

# SUPPORTING SOLAR ENERGY DEVELOPMENT THROUGH GREEN POWER MARKETS

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## ABSTRACT

In the United States, nearly 50% of retail electricity customers currently have the option to purchase renewable energy directly from their utility or from a competitive green power supplier. Solar power from both utility-scale and small, distributed systems has been a feature of many green power products offered to consumers. While green power markets are still developing, participation in these programs is supporting a significant amount of new solar energy capacity – as of the end of 2002, nearly 5 megawatts (MW) of new photovoltaics development had been funded in part through green power marketing. This paper describes the use of solar energy in green power products and highlights various strategies that have been employed to leverage consumer demand for clean energy and support solar energy development.

## 1. WHY SOLAR?

Surveys have consistently shown that solar energy is highly preferred as an energy supply option among consumers. For utilities and marketers considering green power programs, solar energy systems offer many attractive features, such as lack of fuel use and pollution, an ability to locate systems within the utility service territory and in close proximity to customers, short construction lead times, and high public visibility. On the other hand, the energy produced from most solar technologies is more expensive than that of many other renewable energy options, which presents a challenge for pricing and marketing a green power product based on solar. For this reason, most programs either offer solar as a stand-alone product, which may appeal to a specific

subset of customers; or blend solar resources with other, lower-cost renewable resources to provide a lower-priced green power product that retains some solar content.

## 2. GREEN POWER MARKETING TODAY

Today's green power market has three components: (1) utility green pricing programs, (2) competitive green power marketing, and (3) renewable energy certificates. Below, we provide brief descriptions of these markets.

### 2.1 Utility Green Pricing

More than 300 utilities in 32 states currently offer “green pricing” programs. Green pricing is an optional electricity service that allows customers to support a greater level of utility investment in renewable energy. Solar is used to supply at least a portion of the green power products of nearly one-quarter of these utilities. Early solar-related programs allowed customers to either contribute to a fund that would be invested in small solar projects or to pay a premium to receive a piece of the output of a commercial-scale PV system. More recently, some utilities have focused on developing solar projects for school buildings or using customer funds to provide incentives for small PV system development. Finally, a number of utilities blend a small percentage of PV-generated electricity into green power products, for which the bulk of the supply is provided from other, lower-cost renewable energy technologies.

### 2.2 Competitive Marketing

Green power marketers are active in nine states that have opened their retail electricity markets to competition. However, in order to purchase these products, customers

TABLE 1: REPRESENTATIVE UTILITY GREEN-PRICING PROGRAMS THAT SUPPORT SOLAR

Utility Company	Program Name	Solar Installed	Year Started	Price Premium
<b>Commercial-scale PV</b>				
Arizona Public Service	<i>Solar Partners</i>	616 kW*	1997	17.6¢/kWh
Austin Energy	<i>GreenChoice</i>	153 kW	1997	1.08¢/kWh
Salt River Project	<i>EarthWise Energy</i>	400 kW	1998	3.0¢/kWh
Tennessee Valley Authority	<i>Green Power Switch</i>	310 kW	2000	2.67¢/kWh
Tucson Electric	<i>GreenWatts</i>	390 kW*	2000	10.0¢/kWh
<b>Residential Rooftop PV</b>				
Sacramento Municipal Utility District	<i>PV Pioneers I</i>	1,850 kW	1993	\$4.00/month
<b>Incentive Payments</b>				
Chelan County PUD	<i>Sustainable Natural Alternative Power</i>	21 kW	2001	Contribution
Orcas Power and Light	<i>Green Power</i>	10 kW	1999	3.5¢/kWh
<b>Solar Schools</b>				
Wisconsin Public Service	<i>SolarWise for Schools</i>	72 kW	1997	Contribution
Xcel Energy	<i>Renewable Energy Trust</i>	100 kW	1993	Contribution

\*Only capacity supported through green power sales is included

must switch from their traditional utility provider to an alternative green power marketer. Experience in these markets indicates that many customers are reluctant to make this switch.<sup>1</sup>

Nevertheless, several green power marketers are active, with some including solar energy in their products. For example, Green Mountain Energy Company has teamed with developers to install nearly 500 kilowatts (kW) of new PV to serve its customers in California, New Jersey, Pennsylvania, Ohio, and Texas. In the Northeast, Sun Power Electric, a Boston-based, nonprofit organization, has installed systems at several highly visible retail store sites, such as BJ’s Wholesale and IKEA stores, to raise awareness about solar energy and competitive market choices.

### 2.3 Renewable Energy Certificates

One emerging alternative to both competitive and regulated green power offerings is the marketing of products based on renewable energy certificates (RECs). Alternatively known as “green tags” or tradable renewable certificates (TRCs), RECs represent the environmental attributes of renewable energy generation

and can be sold separately from the physical electricity product. Thus, in competitive electricity markets, consumers can purchase renewable energy through RECs without having to switch to a new retail provider and, likewise, utility customers can purchase RECs separately from utility-supplied power, whether or not their utility offers a green power product. RECs also can be used to supply green power to utilities and marketers that is then sold to retail customers. More than a dozen companies are now marketing RECs nationwide.

## 3. GREEN POWER PRODUCTS

Below, we describe a number of ways in which green pricing programs have been designed to include solar with reference to particular utility and marketer programs (see Table 1, above).

### 3.1 Customer-sited systems

Since 1993, the Sacramento Municipal Utility District (SMUD) has operated the PV Pioneers I program, under which customers pay a \$4 flat monthly fee (for 10 years) to have a 2-kW to 4-kW, grid-connected PV system

installed on their rooftops. SMUD installs, operates, maintains, and owns the systems, which feed electricity directly into the grid. Therefore, participating customers are purchasing only the environmental and location attributes of the PV systems. More than 450 residential and 30 commercial systems with a total capacity of about 1.85 MW have been installed under the program. Total installations have been limited to around 100 systems per year. However, SMUD has been phasing out the program in favor of its PV Pioneers II program, which it launched in late 1998 to allow customers to purchase PV systems to meet their household electricity use under a net-metering arrangement.

### 3.2 Commercial-scale systems

In 1996, Detroit Edison was one of the first utilities to offer a green pricing product supplied from commercial-scale PV systems. Two facilities, totaling 54.8 kW, were developed to supply the program. Customers could purchase the output of 100-kW blocks for an additional \$6.59 per month, a premium of about 57 cents per kilowatt-hour ( $\text{\$/kWh}$ ) above the general service rate.

Since that time, several other utilities established programs offering customers the ability to support the development of commercial-scale PV systems through green pricing. Arizona's three largest utilities – Arizona Public Service (APS), Salt River Project (SRP), and Tucson Electric Power Company (TEP) – all offer their customers solar-based green pricing.

Through the APS SolarPartners program, customers can purchase 15-kWh blocks of solar energy for \$2.64 a month, or 17.6 $\text{\$/kWh}$ . Customer response far exceeded the utility's initial targets and the program was expanded. Solar projects have now been installed in seven cities with many of the projects built in partnership with the host cities. APS reports that the cost of building the solar systems to supply the program declined from \$9.13 per watt in 1997 to \$7 per watt in 2002, a decline of 23% in five years.<sup>2</sup>

SRP installed 200 kW of PV at a power plant site in Gilbert, Arizona, which it initially sold to customers for a monthly charge of \$3 per 100-watt block. The utility later announced a new program, EarthWise Energy, which provides a blended product consisting of solar, landfill gas, and low-impact hydropower at a price of \$3 per month, or 3.0 $\text{\$/kWh}$ , for each 100-kWh block of green power. A second 200-kW PV project was added to supply the new program. Solar currently accounts for about 8% of the total program capacity.

TEP offers its GreenWatts program, through which the utility invests voluntary customer contributions in the construction and operation of solar electric-generating facilities. TEP offers its customers the opportunity to purchase 20-kWh blocks of energy tied to the use of landfill methane at the company's Irvington Generating Station. The green power revenues are then invested in the construction of new PV systems.

Finally, in the competitive market arena, Green Mountain Energy Company has invested in solar projects in several states in which it is active as a green power marketer. Most recently, the company was involved in two Texas-based projects, a 43-kW project in Houston and a 58-kW project in Dallas. The development of the systems was supported by customers participating in the Big Texas Sun Club, who pay \$5 per month more than the company's standard renewable energy service rate to promote the development of new solar systems in the state.

### 3.3 Blended products

As previously noted, using solar energy for the entire content of a green power product can be expensive for customers. For this reason, many utilities blend small percentages of solar energy into a product, thus minimizing the price impact while realizing the benefits of having solar in the product mix.

The Tennessee Valley Authority (TVA) offers a green pricing program, through which customers can purchase 150-kWh blocks of renewable energy for a premium of \$4 per month, or about 2.67 $\text{\$/kWh}$ . An average customer using 1,200 kWh per month would pay an extra \$32 per month to receive all of their power from renewable energy. Power for the program is supplied from a combination of wind, landfill methane, and PV projects – the solar projects represent about 4% of the total capacity.

Forty-nine of the 159 distribution companies supplied by TVA now offer the Green Power Switch program, which has resulted in the development of 13 solar systems totaling 326 kW of capacity in five different states. Nearly 6,500 customers, including about 300 businesses, were participating in the program at the end of 2002, which ranked the TVA program among the top 10 utility green pricing programs nationwide.

Several other utilities, including Austin Energy and SRP (which initially offered solar-only products), now use their solar generation as part of a larger mix of renewable energy resources to supply their green pricing programs.

### 3.4 Solar schools

Several utilities have designed green pricing programs that use customer contributions to install PV systems on the rooftops of local schools. The solar systems provide “free” electricity for the schools, which helps conserve school budgets for other uses. These “solar schools” programs often provide student curriculums along with the system.

Wisconsin Public Service Corporation (WPS) has operated a solar schools program since 1996. The expressed goal of the program is “to install solar electric systems on all high schools and to educate the students about solar energy.” The utility provides teachers with a curriculum package that includes a three-week unit on renewable energy, along with a complete set of audiovisual materials and laboratory equipment. To date, the utility has installed systems at 18 of the 63 public and private high schools within its service territory, with nine more scheduled to receive systems during the next two years.

Xcel Energy, formerly Public Service Company of Colorado, established the Renewable Energy Trust in 1993 as a tax-deductible fund to which customers could contribute to develop small-scale renewable energy projects. At its peak, approximately 15,000 customers were funding the trust, either through fixed contributions or using a bill “round-up” option. But participation has dropped off since the utility introduced a green-pricing program that allows customers to purchase portions of their power use from wind energy. Initially, the trust funds were used to support the installation of small PV projects in remote areas, but the trust later turned to the installation of PV systems on schools. To date, the program has supported PV system installations at nearly 30 schools in Colorado.

### 3.5 Incentive programs

Some utilities, such as Chelan County PUD and Orcas Power & Light, use customer premiums to support the development of local, small-scale renewable energy projects, including PV. Chelan customers can donate a fixed amount each month to support the development of grid-connected solar and wind energy projects within the county. The funds are distributed annually to customers that install solar or wind systems of up to 1 MW in size, based on the energy generated. The payment is determined by dividing the amount of the annual fund by the total energy generated from all customer-owned systems with the payment not to exceed \$1.50/kWh. In 2001, all projects received the maximum payment of

\$1.50/kWh, while the payment dropped to \$1.41/kWh in 2002. Given this incentive structure, early adopters will benefit the most – but there is a risk that one large project could dramatically reduce the level of incentive for all system owners.

Orcas customers can purchase a green power mix of low-impact hydro and wind energy at a price premium of 3.5¢/kWh. The utility uses a portion of the customer contributions to support the development of on-site renewable resources in its service territory. As of the end of 2002, 5.5% of the utility’s customers were participating in the program, which was the second highest participation rate among U.S. utilities.

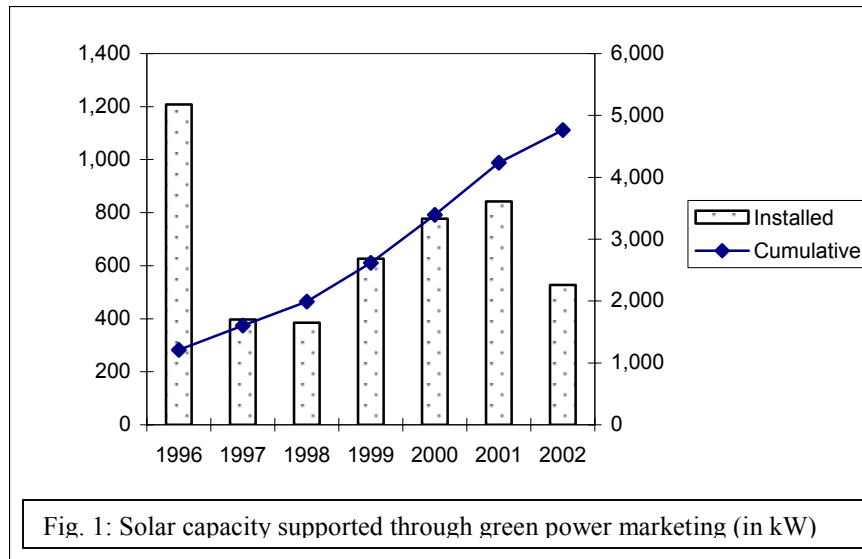
The Energy Cooperative Association of Pennsylvania (ECAP) – a nonprofit, Philadelphia-based competitive energy supplier – offers a residential solar energy buy-back program, through which it pays 20¢/kWh for the output from member-owned PV systems. Under the program, the economic payback period for a typical solar system can be reduced by as much as 30%.

### 3.6 Certificate programs

Several certificate marketers are including solar energy in their certificate products. The Bonneville Environmental Foundation (BEF) has formed a partnership with the Northwest Renewable Energy Cooperative (NWREC), under which NWREC enters into three-year contracts with PV system owners and pays them 10¢/kWh for the environmental attributes of the power produced by the systems. BEF then markets the “green attributes” to businesses, utilities, and residential customers in the Pacific Northwest and nationally.

Under a partnership with JEA, Sterling Planet markets the environmental attributes of solar power installations in the JEA service territory in northeast Florida. The environmental attributes of the solar system output are a component of Sterling Planet’s 100% green energy blend, which also includes attributes from geothermal, small hydro, biomass, and wind projects.

Sterling Planet is also involved with the City of Tallahassee, which offers two program options to its municipal customers: a power blend of solar and biomass and a solar-only product. Customers can purchase the blended product, which is supplied from 95% biomass and 5% solar resources, to meet 50%, 75%, or 100% of their electricity needs at a premium of 1.6¢/kWh. The solar-only product, which is supplied from solar systems



in Tallahassee and other areas of Florida, is offered at a premium of 11.6¢/kWh in increments of from 10% to 100% of a customer's electricity use.

#### 4. OBSERVATIONS

Nationally, 56.4 million customers now have retail access to a green power product either through their regulated utility company or from green power marketers in a competitive market setting. While the most successful utility programs have garnered customer participation rates of between 3% and 5%, average participation is about 1% for utility programs. Competitive markets have yielded similar results for green power where markets are workably competitive and customer switching is occurring. Development of the renewable energy certificates market is still in the early stages.

While there is no clear difference in participation rates among green pricing programs that include solar and those that do not, four of the top 10 utility programs measured by highest participation rates incorporate solar, while six out of 10 utility programs with the highest total customer participation incorporate solar. Clearly, solar energy is an important ingredient in many successful utility programs.

In total, nearly 5 MW of PV capacity has been developed to serve green power markets (see Figure 1, above). However, the SMUD PV Pioneers program and the programs conducted by the three Arizona utilities together account for more than two-thirds of this capacity. Nevertheless, solar is a prominent feature of many utility green power programs and its use continues to grow.

#### 5. CONCLUSIONS

Although the green power market is still in the early stages of development, it is clear that green power marketing provides a new type of revenue stream to help support the installation of commercial-scale and distributed solar facilities, while at the same time raising consumer awareness of the benefits of renewable energy. Utilities and marketers have adopted a number of different strategies to tap into consumer demand for cleaner energy sources to support the development of new solar capacity. These include marketing solar as a stand-alone product (such as customer-sited rooftop systems and community-based or school systems), blending solar with other renewable energy sources, and using green power revenues to provide incentives for small-scale solar development. Finally, the growing use of RECs both in wholesale and retail green power transactions is facilitating a market for power from small, distributed solar systems by aggregating and bundling these attributes for sale to customers on a nationwide level.

For more information on green power markets, please visit the U.S. Department of Energy Green Power Network Web site at:  
<http://www.eere.energy.gov/greenpower>

#### 6. ENDNOTES

<sup>1</sup> Wisner, Bolinger, Holt and Swezey. *Forecasting the Growth of Green Power Markets in the United States*. National Renewable Energy Laboratory, NREL/TP-620-30101, October 2001.

<sup>2</sup> APS *SolMates* newsletter, Spring 2002.