ORIGINAL

0000077742

Net Metering Comments

Docket No. E-00000A-99-0431

RECEIVED

2007 OCT 12 P 3: 56

AZ CORP COMMISSION
DOCKET CONTROL

47

Introduction

The Vote Solar Initiative, Arizona Solar Advocates[1] and the Solar Alliance[2] appreciate the opportunity to comment on the proposed rule for net metering for the regulated utilities under the Arizona Corporation Commission (Commission). The Vote Solar Initiative is a non-profit organization with the mission of stopping global warming and increasing energy independence by bringing solar energy into the mainstream. Arizona Solar Advocates are stakeholders from Arizona organizations that have been involved in the REST, UCPP and other ACC forums related to solar since 2003. The Solar Alliance is a state-focused alliance of manufacturers, integrators and installers that are dedicated to accelerating the promise of solar energy in the United States.

We want to recognize the work and commitment of the Commission to develop sustainable renewable resources in the state. We also want to especially commend the Commission for its foresight in promoting distributed resources through a comprehensive set of policy initiatives including the Renewable Energy Standard and Tariff (REST), interconnection standards, and the uniform credit purchase program. While we recognize that not all policies are fully in place at this time, we believe that the result will be a dynamic and vibrant distributed renewable energy market in Arizona that creates jobs and other economic benefits locally and statewide, and sets the stage for Arizona to become a national leader.

On August 28th, 2007, in Decision No. 69877, the Commission ordered staff to begin a rulemaking process to draft rules on net metering, addressing at a minimum the following issues:

- Customer sector participation
- Types of generation resources
- Project size
- Total participation
- Metering
- Treatment of net excess generation, and
- Responsibility for costs.

Arizona Corporation Commission
DOCKETED
OCT 12 2007

DOCKETED BY	
	nr

The purpose of these comments is to address these and additional design aspects of a prospective net metering rule, the implications for the successful implementation of REST, and long term benefits for Arizona rate-payers.

Background on Proceedings and Prior Comments

[1] Arizona Solar Advocates include ARISEA, Greater Tucson Coalition for Solar Energy, Michael Neary, Valerie Rauluk and Bud Annan.

[2] The Solar Alliance (www.solaralliance.org) members include American Solar Electric, BP Solar, Conergy, DT Solar, Energy Innovations, Evergreen Solar, First Solar, Kyocera, Mitsubishi Electric, MMA Renewable Ventures, REC Solar, Sanyo, Schott Solar, Sharp, SolarWorld, SPG Solar, SunEdison, SunPower, Suntech, and Uni-Solar.

Many of the commenting organizations participated in the September 7, 2006 workshop on net metering, and have long been urging the Commission to conduct rulemaking on the matter. Our arguments for why net metering is important for Arizona were amply covered at the meeting and by our comments submitted on October 20, 2006, and we incorporate them by reference herein.

In our August 16, 2007 comments we recommending that the following wording

"The draft rules should address, at a minimum, the following issues:

- Customer sector participation
- Types of generation resources
- Project size
- Total participation
- Metering
- Treatment of net excess generation
- Responsibility for costs"

Be amended and expanded as follows:

"The draft rules should address, at a minimum, the following issues:

- Customer sector participation
- Types of eligible generation resources
- Project size
- Participation
- Metering hardware and cost responsibility
- Treatment of net excess generation
- Financial implications of net metering for ratepayers and utilities
- Relationship to existing tariffs
- The role net metering plays in the furtherance of other Commission rules, policies, and goals."

We believe that framing in this way offers a more robust discussion of costs and benefits, and long term implications for all rate-payers.

Summary of Purpose of Expanded Comments

Our purpose for expanding on our comments from multiple forums is to incorporate the proposed amended considerations for the draft rule, and present detailed evidence and arguments in support of recommended rule design.

Relationship to Other Policies

True net metering is a fundamental enabling policy to successful implementation of the Renewable Energy Standard and Tariff (REST). As defined in the REST,

> "Net Metering" means a system of metering electricity by which the Affected Utility credits the customer at the full retail rate for each kilowatt-hour of electricity produced by an Eligible Renewable Energy Resource system installed on the customer-generator's side of the

electric meter, up to the total amount of electricity used by that customer during an annualized period, and which compensates the customer-generator at the end of the annualized period for any excess credits at a rate equal to the Affected Utility's avoided cost of wholesale power. The Affected Utility does not charge the customer-generator any additional fees or charges or impose any equipment or other requirements unless the same is imposed on customers in the same rate class that the customer-generator would qualify for if the customer-generator did not have generation equipment."

Application of Net Metering

Net Metering policy is properly applied to all customer-sited eligible generation, is indifferent to customer rate classes, and is trued-up only on an annual basis. In addition, net metering service is offered at non-discriminatory rates to customers with Eligible Renewable Energy Resources without requirement for the customer to change its retail rate.

True net metering has been adopted by states leading in renewable energy deployment as the most effective approach to integrating distributed renewable energy, in alignment with market-driven energy investment and deployment strategies and to assure fairness to all rate-payers. At the heart of the issue is the realistic allocation of costs and benefits to the right parties and for the benefit of the system grid and all rate-payers. What many states have determined, through intensive system specific studies (like the Austin Energy analysis discussed below), is that there are indeed net positive benefits from distributed generation, especially PV generation (we are not suggesting that other renewables do not deliver benefits, but here focus on PV data).

These benefits appear to at least off-set the reduction in fixed cost contribution from the customer-generators energy displacement. There is a theoretical mismatch in costs and benefits with a possible reduction in fixed cost contribution by customers with PV[3] in the near term, and infrastructure savings over a somewhat longer term. However, this is no different than the addition of new generating capacity (or transmission capacity) that is oversized for current load and sales, but looks to accommodate the future growth. Over time, the near term costs paid by retail customers will be offset by the additional capacity and the utility's ability to meet new growth (and receive new revenue). Renewable energy distributed generators can provide major efficiencies, additional flexibility and cost deferrals that benefit the whole system. Effective assessment of projects and productive deployment of distributed renewable resources would be hampered by additional charges and tariffs. Those losses would be borne by all rate-payers.

Summary of Recommended Net Metering Rule

Customer sector participation

We recommend that retail customers in all classes of service be eligible for net metering service provided an Eligible Renewable Energy Resource is sited on the customer's premises, that the rated capacity of the customer's generating facility does not exceed the lesser of 2000 kW or the customer's service entrance capacity.

Types of allowable generation resources

[3] This impact is greatly reduced for rates that include a demand charge.

All Eligible Renewable Energy Resources under REST.

Limits to project size, if any
The lesser of 2000 kW, the customer's entrance capacity, or other limitation that may result from application of the Commission's interconnection rules.

Limits to total participation, if any
Limited only by application of the Commission's interconnection rules.

Metering hardware and cost responsibility
A customer's facility shall be equipped with metering equipment that can measure the flow of electric energy in both directions through a single register. The cost of this meter shall be paid by the utility.

Treatment of net excess generation both monthly and annually
Renewable Energy generation in excess of the customer's consumption, shall be carried forward from month to month and credited at a ratio of 1:1 against the customer's retail kilowatt-hour consumption in subsequent months. The utility shall compensate the customer for any accrued excess kilowatt-hour credits, at the average hourly incremental cost of electricity supply over the most recent calendar year, on an annual basis.

Net financial implications of net metering for ratepayers and utilities
Research and analysis in other states has shown that distributed resources provide net benefits for ratepayers and utilities. We believe that similar benefits will result from larger penetrations of distributed generation in Arizona.

Relationship to existing tariffs
The Customer is not required to change tariffs as a result of obtaining net metering service, nor or any special tariffs, charges, or rates applied only to customers taking net metering service.

The role net metering plays in the furtherance of other Commission rules, policies, and goals.
Net metering is essential to the successful implementation of the distributed energy portion of the REST.

APS current practice
Net metering is limited to systems less than 100kW. For systems in excess of 100kW, APS has proposed net billing determined on a hourly basis and an additional stand-by demand charge based on the capacity provided by the customer's generating facility. This proposal is pending before the Commission.

TEP current practice
TEP offers an annualized net metering program for customers with installed solar generation of 10 kW AC or less. While a program cap of 500 kW was initially part of the program, TEP has not enforced the cap and currently has nearly 1,000 kW of net metering customer participation.

Economic Effects of Net Metering: Benefits to the System Grid & All Rate-Payers

To look at this issue more broadly, we would like to step back and evaluate the transactions taking place. Customers of utilities are willing to invest their own capital in generating facilities that serve a portion of their own consumption for a variety of reasons – be it economic, environmental, or otherwise. The result of this action by the customer is to reduce the amount of energy that needs to be generated by the utility or for the utility through a purchase contract. In addition to the renewable generation premium, which is only partially supported by rate-payer funded REC payments, a customer-generator pays for the avoided cost generation. REST rules stipulate that only the *excess* value over avoided cost can be supported by REST tariffs. In the absence of such a contribution, all rate-payers would contribute to the capital cost of the generation otherwise avoided. Penalizing customer-generators with additional non-cost based charges reduces the ability of the general body of rate-payers to access such sources of low-cost capital from dispersed and diverse sources, factors which reduce risk and contribute to lower cost of capital overall and more optimal capital allocation.

In addition, the reduction in the amount of energy that needs to be transmitted and delivered by the utility mitigates the electrical burden on the wires. Each of those reductions has a value which may be experienced currently, in the future, or both. In addition, the customer's PV generating system also reduces to some extent the amount of capacity needed to meet the needs of all customers. This also represents a value.

It's also important to note that determining the benefits of distributed PV generation for a particular utility system is difficult. However, there have been many studies performed on other utility systems with fairly consistent results. In an attached appendix we have summarized in a more detailed manner the key studies. Below, we highlight the key points that serve as a foundation for our arguments on benefits for the customer-generators, all rate-payers, system grid, utilities, Commission and Arizona communities. In the attached Appendix, further detail regarding these studies is available.

Key findings:

Value of distributed PV is $2,312 per kW (11.3¢ per kWh) for the best fixed configuration.

The Value of Distributed Photovoltaics to Austin Energy and the City of Austin (Clean Power Research, March 17, 2006)

Integrating renewable energy systems into electric power distribution systems increased the value of the benefits by about 20% to 55% above central station benefits in the national regional assessment.

The Integration of Renewable Energy Resources into Electric Power Distribution Systems (Oak Ridge National Laboratory, June 1994)

207 Benefits of Distributed Generation: reducing cost of capital and risk, optimizing financial investment, system grid support, capacity planning and flexibility, operating cost reduction, reliability, community value, regulatory efficiency, security and safety.

Small is Profitable: The Hidden Economic Benefits of Making Electrical Resources the Right Size (Lovins, et al., Rocky Mountain Institute, 2002).

"...the value of load reduction from the perspective of ratepayers (in reducing the prices paid by everyone) is at least twice as great as the market prices themselves, and it rises dramatically as load increases."

Mid Atlantic States Cost Curve Analysis (JBS Energy, 12/5/2000)

PV offers provides significant capacity value (41-71%) to the electrical grid.

Effective Load Carrying Capability Of Photovoltaics In The United States (Perez, et al., presented at the American Solar Energy Society Annual Conference, July 2006).

Optimizing/ Stabilizing Financial Investment – Reducing Risk & the Cost of Capital
Historically, most industries, including the electric power industry, had little need to protect comprehensively against market-wide risks. Markets, in general have been fairly stable. When such risks have occurred in the recent past, such as the natural gas price increases of the last few years, the risks are managed retroactively by passing the costs on to rate-payers.

However fossil fuel markets have become increasingly volatile, uncertain, and upwardly trending, with little evidence of becoming less so in the near to medium term. Prudence and fiduciary responsibilities suggest that more comprehensive risk management strategies, beyond the financial hedges such as forward purchases, futures and options currently available be actively engaged. Renewable energy investment, at sufficient scale, offers such risk reduction protection.

> "A hedge is a mechanism to reduce the risk of paying high prices for natural gas in the future...hedging ability ...provides price stability, not the lowest possible price that could be obtained with perfect forecasting and complete flexibility in resource choices."
> Renewable Energy as a natural gas price hedge...David Berry, 2003

Berry's 2003 analyzed the risk hedge value on a three point scale. While offering great conceptual value, the Austin Energy study of 2006, advanced a more detailed assessment of the hedge value using natural gas forward contracts. Such an approach provides more accurate assessment, but due to limits in forward contract markets offers greatest certainty on the hedge value for years 1 through 5 only. Using this method, the value of the risk protection was determined to be approximately $.02 per kWh. On-going discussions and modeling will more definitely establish this value, but it could be two to three times the hedge value for years 1-5, or $.04-$.06 per kWh over a 35 year life of a solar electric asset.

Impacts on Public Policy efforts in Arizona: ***Renewable Energy Standard and Tariff***
Without true net metering, an additional cost will be imposed on distributed renewable generation. That will result in higher implementation costs for the REST. This may take the form of higher costs through the UCPP to cover the additional costs of the standby rate, or in fewer customers interested in developing distributed generation on their premises – again resulting in higher costs necessary to attract sufficient customer interest.

Effects on Economic Development in Arizona

Re-positioning our economies with cleaner, greener alternatives is a major endeavor. The approach taken in the U.S. is to enlist the power of markets to allocate, value, and distribute, making the job a little less painful and more efficient. It is critical for public policy-makers to encourage the positive behaviors of customer-generators when they are shouldering more than the non-generator customer's share of the system capital requirements and risks. Market based incentives and efficiencies should be promoted, to reduce bias and unfairness in the system.

That renewable energy sources offer reduced and/or eliminated fossil fuel generation impacts such as diminished air and water quality, and destructive land use, is commonly accepted. However, renewable energy can offer many other benefits to the larger community from which all rate-payers can benefit, not just customer-generators.

Many studies have forecasted the economic development benefits of distributed renewable energy deployment. Those forecasts have ranged from 32-100 person year jobs per 1MW of PV deployed (REPP: The Work that Goes into Renewable Energy, 2001, Singh, et al. 35.5 per MW; Arizona Solar Benefits Analysis Segue Energy Consulting/ MSRI Technical Assistance, June 6, 2005, Herig, Job years 142 per MW, Gross State Product $10.8 million per MW, and anecdotal evidence from Arizona/ National design/ builders). Actual experience has shown that the job impacts have been realized at the lower end of the range. The jobs produced are primarily higher level construction jobs, with a smaller number of engineering, management, and business professionals. In a state like Arizona that depends so heavily on construction for jobs and regional personal income, an industry that can build on that core capacity and add value (and income) offers a productive regional strategy. Given the current downturn in traditional construction, a major PV development initiative could provide some relief and soften the blow of the present credit crunch.

In addition, PV deployment offers advantages of security, reliability, and sustainability. Locally available renewable feedstock, at dispersed sites and with the ability to interact or not with the larger power delivery system, offers flexibility and options independent of severe weather impacts and/or intentional sabotage.

This type of information, and the information necessary to do the detailed benefit studies noted above, is not presently available for Arizona specifically. However, it may be worth considering specifying an interim period of perhaps five years to identify and gather the data necessary to perform these studies. Moreover, by implementing true net metering during that period, the Commission would have real world information about the costs and benefits of the policy with which to make an informed decision. During these early years of the program, the impact of distributed energy (i.e. cost and benefit) will be at its lowest level, making it the most opportune time to evaluate the program.

Recommendation

We recommend true Net Metering as defined above and as practiced in many other states for customer-sited generating systems up to 2 MW of rated capacity. We believe that establishing a limit of 2MW will provide the necessary opportunities for distributed resource development sufficient to achieve the goals of the REST. Over time, we believe this limit may be raised or eliminated, allowing the interconnection standards to provide an effective limitation on system size.

We would also be supportive of a more detailed evaluation of the full costs and benefits in Arizona, however respectfully suggest that true net metering up to 2 MW be implemented in the interim.

Recommended Design

Customer sector participation
We recommend that retail customers in all classes of service be eligible for net metering service provided an Eligible Renewable Energy Resource is sited on the customer's premises, that the rated capacity of the customer's generating facility does not exceed the lesser of 2000 kW or the customer's service entrance capacity.

Types of allowable generation resources
All Eligible Renewable Energy Resources under REST.

Limits to project size, if any
The lesser of 2000 kW, the customer's entrance capacity, or other limitation that may result from application of the Commission's interconnection rules.

Limits to total participation, if any
Limited only by application of the Commission's interconnection rules.

Metering hardware and cost responsibility
A customer's facility shall be equipped with metering equipment that can measure the flow of electric energy in both directions. The cost of this meter shall be paid by the utility.

Treatment of net excess generation both monthly and annually
Renewable Energy generation in excess of the customer's consumption, shall be carried forward from month to month and credited at a ratio of 1:1 against the customer's retail kilowatt-hour consumption in subsequent months. The utility shall compensate the customer for any accrued excess kilowatt-hour credits, at the average hourly incremental cost of electricity supply over the most recent calendar year, on an annual basis.

Net financial implications of net metering for ratepayers and utilities
Net benefit for ratepayers and utilities.

Relationship to existing tariffs
The Customer is not required to change tariffs as a result of obtaining net metering service, nor or any special tariffs, charges, or rates applied only to customers taking net metering service.

The role net metering plays in the furtherance of other Commission rules, policies, and goals.
Net metering is essential to the successful implementation of the distributed energy portion of the REST.

Appendix 1
Key studies on Value of Renewable Distributed Generation

The Value of Distributed Photovoltaics to Austin Energy and the City of Austin (Clean Power Research, March 17, 2006)

Austin Energy (AE) has a strong commitment to integrating solar electric generation into its power generation and distribution system emphasized by its goal of installing 15 MW of solar generation by the end of 2007 and 100 MW by 2020. AE initiated this study to ensure that the cost of solar generation was commensurate with its value.

There were two primary objectives of this study:

1. Quantify the comprehensive value of distributed PV to AE in 2006
2. Document evaluation methodologies to assist AE in performing the analysis as conditions change and applying it to other technologies

The results indicate that the value for 15 MW of distributed PV to AE is $2,312 per kW (11.3¢ per kWh) for the best fixed configuration - SW facing at a 30° tilt, which is only slightly higher than a South facing, 30° tilt configuration. The system with the highest value overall is the single axis, 30° tilt tracking system and is worth $2,938 per kW (10.9¢ per kWh).

Value ($ per kW)	**Horizontal**	**South 30°**	**SW 30°**	**West 30°**	**West 45°**	**1-Axis**	**1-Axis 30°**
Energy	$1383	$1,493	$1,465	$1,319	$1,213	$1,797	$1,893
Generation Capacity	$245	$239	$285	$297	$297	$323	$321
Environment	$388	$424	$410	$365	$335	$513	$539
T&D Deferral	$24	$24	$28	$29	$29	$32	$32
Loss Savings	$114	$119	$123	$116	$109	$148	$154
Total	**$2,154**	**$2,299**	**$2,312**	**$2,127**	**$1,983**	**$2,813**	**$2,938**
Levelized Value ($ per kWh)							
Energy	$0.071	$0.070	$0.071	$0.072	$0.072	$0.070	$0.070
Generation Capacity	$0.013	$0.011	$0.014	$0.016	$0.018	$0.013	$0.012
Environment	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020
T&D Deferral	$0.001	$0.001	$0.001	$0.002	$0.002	$0.001	$0.001
Loss Savings	$0.006	$0.006	$0.006	$0.006	$0.007	$0.006	$0.006
Total	**$0.111**	**$0.108**	**$0.113**	**$0.117**	**$0.118**	**$0.110**	**$0.109**

It is important to note other benefits that were not included in the analysis and benefits that may have additional value when a similar analysis is applied to other utilities.

- Disaster Recovery (a methodology for assessing the value of disaster recovery was offered).
- Hedge value for years 6 to 25 (market value of natural gas hedge was only available for years 1-5).
- T&D deferral benefit may be higher at other utilities with different budget reporting practices. (Austin Energy's potentially-deferrable T&D investments represent slightly more than 1/4 percent of AE's annual revenues).

Additional, non-calculated benefits that were called out as potentially valuable are:

- Blackout Prevention
- Emergency Utility Dispatch
- Management of Load Uncertainty
- Reactive Power Control
- Retail Price Cap

The Integration of Renewable Energy Resources into Electric Power Distribution Systems (Oak Ridge National Laboratory, June 1994)

As a result of the Energy and Water Development Appropriations Act of 1992, a study was performed to evaluate the use of distributed utility power generation, utilizing renewable energy systems, for improving power system performance, and generating transmission and distribution savings. The study included both a national assessment which developed values for the various benefits that are representative, at the regional level, for providing an indication of the potential for renewable energy systems, and case studies using actual power distribution system data for seven electric utilities[4] with the participation of those utilities.

Integrating renewable energy systems into electric power distribution systems increased the value of the benefits by about 20% to 55% above central station benefits in the national regional assessment. In the case studies, the range was larger: from a few percent to near 80% for a case where costly investments were deferred. In general, additional savings of at least 10 to 20% can be expected by integrating at the distribution level.

The report found *generation* benefits included the following:

- savings in the cost of fuel,
- credit for avoided generation capacity, and
- savings associated with avoided atmospheric emissions.

It further found that the benefits associated with integrating renewable sources into the *distribution* system would add to the generation benefits listed above. Some of these benefits are difficult to quantify and are utility-specific; insight into these benefits is provided by the case studies. The distributed utility benefits considered in this study are not necessarily a complete set. They are as follows:

- enhanced fuel savings and avoided emissions because of avoided T&D losses,
- deferred T&D facilities,
- voltage and reactive power (VAR) control,
- enhanced reliability, and
- additional capacity credit.

[4] Lenoir City Utilities Board (LCUB) in Lenoir City, Tenn., Southern California Edison (SCE), Public Service Company of New Mexico (PNM), Georgia Power Company (GPC), Green Mountain Power (GMP) in Vermont, Florida Power and Light (FPL) in southern Florida, and Orcas Power and Light Company (OPALCO) on Orcas Island near Seattle, Wash.

The report summarized the following benefits for distributed photovoltaic systems, expressed on a $/kW basis:

Lenoir City Utilities Board	$450
Southern California Edison	$3237
Public Service Company of New Mexico	$2723
Georgia Power Company	$1124
Green Mountain Power	$1444
Florida Power and Light	$1203
Orcas Power and Light Company	$579

The total benefits found for the utilities in closest proximity to Arizona are similar to those found by the Austin Energy Study.

Small is Profitable: The Hidden Economic Benefits of Making Electrical Resources the Right Size (Lovins, et al., Rocky Mountain Institute, 2002). " ...describes 207 ways in which the size of 'electrical resources' – devices that make, save, or store electricity–affects their economic value. It finds that properly considering the economic benefits of 'distributed' (decentralized) electrical resources typically raises their value by a large factor, often approximately tenfold, by improving system planning, utility construction and operation (especially of the grid), and service quality, and by avoiding societal costs."

207 benefits in the categories of

- reducing cost of capital and risk
- optimizing financial investment
- system grid support
- capacity planning and flexibility
- operating cost reduction
- reliability
- community value
- regulatory efficiency
- security
- safety.

Examples:

Reducing cost of capital and risk

6 Smaller, faster modules can be built on a "pay-as-you-go" basis with less financial strain, reducing the builder's financial risk and hence cost of capital.

7 Centralized capacity additions overshoot demand (absent gross under forecasting or exactly predictable step-function increments of demand) because their inherent "lumpiness" leaves substantial increments of capacity idle until demand can "grow into it." In contrast, smaller units can more exactly match gradual changes in demand without building unnecessary slack capacity ("build-as-you-need"), so their capacity additions are employed incrementally and immediately.

49 Volatile fuel prices set by fluctuating market conditions represent a financial risk. Many distributed resources do not use fuels and thus avoid that costly risk.

172 Technologies perceived as benign in their local impacts make siting approvals more likely, reducing the risk of project failure and lost investment and hence reducing the risk premium demanded by investors.

Optimizing financial investment

99 Distributed resources offer greater business opportunities for profiting from hot spots and price spikes, because time and location-specific costs are typically more variable within the distribution system than in bulk generation.

100 Strategically, distributed resources make it possible to position and dispatch generating and demand-side resources optimally so as to maximize the entire range of distributed benefits.

156 Bundling distributed supply- with demand-side resources increases many of distributed generation's distributed benefits per kW, *e.g.*, by improving match to loadshape, contribution to system reliability, or flexibility of dispatching real and reactive power.

141 Distributed resources available on peak can reduce the need for the costlier to-keep-warm centralized units.

143 Distributed resources can reduce power stations' startup cycles, thus improving their efficiency, lifetime, and reliability.

147 Distributed resources may reduce utilities' avoided marginal cost and hence enable them to pay lower buyback prices to Qualifying Facilities.

System grid support

101 Distributed resources (always on the demand side and often on the supply side) can largely or wholly avoid every category of grid costs on the margin by being already at or near the customer and hence requiring no further delivery.

102 Distributed resources have a shorter haul length from the more localized (less remote) source to the load, hence less electric resistance in the grid.

104 Distributed resources cause effective increases in conductor cross-section per unit of current (thereby decreasing resistance) if an unchanged conductor is carrying less current.

105 Distributed resources result in less conductor and transformer heating, hence less resistance.

120 Distributed resources that operate in the daytime, when sunlight heats conductors or transformers, help to avoid costly increases in circuit voltage, reconductoring (replacing a conductor with one of higher ampacity), adding extra circuits, or, if available, transferring load to other circuits with spare ampacity.

Capacity planning and flexibility

36 The flexibility of distributed resources allows managers to adjust capital investments continuously and incrementally, more exactly tracking the unfolding future, with continuously available options for modification or exit to avoid trapped equity.

58 Distributed resources are typically sited at the downstream (customer) end of the traditional distribution system, where they can most directly improve the system's lowest load factors, worst losses, and highest marginal grid capital costs—thus creating the greatest value.

59 The more fine-grained the distributed resource—the closer it is in location and scale to

customer load—the more exactly it can match the temporal and spatial pattern of the load, thus maximizing the avoidance of costs, losses, and idle capacity.

60 Distributed resources matched to customer loads can displace the least utilized grid assets.

63 Distributed resources matched to customer loads can displace the part of the grid that has the highest capital costs.

93 Smaller units tend to require less stringent technical reliability performance (*e.g.*, failures per meter of boiler tubing per year) than very large units in order to achieve the same reliability (in this instance, because each small unit has fewer meters of boiler tubing)—thus again increasing unit availability and reducing reserves.

Operating cost reduction

55 Compared with central power stations, mass-produced modular resources should have lower maintenance equipment and training costs, lower carrying charges on spare-parts inventories, and much lower unit costs for spare parts made in higher production runs.

91 Smaller generating units have fewer and generally briefer scheduled or forced maintenance intervals, further reducing reserve requirements.

92 Distributed generators tend to have less extreme technical conditions (temperature, pressure, chemistry, etc.) than giant plants, so they tend not to incur the inherent reliability problems of more exotic materials pushed closer to their limits—thus increasing availability.

95 Distributed substitutes for traditional spinning reserve capacity can reduce its operating hours—hence the mechanical wear, thermal stress, corrosion, and other gradual processes that shorten the life of expensive, slow-to-build, and hard-to-repair central generating equipment.

98 Distributed resources can help reduce the reliability and capacity problems to which an aging or overstressed grid is liable.

Reliability

71 Some distributed resources are the most reliable known sources of electricity, and in general, their technical availability is improving more and faster than that of centralized resources. (End-use efficiency resources are by definition 100% available—effectively, even more.)

72 Certain distributed generators' high technical availability is an inherent per-unit attribute—not achieved through the extra system costs of reserve margin, interconnection, dispersion, and unit and technological diversity required for less reliable central units to achieve the equivalent supply reliability.

73 In general, given reasonably reliable units, a large number of small units will have greater collective reliability than a small number of large units, thus favoring distributed resources.

144 Inverter-driven distributed resources can provide extremely fast ramping to follow sudden increases or decreases in load, improving system stability and component lifetimes.

145 By combining fast ramping with flexible location, often in the distribution system, distributed resources may provide special benefits in correcting transients locally before they propagate upstream to affect more widespread transmission and generating resources.

Community value

181 Distributed resources facilitate local stakeholder engagements and increase the community's

sense of accountability, reducing potential conflict.

182 Distributed resources generally reduce and simplify public health and safety impacts, especially of the more opaque and lasting kinds.

187 Distributed resources are more likely than centralized ones to respect and fit community and jurisdictional boundaries, simplifying communications and decision-making.

189 Distributed resources foster institutional structure that is more weblike, learns faster, and is more adaptive, making the inevitable mistakes less likely, consequential, and lasting.

Regulatory efficiency
23 Smaller plants have less obtrusive siting impacts, avoiding the risk of a vicious circle of public response that makes siting ever more difficult.

173 Technologies perceived as benign or de minimis in their local impacts can often also receive siting approvals faster, or can even be exempted from approvals processes, further shortening construction.

Security
84 Deliberate disruptions of supply can be made local, brief, and unlikely if electric systems are carefully designed to be more efficient, diverse, dispersed, and renewable.

85 By blunting the effect of deliberate disruptions, distributed resources reduce the motivation to cause such disruptions in the first place.

86 Distributed generation in a large, far-flung grid may change its fundamental transient-response dynamics from unstable to stable—especially as the distributed resources become smaller, more widespread, faster-responding, and more intelligently controlled.

134 Distributed generators can be designed to operate properly when islanded, giving local distribution systems and customers the ability to ride out major or widespread outages.

171 Distributed resources can significantly—and when deployed on a large scale can comprehensively and profoundly—improve the resilience of electricity supply, thus reducing many kinds of social costs, risks, and anxieties, including military costs and vulnerabilities.

Safety
79 Distributed generation resources are quick and safe to work with: no post-shutdown thermal cooling of a huge thermal mass, let alone radioactive decay, need be waited out before repairs can begin.

80 Many distributed resources operate at low or ambient temperatures, fundamentally increasing safety and simplicity of repair.

Mid Atlantic States Cost Curve Analysis (JBS Energy, 12/5/2000)

This report was prepared to analyze the impact of load reduction on reducing the cost of electricity in the context of the PJM utility system. In essence, when consumption is reduced, particularly during peak periods, the market price of electricity is reduced for all consumers. The consumers who reduce their usage receive the benefit of reducing their total consumption multiplied by the market price (with a real time pricing meter), or the load reduction multiplied

by a monthly average price (for load-profiled customers), even though they are providing greater benefits to the system as a whole.

The report concluded that the value of load reduction from the perspective of ratepayers (in reducing the prices paid by everyone) is at least twice as great as the market prices themselves, and it rises dramatically as load increases. It is clearly in the best interest of society to spend money and send price signals beyond the market price to encourage energy efficiency and load shifting, particularly during the summer peak. Distributed photovoltaic generation, with its relatively strong correlation with peak loads, could be particularly important in this regard. This finding that conservation not only benefits the conserver but everyone else should become the cornerstone of a new public goods imperative and the associated rate design policy.

Effective Load Carrying Capability Of Photovoltaics In The United States (Perez, et al., presented at the American Solar Energy Society Annual Conference, July 2006)This study is an update and an expansion of the original work of Perez et al. (1993, 1996). In the original work, selected utility loads from the late 1980s and early 1990s were analyzed in conjunction with PV output simulated from low resolution satellite data. The results from the selected utility sample were extrapolated to all US utilities by modeling Effective Load Carrying Capability[5] (ELCC) from the robust relationship observed between ELCC and utility summer to winter peak load (SWP) ratio. Using a higher resolution and more accurate satellite model to simulate site/time specific PV output, the emphasis of the present work is placed on reporting state-by-state potential and on assessing the impact of grid penetration and array geometry on ELCC. The potential for Arizona was based on extrapolated data for APS.

Results show that overall regional trends identified in the early 1990s remain pertinent today, while noting a significant increase in PV ELCC the Western and Northern US, and a modest decrease in the central and eastern US. The main conclusions reached in the original study remain valid: PV's effective capacity is significant – and considerably higher than PV's capacity factor – for much of the United States. Data for APS indicates that the ELCC is in the 70-75% range for a two-axis tracking system. The underlying data was used to develop the following estimates of ELCC for various system geometries and penetration levels for Arizona:

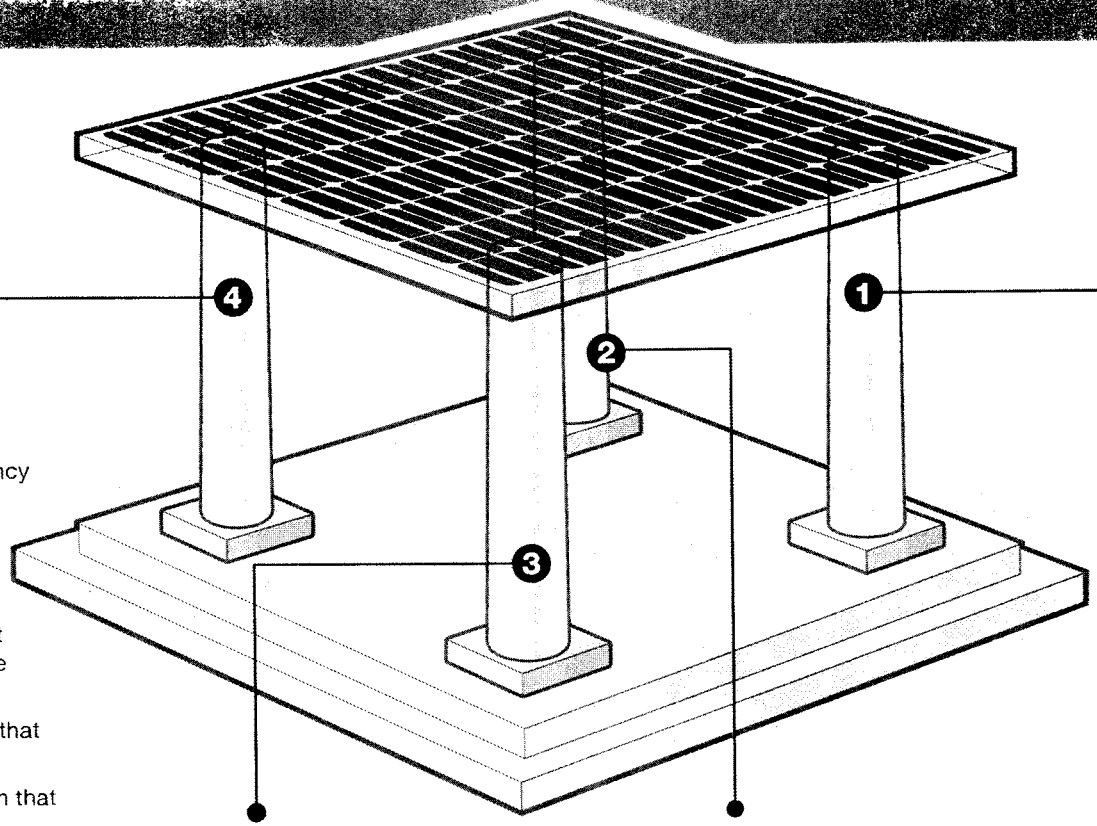
Geometry:	2-axis tracking				Horizontal				South 30° tilt				Southwest 30° tilt			
Penetration:	2%	5%	10%	15%	2%	5%	10%	15%	2%	5%	10%	15%	2%	5%	10%	15%
ELCC:	71%	68%	61%	53%	55%	52%	47%	42%	57%	54%	47%	41%	65%	61%	55%	48%

The data from this study clearly shows that PV provides significant capacity value to the electrical grid.

[5] The ELCC of a power generator represents its ability to effectively increase the generating capacity available to a utility or a regional power grid without increasing the utility's loss of load risk. For instance, a utility with a current peaking capability of 2.5 GW could increase its capability 2.55 GW with the same reliability by adding 100 MW PV, provided the ELCC of the 100 MW PV is 50 MW, or in relative terms, 50%.

THE FOUR PILLARS OF COST-EFFECTIVE SOLAR POLICY

Any state can develop a world-class solar market, strengthening the local economy and environment, increasing grid stability, and reducing dependence on costly peak energy.



Utility Rates & Revenue Policies

- Decouple utility profits from revenues to encourage efficiency and on-site generation
- Align utility shareholder and customer benefits resulting from utility solar investments
- Encourage rate structures that align peak retail and wholesale costs
- Eliminate "volume discounts" that discourage efficiency
- Include a commercial rate plan that exchanges low or no demand charges for higher energy charges
- Provide a range of rates that incentivize efficiency and peak reductions
- Allow customers to choose a solar-friendly rate

Interconnection

- Keep fees fair and proportional to project size
- Allow systems up to 2MW per FERC Order 2006
- Make rules transparent, uniform, detailed and public
- Plug-and-play rules for residential, expedited procedures for other systems
- Process applications quickly
- Standardize and simplify forms

Net Metering

- Treat clean, on-site power the same as customer efficiency investments
- Allow net-metered systems up to 2MW
- Permit significant deployment
- Eliminate special fees
- Establish "rollover" provisions

Incentives

- Encourage business growth and investment with large-scale, long-term programs
- Tie incentives to system performance
- Reduce incentives over time as the market grows and prices decline
- Support a broad range of system types and sizes
- Make incentive programs simple, transparent and easy to administer
- Coordinate policy development with stakeholder groups
- Demonstrate program effectiveness with reliable, rigorous analysis
- Publish timely, comprehensive and consistent data on installed systems
- Recognize the environmental attributes of solar production

The Solar Alliance

More details and sample policies can be found at www.solaralliance.org

The Solar Alliance

The Solar Alliance is your resource for understanding how to build cost-effective solar policies and programs. We are an alliance of leading photovoltaic manufacturers, installers and financiers focused on helping legislators, regulators and utilities make the transition to solar power. We are here to provide you with the technical and policy expertise that will result in programs that best serve the interests of all residential, commercial and government ratepayers.

American SOLAR ELECTRIC
bp solar
CONERGY
DT SOLAR
Energy Innovations
evergreen solar
First Solar
THE NEW VALUE FRONTIER KYOCERA
MITSUBISHI ELECTRIC SOLAR ELECTRIC INNOVATIONS
MMA Renewable Ventures
PPM Energy
REC
SANYO
SCHOTT solar
SHARP solar electricity
SOLARWORLD
SPG SOLAR
SunEdison
SUNPOWER
SUNTECH
UNI-SOLAR
xantrex