Providers should be allowed to "bank" or save up any extra (that is, above the annual portfolio requirement) solar kWh produced in a year for use in later years. The Subcommittee agreed that excess solar kWh should be tradable commodities that may be sold to other interested parties.

**D. ISSUE: Cost Reduction Incentive.** The Subcommittee agreed that the cost of the Solar Portfolio Standard should be limited to an acceptable cost/benefit point, and a cost-reduction incentive should be provided to protect Arizona consumers from increasing solar purchases if lower-price objectives are not met. A kWh cost-impact cap could be set to insure that costs must decline in order for solar installation rates to increase. If the kWh cost-impact cap is broadly accepted and achieved, it could help provide a reasonable expectation for the solar industry that the Solar Portfolio Standard requirement would remain or could even increase. This range and the related assumptions and uncertainties would need to be considered in determining an acceptable cost-impact cap. Other measures such as the average solar installed cost and performance should be monitored as well. The Subcommittee agreed that the Commission should establish a mechanism to develop the cost-impact cap and decide on a date when the costs of solar electricity is to be compared to the cost-impact cap. This "decision point" would be used by the Commission to determine if the Solar Portfolio Standard percentage should change.

#### IV. MAJOR AREAS OF DISAGREEMENT

**A. ISSUE: Allowable Technologies in the Solar Portfolio Standard Definition.** The issue is whether the Solar Portfolio Standard definition should be expanded to include renewables other than solar electric systems. Some Subcommittee members suggested including other renewable technologies, such as wind, biomass, or geothermal, in the definition. Representatives of the Arizona Solar Energy Industries Association suggested expanding the definition of solar equipment eligible for the Solar Portfolio Standard by adding the following wording to the definition: "or displace electricity by active or passive solar thermal energy technologies."

● **Majority Opinion:** The Solar Portfolio Standard definition should stay as it is: requiring the use of solar electric technologies. This will increase fuel diversity in the electricity generation mix. It will increase electric service provider expertise in using solar electricity systems. By concentrating on four solar electric technologies, the Solar Portfolio Standard will contribute to the commercialization of those four technologies in a major way. This concentration will lead to manufacturing expansions which will reduce the future costs of electricity produced by solar. Focusing on solar electric technologies is more consistent with the business in which electric service providers operate. The "portfolio" to which the standard refers is the provision of electricity. Adding a long list of other "renewable" technologies would dilute that commercialization effort.

Renewables other than solar electricity, such as wind or solar water heating (SWH), should not be included in the SPS. Wind resources are not widely available in Arizona, and are poorly matched in time and location to the daily and seasonal electric load of the state. Wind is already in large scale use and is well supported in other states that have more wind resources. Water heating provides thermal energy which is a totally different product than electricity, measured in thermal BTUs which have a much lower value and cost than electric kWh. Solar water heaters are devices that normally must be installed as part of a customer's water plumbing and heating system and their cost-benefits are better handled by companies that sell equipment and services for energy savings. Finally, it was recognized that there was another mechanism in the rules, the System Benefits Charge, that allows the use of all other renewable technologies that were suggested for inclusion in the definition. The majority felt that the System Benefits Charge was the proper mechanism to encourage solar water heaters and other renewables. Any incentives for wind, solar water heating or other renewables should be considered separately, under the System Benefits Charge. **(ElectriSol, Tucson Electric, R. Annan, Boeing, LAW Fund, Enron, Stirling Energy Systems, Arizona Public Service Company, USSC, KJC Operating Company, PVRI, PowerMark, City of Tucson, American Hydrogen Association)**

● **Dissenting Opinion(s):** Solar water heating should be included as part of the Solar Portfolio Standard. Solar water heating does produce BTUs, which can be expressed in electric terms by the following simple formula:  $3250 \text{ BTUs} = 1 \text{ kWh}$ . Meters are available that make this calculation. Like other solar technologies, the cost of solar water heating would decrease significantly if used on the scale expected to be created by the SPS. Unlike other solar technologies, solar water heating panels are presently manufactured in Arizona and other manufacturers have indicated that they would open facilities here if solar water heating were included in the SPS. Solar water heating is by far the most economical solar technology. A standard solar water heater, which costs approximately \$2,500 offsets as much electricity in a year as \$20,000 photovoltaic would. That is obviously a substantial difference.

Unlike the other solar technologies, such as central receiver, Stirling dish, or central station photovoltaic, solar water heating will be located at the home of the residential user instead of a remote location. At this home location, it will produce a direct observable benefit to that consumer immediately. In addition, the "majority opinion" is seriously compromised since those who comprise the majority stand to lose financially if it is included. The only winners would be residential users. It gives them five to ten times the amount for their money. The only state with similar conditions with a Solar Portfolio Standard, Nevada, included solar water heating in its renewable standard. (**Arizona Solar Energy Industries Association, Entech, York Research Corporation, AEPCO, Conservative Energy Systems, SAIC, Solar Energy Industries Association, Bechtel**)

- Individual Dissenting Opinion(s):

- A provision for solar water heating and other renewable technologies could be incorporated after the year 2003, assuming there is an increase of an additional 4% of the total electrical power generation for renewables in Arizona. (**Stirling Energy Systems, American Hydrogen Association**)

- Pacific Energy Group joins with the dissenting opinion under the following conditions: If solar water heating were allowed in the SPS, then:

- It should be allocated a maximum percentage of the SPS to address concerns of diluting commercialization efforts of competing solar electric technologies. We suggest a maximum percentage of 15%. This does not mean that 15% of the SPS is reserved for solar water heating, it means that solar water heating is eligible to fulfill up to 15% of the SPS on a per Energy Service Provider basis;

- The definition of eligibility should be more strictly defined. For example, replace the dissenting opinion language to read, *or solar hot water systems that directly displace electricity used to heat water*; and

- Solar hot water systems that qualify under the SPS shall not be eligible for other funds resulting from restructuring, such as a system benefits charge, only if other technologies such as troughs, towers, dishes, and PV are similarly ineligible. (**Pacific Energy Group**)

**B. ISSUE: Solar Portfolio Standard Percentage and Timing.** The issue relates to the size of the Solar Portfolio Standard percentage and how that should change over time. Some feel that the percentage is too high in the early years, when solar is more expensive. Others feel that the timing of the phase-in should be extended.

- Majority Opinion: The majority of the Subcommittee members believe that either the percentage should be changed, or, by the use of multiple-credit incentives, the "effective percentage" should be reduced. (The "effective percentage" idea relates to the idea that a double credit, for instance, will effectively temporarily reduce the percentage to one-half of the required amount, though the full amount would be built after the credit expires. ) **There is no majority agreement on what the percentage should be. There also is no majority agreement on when the percentage should be increased.**

Some of the suggested changes mentioned are:

- Mixed Opinions:

- The .5% portfolio requirement should be kept until 2003 and increased by .1% each year until reaching 1% in 2008. (**Arizona Public Service Company, AEPCO, Tucson Electric**)
- If there is a delay in the percentage increase, there should be a commensurate increase in the percentage above the 1% amount to compensate for the resulting delay in adding new solar resources. There should be minor modifications in the gradation of the Solar Portfolio Standard over time to produce (in conjunction with the major step increases in eligible customers in 1999, 2001, and 2003) a more gradual solar increase over years and increasing above 1% in later years. SPS % suggestions were: 1999: .5%; 2000: .75%; 2001: .5%; 2002: .75%; 2003: .5%; 2004: .75%; 2005: 1%; 2006: 1.25%; 2007: 1.5%. (**ElectriSol, Bechtel**)
- The SPS % should be increased to 1% in 1999 and increased by at least .5% per year for at least five years. (**KJC Operating Co.**)
- Starting with a lower SPS % of 1/4 of 1%, increasing to 1/2 of 1% in 2003, 3/4 of 1% in 2005, and 1% in 2007, assuming that the competitive phase-in currently contemplated by the Rules were to be changed in favor of a flash-cut in 2001. (**Tucson Electric, AEPCO**)
- The 1% requirement should be gradually increased to 5% by January 1, 2008. (**Stirling Energy Systems, Inc., American Hydrogen Association**)
- The percentage requirements, as stated in the Solar Portfolio Standard, should remain in place although effective percentages would be adjusted by any approved credit incentive. (**Enron**)
- Changing the effective SPS percentage phase-in and/or the ultimate percentage appears to be prudent to optimize the success of the Solar Portfolio Standard. However, it is not prudent to change the SPS percentage and timing until it is known whether or not Salt River Project is a full participant of the SPS. (**Pacific Energy Group**)
- The SPS percentage should be increased and ramped up to respond to national renewable portfolio standards. (**Science Applications International Corporation**)

- Dissenting Opinion(s):

- Some members of the Subcommittee felt that the Solar Portfolio Standard percentage and timing should remain as written in the rules. No change is needed. (**Boeing, York Research Corporation, R. Annan, LAW Fund, Solar Energy Industries Association, USSC, City of Tucson**)
- The Mines and Coalition do not support the mandate of the Solar Portfolio Standard; but if the Solar Portfolio Standard is implemented, we do not support any increase in the SPS percentage requirements currently mandated by the ACC rule. (**Mines & Coalition**)

**C. ISSUE: Incentives.**

● **Majority Opinion:** The majority of the Subcommittee members agree that some sort of incentives should be incorporated into the Solar Portfolio Standard. The majority agree that two different incentives should be offered: one incentive to encourage early installation of solar electric systems and another incentive to encourage solar economic development in Arizona:

● **Early Installation Extra Credit Multiplier:** For new solar electric systems installed and operating prior to December 31, 2003, electric service providers would qualify for multiple extra credits for kWh produced for five years following operational start-up of the solar electric system. The five-year extra credit would vary depending upon the year in which the system started up, as follows:

<u>YEAR</u>	<u>EXTRA CREDIT MULTIPLIER</u>
1997	.5
1998	.5
1999	.5
2000	.4
2001	.3
2002	.2
2003	.1

The Early Installation Extra Credit Multiplier would end in 2003.

● **Solar Economic Development Extra Credit Multiplier:** There are two equal parts to this multiplier, an in-state installation credit and an in-state content multiplier.

● **In-State Power Plant Installation Extra Credit Multiplier:** Solar electric power plants installed in Arizona shall receive a .5 extra credit multiplier.

● **In-State Manufacturing & Installation Content Extra Credit Multiplier:** Solar electric power plants that are installed in Arizona shall receive up to a .5 extra credit related to the manufacturing and installation content that comes from Arizona. The percentage of Arizona content of the total installed plant cost shall be multiplied by .5 to determine the appropriate extra credit multiplier. So, for instance, if a solar installation included 80% Arizona content, the resulting extra credit multiplier would be .4 (which is .8 X .5).

**All multipliers are additive, allowing a maximum combined extra credit multiplier of 1.5 in years 1997-2003, for equipment installed and manufactured in Arizona. So, for example, if an Electric Service Provider installed a solar power plant in 1999 in Arizona, using 100% Arizona content, which produced 1 million kWh, the ESP would receive credit for 1 million kWh plus extra credit of 1.5 million kWh, totalling 2.5 million kWh.**

**(LAW Fund, Pacific Energy Group, Bechtel, SAIC, USSC, Enron, Solar Energy Industries Association, KJC Operating Company, Stirling Energy Systems, American Hydrogen Association)**

Some of the suggested incentives are:

- Mixed Opinions:

- The Solar Portfolio Standard should encourage the local economic development of the solar industry. A 2-times credit should be given for solar kWh from equipment manufactured and installed in Arizona. The double credit should be good for five years and apply to plants installed through 2008. Economic development incentives are fully described in Issue D. (Arizona Public Service Company, Tucson Electric, AEPCO, R. Annan, City of Tucson)

- Double credits for early installations and credit for competitive suppliers who invest in solar manufacturing, systems integration, or similar businesses in Arizona. (Tucson Electric)

- An expanded crediting system which would encourage parties to enter into long-term power purchase agreements. Parties signing long-term agreements (from 5 to 20 years) would receive incentive credits with larger credits for the 20-year agreements and relatively smaller credits for the shorter agreements. (Enron)

- Recommends a combination of incentives, such as incentives that encourage economic development and longer-term agreements. The development of these incentives should be in concert with the development of the SPS Percentage and Timing. (Pacific Energy Group, LAW Fund)

- Dissenting Opinion(s): Some of the Subcommittee members feel that no changes to the Solar Portfolio Standard are needed. (Boeing, ElectriSol, and York Research Corporation)

#### D. ISSUE: Economic Development Incentives.

- Majority Opinion: A majority of the committee agreed that the SPS should be modified to enhance its economic benefits for Arizona consumers. The present rule does not contain a mechanism to specifically encourage the long-term development of the Arizona solar industry, or for installations of solar in Arizona. Arizona consumers who subsidize solar under the SPS are likely to expect substantial economic benefits from the resulting development of the solar industry. The majority agreed to a two-part economic development incentive (as shown in Issue C.) that offers incentives for in-state power plant installation and in-state solar equipment manufacturing. (Arizona Public Service Company, ElectriSol, Bechtel, Tucson Electric, R. Annan, York Research Corporation, AEPCO, Stirling Energy Systems, SAIC, USSC, Enron, City of Tucson, KJC Operating Company, American Hydrogen Association)

#### Additional opinion(s):

- Credit for competitive suppliers who invest in solar manufacturing, systems integration, or similar businesses in Arizona. TEP suggests that a Competitive Supplier should be entitled to receive a credit against the Solar Energy Requirement if the Competitive Supplier owns or otherwise makes an investment in any solar energy-related manufacturing, systems integration.

or other similar business enterprise for which physical facilities are located in the state of Arizona. TEP proposes that any such credit against the Solar Energy Requirement will be equal to the amount of nameplate capacity produced in a calendar year times 2,190 hours (based on an assumption of 25% capacity factor for solar energy generation). Any assumptions and standards related to the determination of the Solar Energy Requirement could be adjusted by the Commission from time to time to reflect changes in the cost and operation of solar technology and related market conditions. **(Tucson Electric, Bechtel)**

- **Pro-rata credit for Arizona content.** Allow a credit to apply toward Arizona construction content for central station. **(Bechtel)**

- The SPS should be modified to provide economic development incentives that will more directly benefit Arizona. Particularly, incentives that promote the installation of systems in Arizona are viewed favorably. The approach proposed that includes a determination of Arizona content merits consideration, however, there is concern that it may prove to be overly burdensome to administer. The development of these incentives should be in concert with the development of the SPS Percentage and Timing. **(Pacific Energy Group)**

- **Dissenting Opinion(s):** Some Subcommittee members believe that the Solar Portfolio Standard is not an appropriate place to have economic development incentives. Manufacturers will make plant location decisions based on other considerations and not on market issues such as those in the Portfolio Standard. **(Boeing, Solar Energy Industries Association)**

**E. ISSUE: Protection for Electric Service Providers in Case of Future Commission Changes in the Portfolio Standard Requirement.** One of the major barriers to the Affected Utilities and Electric Service Providers meeting the Solar Portfolio Standard is that, in the future, the Commissioners may decide to change or eliminate the Solar Portfolio Standard. This might leave the early participants at a competitive disadvantage.

- **Majority Opinion:** A rule clarification was suggested that would "grandfather" solar systems already installed or solar electricity already contracted for, if the Commission decided at a later date to drop the SPS requirement. The majority agreed that some wording should be added to the rules to protect the participants from the adverse affects of a future change in Commission rules to reduce or eliminate the Solar Portfolio Standard. **(ElectriSol, Tucson Electric, R. Annan, AEPCO, York Research Corporation, Bechtel, Boeing, LAW Fund, Stirling Energy Systems, Solar Energy Industries Association, SAIC, USSC, KJC Operating Company, American Hydrogen Association)**

- **Dissenting Opinion(s):** The ACC Rule clearly presents the definition of stranded cost "as the value of all the prudent jurisdictional assets and obligations necessary to furnish electricity...acquired or entered into prior to the adoption of this Article, under traditional regulation of Affected Utilities." Alone, this definition should provide reason to reject any proposal to recover future stranded solar investment.

Additionally, the current amount of stranded cost recovery imposed by the ACC Rule is burden enough to customers. Imposing future increases in stranded cost recovery will continue to impede pure competitive pricing for customers. Furthermore, the assurance of future recovery of stranded costs associated with solar investments can lead to imprudent solar investment on the part of the ESPs, which the customers will be responsible for subsidizing if stranded costs are imposed.

Ultimately it will be all customers that will be negatively impacted if future solar stranded investments are allowed to be recovered. We do not support a mechanism which will impose additional costs to competitive electricity prices as a result of stranded investment in solar facilities. (**Mines & Public Interest Coalition on Energy, Enron**)

**F. ISSUE: Details of the Penalty in the Standard.** Although there was majority agreement that the penalty wording in the rule should change, there was no general agreement in how the penalty monies should be used or what the penalty level should be. Some of the ideas suggested were:

- Mixed Opinions:

- Increasing the penalty to 50 cents per kWh to discourage participants from simply deciding to pay the lower 30 cent penalty deserves consideration since energy providers are unlikely to enter into long-term contracts that would offer energy pricing well below the current penalty level. While it is understandable that the Commission would like to set limits on solar power pricing in order to minimize the rate impact on consumers, the penalty is not the optimal mechanism to achieve this goal. Instead, the Commission should evaluate the various pricing scenarios that may occur if energy service providers buy spot solar power versus if they enter into longer term contracts and establish target prices for solar power over time. (**Enron, ElectriSol, Boeing, LAW Fund**)

- The penalty funds should be allocated to the System Benefits Charge to be used to purchase solar electricity for public schools or other public facilities. (**LAW Fund, City of Tucson**)

- The funds should be given to "wires" companies to be used to purchase solar electricity or install solar electric systems. (**Arizona Public Service Co., Tucson Electric, York Research Corporation, AEPCO, SAIC, LAW Fund**)

- The penalty funds go into a "solar fund" to be used for a consumer-based program to foster the development of solar technologies in small-scale, distributed generation applications. The fund approach could be similar to California's emerging technology fund that is resulting from restructuring. The fund should provide monetary rebates, buydowns, or equivalent incentives to purchasers, lessees or lessors of eligible solar electric systems. (**Pacific Energy Group, LAW Fund**)

- SEIA agrees with the concept that penalty funds should be used to fund a solar deployment trust fund. SEIA does not agree with any of the mixed options. (**Solar Energy Industries Association, KJC Operating Company**)

- Dissenting Opinion(s):

- Some organizations are firmly against increasing the penalty levels. (**Mines & Public Interest Coalition on Energy, Bechtel, Stirling Energy Systems, American Hydrogen Association**)

- Leave the penalty as written in the rule. (**R. Annan**)

## V. RECOMMENDATIONS TO THE WORKING GROUP AND COMMISSION

The Subcommittee recommends that the revised Objectives of the Solar Portfolio Standard as agreed upon by the Subcommittee and included in this report be incorporated into the rules to clarify the purpose and future implementation of the Standard.

The Subcommittee recommends that the penalty be changed to a mechanism whereby the penalty funds are utilized to install solar electricity systems in Arizona.

The Subcommittee recommends that the Solar Portfolio Standard include incentives of some type to encourage the electric service providers to take actions which will better meet the objectives of the solar portfolio standard.

The Subcommittee recommends that Electric Service Providers be allowed to "bank" or save up any extra (that is, above the annual portfolio requirement) solar kWh produced in a year for use in later years.

The Subcommittee recommends that excess solar kWh should be tradable commodities that may be sold to other interested parties.

The Subcommittee recommends that the cost of the Solar Portfolio Standard should be limited to an acceptable cost/benefit point, and a cost-reduction incentive should be provided to protect Arizona consumers from increasing solar purchases if lower-price objectives are not met. The Subcommittee recommends that the Commission establish a mechanism to develop the cost-impact cap and decide on a date when the costs of solar electricity is to be compared to the cost-impact cap. This "decision point" would be used by the Commission to determine if the Solar Portfolio Standard percentage should change.

## MAJOR FINDINGS

### Solar Portfolio Standard Analysis

Submitted to the Arizona Corporation Commission  
By Pacific Energy Group

On August 6, 1997, the Solar Portfolio Standard Subcommittee requested an independently-derived analysis of the impact of suggested changes to the Arizona Solar Portfolio Standard (SPS).<sup>1</sup> Pacific Energy Group, under subcontract to NREL, developed a computer spreadsheet tool to analyze costs, MW deployment schedule, and rate impacts of five different options to the current SPS.<sup>2</sup> The following major findings have been abstracted from a more detailed report.

- Table 1 provides a summary of the analysis results.<sup>3</sup> Depending on the SPS option selected, the Base Case ("best guess") results indicate that 250 to 330 MW of new solar capacity will be needed by the year 2010 at a total cost to Energy Service Providers (ESPs) of \$450 to \$750 million (1998\$). This cost range results in a rate increase of about 0.6% to 1.0% or \$0.0005/kWh to \$0.0008/kWh. The costs and rate impacts are bounded by the Low and High Case which are about 50% lower and 50% higher than the Base Case, respectively. *The analysis assumed that Salt River Project is a full participant in the SPS. The total costs and solar capacity needs are reduced by about 40% if SRP does not participate.*

**Table 1. Results Summary**

	Solar Capacity by 2010 (MW)	Total Cost, NPV (\$million)	Rate Increase (%)	Rate Increase (\$/kWh)
Low Case	250 to 330	\$250 to \$450	0.3% to 0.6%	\$0.0002 to \$0.0005
Base Case	250 to 330	\$450 to \$750	0.6% to 1.0%	\$0.0005 to \$0.0008
High Case	250 to 330	\$750 to \$1,150	1.0% to 1.7%	\$0.0008 to \$0.0013

- Between 11,600 GWh and 12,800 GWh of new solar energy generation and/or credits are needed cumulatively by 2020 for all options, except Option 4 which requires 17,400 GWh.
- The results indicate there is a strong incentive for ESPs to comply with the SPS rather than pay a credit, or penalty charge, even at the high end of the cost assumptions. Non-compliance costs for most options range between \$1.3 and \$1.6 billion.
- Including a double or multiple credit provision as an incentive for in-state economic development and/or longer-term power purchase contracts reduces total costs by about 30% and solar capacity needs by about 20% relative to the current SPS. It also provides ESPs an added incentive to comply with the SPS rather than pay for credits or penalty charges.

<sup>1</sup> The current rule sets the SPS at one-half of one percent beginning in 1999 and one percent beginning in 2002.

<sup>2</sup> The spreadsheet tool is available for downloading at [www.PacificEnergy.com](http://www.PacificEnergy.com)

<sup>3</sup> Option 4 has substantially higher requirements than all other options because it has a 1.5% SPS. All other options have a 1% SPS. Therefore Option 4 has been excluded from the table to avoid skewing the summary results.

- ESPs can substantially delay and more evenly spread out the costs associated with the SPS by contracting with solar power providers. Contracting for power may also serve to minimize risks to the ESP associated with new plant construction.
- Rate impacts are substantially lower than expected. Rate impacts (or rate increases), however, are somewhat illusory in the sense that once competition is introduced rates are projected to decline considerably. Rates for certain customers may not be at all impacted by the SPS. Rates for other customers may just not decline as much with the SPS.

To illustrate this point, take the case of a residential customer. The average AZ rate over the next 30 years is estimated at \$0.0761/kWh. The SPS requirement increases this \$0.0761/kWh rate to about \$0.0768/kWh. This translates to a bill increase of about 70 cents per month for a residential customer with a 12,000 kWh/year demand. This increase, however, may in fact be transparent to the customer. Assume because of competition the customer would have realized a 10% rate reduction with a net bill savings of about \$8.45 per month. Now because of the SPS the customer saves \$7.75 per month instead. See Table 2.

**Table 2. Bill Impact for Residential Customer**

	Before Competition	After Competition without SPS	After Competition with SPS
Customer Electric Bill Total (\$/month)	\$84.55	\$76.10	\$76.80
Customer Electric Bill Savings (\$/month)	NA	\$8.45	\$7.75

- In our opinion, all of the objectives of the Solar Portfolio Standard will be met. This statement must be qualified in part to say that at least three of the objectives may require further attention: "Economic benefit throughout Arizona", "Reach an acceptable cost/benefit point", and "Environmental benefits". In order to address these objectives, the benefits of the SPS to Arizona need to be quantified. The focus so far has been on costs.

Table 3 shows a preliminary estimate of selected economic development and environmental benefits, assuming full implementation of the current SPS. The analysis indicates that these benefits may indeed be substantial with some 600 jobs created and \$450 million in wages, salaries, state income taxes, and avoided environmental externalities. These results are intended to begin to address the open questions regarding benefits-oriented objectives.

The results are preliminary, however, and a detailed input-output analysis that quantifies direct, indirect, and induced effects is suggested. Other studies provide some insight to these detailed analyses, including a macroeconomic study of the Wisconsin economy: "The results show that renewable energy investments produce over three times more jobs, income, and economic activity than the same amount of electricity generated from coal and natural gas power plants."<sup>4</sup>

<sup>4</sup> Clemmer, S., and D. Wichert, *The Economic Impacts of Renewable Energy Use in Wisconsin*, Wisconsin Department of Administration, Energy Bureau, April, 1994.

Table 3. Preliminary estimate of selected SPS benefits to Arizona

Parameter	Result	Notes
Jobs Created by 2010	<b>600 jobs</b>	From operating solar plants, 20 MW/yr local manufacturing, and ancillary services. Indirect and induced effects are <u>not</u> included.
Wage, salary, and state income tax revenue (1998-2020)	<b>\$200 million</b>	\$400 million in nominal\$. Does <u>not</u> include other direct, indirect, and induced effects normally considered in a full input-output model used in economic development analysis. These multipliers are considerable.
Global warming CO <sub>2</sub> emissions avoided by 2020	<b>12 million tons, \$120 million</b>	At \$13/ton this equates to \$120 million in 1998\$.
Acid rain SO <sub>x</sub> emissions avoided by 2020	<b>32 thousand tons, \$85 million</b>	At \$2.03/lb this equates to \$85 million in 1998\$.
SMOG NO <sub>x</sub> emissions avoided by 2020	<b>38 thousand tons, \$40 million</b>	At \$0.82/lb this equates to \$40 million in 1998\$.

# **Arizona Energy Outlook 2010:**

**Energy Efficiency and Renewable Energy Technologies  
as an Economic Development Strategy**

**Prepared for the**

**National Renewable Energy Laboratory**

**Land and Water Fund of the Rockies**

**Arizona State Energy Office  
a Division of the Arizona Department of Commerce**

**Prepared by**

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**July 1997**

## Executive Summary

The state of Arizona has long been noted for its sunny days, dry, warm climate, and scenic beauty. The Grand Canyon, deserts, mountains, rivers, and attractive business climate make the state a very popular tourist destination and a desirable place to live, work, and retire. As a result, the state is experiencing startling population and job growth, and the economy is thriving. This growth and economic prosperity is shaping a growing demand for energy.

The access to quality energy resources ensures the availability of adequate power to drive the state's industrial processes, electricity to provide light and water to homes and businesses, and fuels to transport both people and goods throughout the world. Yet Arizona's most significant resources — energy efficiency and solar energy technologies — are relatively untapped.

A recent study by the National Renewable Energy Laboratory notes, for example, that Arizona has one of the best markets in the nation for cost-effective customer-sited photovoltaic systems. Moreover, the state has a high-technology manufacturing capacity that is well-above the national average, and the financial resources to support new industrial initiatives. Combined, these and other factors make Arizona a prime area for developing the manufacturing capacity to produce its own renewable energy technologies. Hence, Arizona is poised to take advantage of its renewable energy resources and the many associated job and economic development benefits.

At the same time, energy that is inefficiently used will constrain the Arizona economy. Conversely, energy efficient technologies will lower energy bills for residents and increase the productivity of Arizona businesses. The lower energy bills and higher productivity levels, in turn, will promote overall economic efficiency in

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**Policy and business leaders are looking at more productive strategies to meet the nation's economic and environmental needs. Energy efficiency and renewable energy technologies offer Arizona one such opportunity.**

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ways that create new jobs in the state. Moreover, accelerated investments in both energy efficiency and renewable energy technologies will enhance Arizona's air quality. Such investments will also diversify the mix of energy resources available to homes and businesses to ensure a stable and reliable resource base to meet future energy needs. Finally, new investments in energy efficiency and renewable energy technologies will encourage the development of new clean technologies and industries in Arizona.

In 1994, Arizona consumers and businesses spent approximately \$7.5 billion to provide for their overall energy needs. This total is 33 percent more than the combined annual tax collections authorized by the Arizona legislature during that same year. Many community and business leaders are looking for ways to use state tax dollars more efficiently, yet few

The study paints two pictures of Arizona. The first, follows a “business as usual” energy course. The second, identifies an “alternative energy Arizona” which, in the year 2010, pays approximately \$1.4 billion less in energy bills, has 11,100 more jobs, and enjoys a cleaner environment. Hence, increased investments in both energy efficiency and renewable energy technologies are important steps toward promoting a sustainable energy future for Arizona. More specific findings of the report include:

- ❖ In 1994, Arizona consumed a total of 1,033 trillion Btus of energy for all end-uses, the latest year for which energy consumption data are available. That level of consumption represents a per capita consumption of 254 million Btus. If we were to think of this energy use in terms of an equivalent amount of gasoline, the Arizona economy annually consumes the heat equivalent of just over 2,000 gallons of gasoline per capita to maintain the economic well-being of each of its residents.
 

**The Arizona economy annually consumes the heat equivalent of just over 2,000 gallons of gasoline per capita to maintain the economic well-being of each of its residents.**
- ❖ Under the baseline projections, Arizona’s economy — represented by the change in Gross State Product (GSP) — will grow from \$89.4 billion in 1994 to \$141.5 billion in 2010 (measured in constant 1996 dollars). This is a 58 percent growth in GSP in that period. At the same time, the number of Btus of energy needed to support a dollar of GSP will decline by only 15 percent under the business-as-usual projection. This implies that total energy consumption will increase 35 percent to 1,395 trillion Btus in the year 2010.
- ❖ The accelerated energy efficiency and renewable energy scenario outlined in this study would lower the number of Btus needed to support a single dollar of Arizona GSP by another 11 percent — from a 15 percent decline in the baseline projection to a 26 percent decline in the alternative energy scenario. This combination of factors would lower Arizona’s energy requirements to 1,216 trillion Btus. This change represents a 13 percent reduction in total energy consumption over the baseline energy projections for the year 2010 — without reducing either the services or standard of living for Arizona residents and businesses.
- ❖ Under the alternative energy scenario for the year 2010, new energy efficiency investments would provide 179 trillion Btus of energy savings while new renewable energy technologies would provide another 5.6 trillion Btus. Arizona ratepayers in 2010 would save approximately \$1.4 billion in lower energy costs. Energy efficiency and renewable energy investments, on the other hand, would require a total of \$461 million from residents and businesses in 2010. Net energy bills, therefore, would decline by approximately \$952 million in 2010 (in 1996 dollars).

of the study period.

- ❖ The alternative energy scenario examined in this study is aggressive and at the same time achievable. In fact, other studies suggest that additional gains in cost-effective energy efficiency improvements and greater use of renewables are highly possible. If these additional savings are pursued, the net return would extend the energy and economic benefits described in this analysis. Furthermore, if Arizona is able to develop a renewables manufacturing industry capable of producing 50 MW by 2010 — to meet in-state renewable electricity generating needs and take advantage of growing export opportunities — the market potential will be \$115 million in 2010 and generate 1,100 new jobs in that year.

**Impact of an Arizona Efficiency/Renewable Energy Scenario**  
(Millions of 1996 Dollars)

<i>Year of Analysis</i>	<i>GSP (\$MM)</i>	<i>Income (\$MM)</i>	<i>New Jobs</i>
2000	\$2	\$23	900
2005	\$69	\$112	5,200
2010	\$162	\$233	11,100

Source: Laitner and Goldberg, Arizona Energy Efficiency Study, 1997

**Sensitivity Analysis of 2010 Arizona Efficiency/Renewable Energy Scenario**  
(Millions of 1996 Dollars)

<i>Year of Analysis</i>	<i>GSP (\$MM)</i>	<i>Income (\$MM)</i>	<i>New Jobs</i>
Base Case	\$162	\$233	11,100
+ 20 % Investment	\$152	\$228	10,700
-20 % Energy Bill	\$116	\$177	8,400

Source: Laitner and Goldberg, Arizona Energy Efficiency Study, 1997

**Potential Impacts from PV Manufacturing Facilities in Arizona**

<i>Category of Impact</i>	<i>Amount</i>
Year 2010 Production (GWh)	534
Investment: 1998-2010 (millions of 1996\$)	706
Manufacturing Capacity (MW of output)	50
Year 2010 Market (millions of 1996\$)	115
Total Manufacturing Job Benefits in 2010	1,100

**The 13 Percent Energy-Savings Investment Strategy Assumes:**

- ◆ The adoption of underutilized but cost-effective energy efficiency technologies that are now available;
- ◆ On average, a payback of less than five years;
- ◆ Energy efficiency investments of \$4.8 billion in all end-use sectors in the 13-year period from 1998 to 2010; with a
- ◆ Cumulative energy bill savings of \$9.2 billion in the same 13-year period.

Source: Laitner and Goldberg, Arizona Energy Efficiency Study, 1997

**To Deliver a 13 Percent Reduction In Energy Use by 2010 Requires:**

- ◆ A cumulative energy efficiency investment of \$4.8 billion in the period 1998 through 2010.
- ◆ While a large number, \$4.8 billion is less than 0.3 percent of Arizona's GSP in that same period.
- ◆ It means that, on average, about 5 percent of the annual energy bill must be invested in energy efficiency and renewable energy technologies.

Source: Laitner and Goldberg, Arizona Energy Efficiency Study, 1997

**In Arizona, a 13 Percent Reduction in 2010 Energy Use Would:**

- ◆ Increase employment equivalent to the output of about 90 small manufacturing firms;
- ◆ Lower the region's unemployment rate by one-half percent;
- ◆ Reduce the state's energy expenditures by a net of \$194 per household; and
- ◆ Decrease carbon emissions by about 3 MMT.

Source: Laitner and Goldberg, Arizona Energy Efficiency Study, 1997



# Arizona Electric Power Cooperative, Inc.

P.O. Box 670 • Benson, Arizona 85602-0670 • Phone 520-586-3631

## General Comments Regarding the Solar Portfolio Standard

Arizona Electric Power Cooperative, Inc. (AEPCO) is a generation and transmission cooperative; it is a non profit entity and has no shareholders. AEPCO has no retail customers. AEPCO makes wholesale sales to its member distribution cooperatives. AEPCO's members are AEPCO's owners. Without shareholders, and as a nonprofit organization, AEPCO's member-customers have no venture capital to invest in a solar enterprise.

AEPCO does not need any new generation until after the turn of the century. Thus, any new resources required by the Rules to be added to our system in the interim (i) violate least-cost principles; (ii) are unnecessary; (iii) serve only to drive up system costs; and, (iv) constitute 100% potential stranded investment. In effect, adding such a new resource simply drives up the cost of our competitive price.

### *1. The Effect of the Solar Portfolio Standard on AEPCO's Member-Customers*

We must point out that the ("Standard") impermissibly interferes with AEPCO's internal affairs and contractual relations with its Class A members who are required to buy all their power requirements from AEPCO. It micro manages both our and their business operations. The ACC's Standard forces AEPCO and its members to ignore and breach those contracts and allows the members to purchase their solar resources elsewhere or forces AEPCO to add unnecessary generation resources and recoup those additional imposed costs through higher prices, thereby making AEPCO power more expensive for our members' customer-owners and less competitive. Neither of these is good business and neither is good policy-making.

Additionally, AEPCO's solar requirements may not be sufficient demand for a solar supplier to locate in our members' service areas. Consequently, the chances that a solar supplier, if stimulated by the Standard to locate manufacturing in Arizona, would build in such an area, is remote. More likely only solar collectors would be so located, providing perhaps a job to a minimum wage glass cleaner. Thus, no new jobs or economic benefit would reach the rural customers of AEPCO's members because of the Standard. Instead, they simply would pay more for the electricity they buy. And, since a significant portion of the rural customers AEPCO's members serve are low income, it would appear their only "reward" from the Standard will be higher power costs, the result of unnecessary generation.

### *2. Solutions and suggestions for change:*

AEPCO believes that the market should regulate the amount of solar energy included in an Energy Service Provider's (ESP's) portfolio; that an ESP should purchase and sell "green power" based on its customers wants and needs. Therefore, the Rules should require each ESP to make "green power" available, thus assuring customer choice. The creation, stimulation and stabilization of an Arizona solar energy industry could then be left to a systems benefit charge equally levied on all by the ACC through bills, to a tax or tax credit levied by the Legislature, or to other subsidy/incentive mechanisms which would be used towards reducing the cost of solar energy so that once competitively priced, it would become the resource of choice for all.

AEPCO would also suggest, as in the State of Nevada's solar standard rules, that Arizona's Rule should exempt electric cooperatives from compliance. The 10-13 MW of solar capacity which AEPCO or its members might need to install to comply with the standard are insignificant when compared to the state total and therefore bear little effect on the economic impacts potentially generated by their implementation.

## AEPCO's General Comments Regarding the Solar Portfolio Standard (continued)

Short of exempting of the Cooperatives, it is important that when considering AEPCO's members' 1995 retail sales (sales by our Class A members) to determine the amount of solar capacity needed, special contract sales, because of their nonfirm interruptible contingent, or buy through nature, should be excluded from the total.

AEPCO's other suggestions offer solutions to current problems with the Rules or respond to concepts raised in the Subcommittee:

### *a. The current rules favor new market entrants:*

While the percentage figures appear facially neutral, in application they favor new market entrants, particularly power marketers. Because of the need to plan and provide for the obligation to serve all who request service, Arizona's utilities *have already committed to energy resources* at least through 2003 (to include projected growth levels). *The Standard will be excess capacity for them* and increase their overall costs, making them less price competitive with newcomers who can fashion their portfolio of resources from scratch, as sales are made, and to meet whatever rules come along. As multi-state sellers, such new entrants can also tote the same "solar or renewables portfolio" to whatever state requires it. Arizona's rural electric cooperatives cannot. They are Arizona cooperatives, not giant holding companies, not subsidiaries of another state's IOU's. They are already committed to the renewables goals of the IRP. An excess capacity solar standard should not be further stacked against them.

### *Recommendation:*

Phase in the portfolio standard as new generation resources are needed to serve the retail competitive load. The ACC already has IRP plans which indicate those dates for Arizona's utilities. New market entrants with existing resources could file similar documents. Otherwise, the ACC would presume all resources to be new. This will provide a fair and economically efficient means for Arizona's consumers to meet the Standards.

### *b. The rules should encourage remote small-size "distributed" solar generators:*

Solar generation is ideal for rural Arizona where loads are remote and uneconomic to build distribution lines. ESP's should be rewarded with a double count as a incentive to install such systems at consumers' homes, ranches and businesses.

### *c. Complying with the Standard is unworkable in an unknown market:*

Competitive electric generation is an unknown product. No realistic forecasts of sales by affected utilities or new market entrants can reasonably be made. Therefore, it is impossible to accurately predict and acquire the "right amount" of solar resources to meet the Standard. Yet, ESP's will be required to meet the Standard on a continuous basis with each kW sold. If they do not "consistently" do so, they face a penalty. If they "under buy", they are penalized. If they "over buy", they pay more than necessary for energy and will be uncompetitive in pricing. While the "banking" and "trading" recommendations of the Subcommittee are a step in the right direction, some sort of flexibility or forgiveness mechanism in the Standard itself is needed in the first few years until reasonable estimates can be made.

**ARIZONA PUBLIC SERVICE COMPANY**

9/23/97

APS believes the SPS would be improved by the addition of strong incentive-credits for Arizona economic development as proposed in the report. However, in order to improve the cost and sustainability of the SPS, the solar kWh requirement should remain at 0.5% until 2003 when a review should be conducted of the costs of the SPS and the progress the solar industry has made in cost reductions.

Only if that review is favorable should an increase in the SPS be considered. If an increase is warranted, it should then be done on an incremental basis, such as by 0.1% per year until a new target is reached, rather than the doubling to 1% in 2001 as written today. This gradual increase would be beneficial to protect the electric consumers against higher costs, and would avoid unrealistic expectations by the solar suppliers of an increase in demand if their costs do not come down. In addition, this would help the suppliers see a sustainable increase in demand, and gradually increase their production, instead of requiring a sudden increase all in one year.

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Solar Thermal Technologies in Electric Utility  
 Restructuring  
 Solar Water Heating in  
 Arizona's Solar Portfolio Standard

The Arizona Solar Energy Industries Associations (ARISEIA) supports the solar portfolio in the restructuring rules approved by the Arizona Corporation Commission. We feel that any changes made to the portfolio should be meant to simply fine tune the document and that it's goals should not be reduced or delayed. Minor changes, those that would facilitate the orderly development of the industry, yet not dilute the Portfolio, should be considered.

We feel that the benefits to the state of Arizona far will far outweigh the small cost to the consumer. The state will receive a rapid return on their investment through cleaner air and economic development. The solar industry will be advanced through the greater use of technologies, important to our future, that could be left undeveloped in the drive for competition. It will allow movement towards a 21<sup>st</sup> century technology in financial partnership with the electric utility industry.

This Solar Portfolio Standard will bridge the gap between the bottom line realities of a competitive business during a period of history where there is an excess energy supply and a long-term need to develop alternative resources. Solar technologies are the obvious choice for alternative energy in this state where solar insolation is our greatest natural resource. However, an important solar technology has been excluded from this document: solar thermal water heating. While solar thermal does not produce electricity, it does capture energy as a renewable resource, something that differentiates it from energy efficient technologies. This energy is quantifiable in the form of BTU's, which can easily measured and converted to an kilowatt hours. The advantages of solar as a clean technology are achieved with solar thermal water heating and can be done directly at residential customers homes.

Please consider the following information regarding the inclusion of solar thermal water heating in the Solar Portfolio Standard:

**Cost to the Providers and Public**

Not only would the addition of solar thermal water heating provide a less expensive means of reaching a portion of the solar portfolio standard, but it will be a technology that can provide business opportunities to providers. A Business Opportunity Prospectus for Utilities in Solar Water Heating, prepared by the Energy Alliance Group for the Utility Solar Water Heating Initiative (US H20) demonstrates how utilities can turn what was once thought of as a loss of electric sales into increased revenues.

Depending on the type of systems used, solar water heating systems can produce energy at the equivalent rate of under four cents per kWh. Technology advances and industry standards that have been developed and implemented in Arizona will insure the quality of systems installed.

Simple rules and guidelines for the inclusion of solar water heating can be easily developed. The output of thermal systems can be easily measured through the installation of a BTU meter.

## **Economic Development**

Solar thermal offers additional economic benefits to Arizona. Just as with PV, the solar thermal industry has the potential to bring jobs to Arizona. There were once many companies manufacturing solar water heating products in the state. These companies shipped solar products throughout Western United States and made use of another of Arizona's natural resources, copper. The jobs that a solar thermal industry creates extend to all sectors of the economy. Skilled and unskilled jobs are created in manufacturing, as well as in service and installation. With the existing infrastructure in place, this technology is ready for immediate expansion.

## **Air Quality**

The use of solar thermal water heating systems assist in Arizona's efforts to improve air quality. According the Arizona Public Service's *Consumers Guide to Solar water Heating*, a solar water heating system that provides 55% of a 70 gallon per day load at 120 degrees will eliminate 2800 pounds of pollution when replacing an electric water heater in the Phoenix area. When replacing a gas water heater, 1200 pounds of pollution are displaced at the source, producing results directly over our neighborhoods. Most DHW systems that are on the market today will provide a family with significantly more than a 55% solar fraction resulting in greater air quality benefits than the above statistics.

The numbers for other Arizona cities are even more attractive. Prescott tops the list with a 3500 /1500 pounds (electric/natural gas) per system savings in pollution, followed by Flagstaff at 3300/1400 pounds and Tucson with 2600/1100 pounds.

Commercial solar heating systems for heating larger volumes of water can be economically competitive and provide additional business opportunities for utilities. These large scale systems would produce additional air quality benefits.

## **Less Demand on the Systems Benefit Charge**

Inclusion of solar thermal water heating will reduce the need for some programs under the systems benefit charge. Some who are involved in the restructuring process will be seeking higher levels of funding for solar technologies, environmental and low income programs to be included in the systems benefit charge. The inclusion of solar DHW, in the Portfolio, will eliminate the need for developing more traditional utility programs for DHW. This will allow the market to develop without funding under the SBC.

## **Conclusion**

Inclusion of solar water heating in the Solar Portfolio Standard, by simply adding the phrase, "**or electricity displaced by solar thermal energy technologies**" will provide utilities a low-cost option to fulfill a portion of the requirement of the standard. If the goal of the standard is to bring solar technologies costs down to more marketable levels and to provide the environmental and economic benefits that solar has to offer, all solar technologies should have equal footing in the standard. Inclusion will provide a site based method of bringing restructuring to residential and the small commercial customers. The solar industry will benefit by the resulting economies of scale and the competition for improved and cost effective products. This will serve the state of Arizona well in the coming century.

**MEMORANDUM**

**DATE:** September 23, 1997

**TO:** Ray Williamson

**FROM:** On behalf of ASARCO, BHP Copper, Cyprus Climax Metals, Phelps-Dodge, and Public Interest Coalition on Energy

**SUBJECT:** Solar Portfolio Standard Report

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The Mines and the Coalition support the implementation of the Commission's Rule on retail electric competition -- taken as a whole. However, we continue to be concerned that the solar portfolio standard feature of the Rule will hamper the implementation of retail competition by increasing retail prices and by adding supply-side risk to the provision of competitive resources. The recommendation in this Report to create a new class of potentially stranded costs to cover future solar facilities further adds to our concern.

If the portion of the Rule concerning the solar portfolio standard is to be revised, we suggest that consideration be given to scaling back the solar requirement. Reducing the required solar content would mitigate the cost impact on consumers and would lower the supply-side risk.

LAND AND WATER FUND OF THE ROCKIES  
ENERGY PROJECT

COMMENTS ON SOLAR PORTFOLIO STANDARD SUBCOMMITTEE REPORT

In the interest of brevity, the Land and Water Fund of the Rockies (LAW Fund) focuses its comments on five conceptual areas: penalties, incentives, future rule changes, and resource review.

Penalties

The LAW Fund supports a penalty provision in this section of the Rule that is high enough to encourage ESPs to purchase appropriate levels of energy derived from solar electric renewable technologies. We are not opposed to increasing the penalty to 50¢, although 30¢ is probably sufficient if a workable credit system is incorporated. The funds collected through this provision, if any, should be used to advance the development of solar electric resources, i.e. to meet the objectives for the Arizona Solar Portfolio Standard outlined in the report. In our view, the best way to accomplish this goal is to transfer the funds to the administrator of the System Benefits Charge monies, and charge this entity with achieving the greatest amounts of solar electric renewable technologies possible through a competitive bidding process.

APS has proposed a concept of a 30¢/required solar kWh wires charge, reduced by 30¢/actual solar kWh provided by the ESP, ostensibly to avoid the "problems with penalties." The difference, if any, would be paid to the regulated "wires" companies to use in acquiring as much solar as possible. This complicated administrative approach has several fundamental flaws. First, it guarantees unnecessarily that every customer pay an explicit price for the Solar Portfolio Standard. In reality, the relatively small cost of the Standard, to which all ESPs are subject, may be absorbed by the ESP. Second, the nature of the regulated wires companies is unclear at this point. Companies whose sole business is to build and operate wires may be poorly suited to administer these funds. Finally, the majority of Arizona retail electric customers will be served by regulated wires companies that are affiliated with generation companies. These corporate affiliations may provide mixed incentives to the wires company administering the "penalty" funds. We oppose APS' approach and suggest that a wording change in the Rule may solve the concern that the penalty monies may not be used to purchase solar resources.

Incentives

We are longtime supporters of incorporating effective incentive provisions in regulatory regimes to encourage desired behavior. The LAW Fund supports adoption of incentive provisions which encourage not only early implementation, but also in-state manufacture and installation. Section 1609C of the Rule provides a 2-times credit to ESPs for early installation. This section can be modified to include a similar credit for in-state manufacture and installation, but a maximum credit of 2 should be imposed. In addition, the credit should have an expiration date (e.g. 2004) to avoid the possibility of effectively cutting the Standard in half. We believe that implementation of the Standard percentages as written, in conjunction with appropriate credit provisions will inherently provide cost reduction incentives to ESPs, and no further direct incentive is necessary. Moreover, these incentives, along with the banking (i.e. carry-forward) proposal in the Subcommittee Report, provide a mechanism for ESPs to avoid the large lumpy solar resource additions implicitly required by the Rule.

#### Future Rule Changes

There is justifiable concern that ESPs which, in good faith, implement the provisions of the Solar Portfolio Standard and work hard to acquire least cost solar resources, may be left with potentially strandable assets should a future Commission reduce or eliminate the Standard. We agree that at the time of any future Commission review which results in adverse changes to the Standard, the Commission should take steps to protect solar investments made to date. For example, ESPs that choose to pay the penalty, gambling that the Commission will eliminate the Standard, should not entirely escape cost responsibility. Continuation of penalties for a specified period and other creative cost-sharing options should be considered as options. In this regard, wording changes to the Rule must be carefully constructed to assure that all ESPs are treated fairly and equitably.

#### Resource Review

It's apparent from this report, other working groups, and other proceedings at the Commission, that a periodic review of electric resource needs, costs, characteristics, availability, and so on will continue to be a necessary function of the Commission. The LAW Fund recommends that the Commission continue a workable resource review process, allowing for participation in a public forum, that is an effective descendent of the IRP process to fulfill these needs.



SOLAR ENERGY INDUSTRIES ASSOCIATION

**SOLAR THERMAL TECHNOLOGIES  
FOR  
RESIDENTIAL, COMMERCIAL, AND INDUSTRIAL  
WATER AND SPACE HEATING APPLICATIONS  
A PRIMER FOR PORTFOLIO STANDARD ISSUES IN REGARD TO  
ELECTRIC UTILITY RESTRUCTURING**

**Introduction**

Current draft utility restructuring legislation does not include solar thermal water or space heating technologies within the definition of renewable energy technologies in regard to renewable energy portfolio standards (RPS). As a result, the legislation favors large-scale grid-tied projects over small-scale residential renewable energy producers. The Solar Energy Industries Association (SEIA) has drafted this primer in an effort to change this definition as it currently stands by demonstrating the value and necessity of including solar thermal technologies in a proposed RPS. First, here are some facts regarding today's solar thermal water and space heating industry:

- Today, over 1 million buildings utilize solar thermal generated energy to offset conventional water heating technology, which is primarily electricity.
- The industry consists of experienced small manufacturers that currently produce the highest quality solar thermal technologies in the world today.
- The non-profit Solar Rating and Certification Corporation and the Florida Solar Energy Center offer the most comprehensive rating and certification options available to solar manufacturers in the world. Ratings are based on actual field performance, thus resulting in one of the only few 'real world' appliance certifications available today.
- In a recent study performed by the Florida Solar Energy Center (FSEC), if the potential market for solar water heaters in the US was fully realized, 41 million kWh equivalent would be generated per year - equivalent to the output of eight 100 MW fossil-fueled generating plants.

**Proposed Change**

Each of the proposed bills define renewables in the following manner:

“The term ‘renewable energy’ means electricity generated from solar, wind, waste, except for municipal solid waste, biomass, hydroelectric, or geothermal resources.”

The national solar energy industry requests that this definition be expanded by adding the following phrase, “or electricity displaced by solar thermal energy technologies.”

*(over)*

### **Rationale**

The rationale for the proposed change includes the following:

- Many utilities studying the potential of using solar thermal water heating technologies as a tool for distributed generation and renewable energy deployment understand that allowing solar thermal technologies to be included in the definition of renewables may add significant value to future investments in solar water heating technologies.
- Solar thermal water heating systems can be measured in the **exact same manner** by which other end-use renewable energy technologies are measured. The addition of a low-cost Btu meter to the system with a readily available device that converts the Btus directly to kilowatt-hours is an easy way to measure energy output for the purposes of the RPS.
- Utility programs utilizing cost-effective solar thermal technologies may, in many cases, be the lowest cost means of complying with an RPS.
- As currently crafted, photovoltaic systems configured as rooftop distributed generation would be eligible to participate in RPS's, providing at least some electricity for electric water heaters. Heating water with solar thermal technologies can be accomplished at one-tenth the cost.

### **Conclusion**

This change in the definition of renewable energy will most certainly give utilities an option that is low-cost and extremely valuable to fulfill renewable energy portfolio standard requirements and is essential to assuring that the US fully recognize its renewable energy generation potential.

TUCSON ELECTRIC POWER COMPANY  
ADDITIONAL COMMENTS  
ON  
SOLAR PORTFOLIO SUBCOMMITTEE REPORT

Section IV.D of the Report notes that Tucson Electric Power Company ("TEP") suggests that, in addition to the incentive credits recommended by the Subcommittee for early installation and Arizona content, Competitive Suppliers who invest in solar manufacturing or similar facilities in Arizona should get credit against the Solar Portfolio Standard requirements. TEP also suggests that clarifying language be adopted to remove any uncertainty as to whether credit will be given for customer-sited and customer-owned facilities. TEP offers the following language for the Commission's consideration as possible amendments to the Rules designed to address these issues:

"A. A Competitive Supplier will be entitled to receive a credit against the Solar Energy Requirement if the Competitive Supplier owns or otherwise makes an investment in any solar energy-related manufacturing, systems integration, or other similar business enterprise for which physical facilities are located in the state of Arizona. Any such credit against the Solar Energy Requirement will be equal to the amount of nameplate capacity produced in a calendar year times 2,190 hours (based on an assumption of 25% capacity factor for solar energy generation). Any assumptions and standards related to the determination of the Solar Energy Requirement may be adjusted by the Commission from time to time to reflect changes in the cost and operation of solar technology and related market conditions.

B. A Competitive Supplier will be entitled to receive an appropriate credit against the Solar Energy Requirement if and to the extent the Competitive Supplier incurs costs, including any financial incentive programs or measures, associated with the installation and ownership by a customer of New Solar Resources at that customer's residence, commercial or industrial location. Prior to implementation, the Competitive Supplier will file an application with the Commission for approval of the program or measure and approval of the credit proposed to be applied against the Solar Energy Requirement."