Renewable Certificates for Photovoltaics: A Model to Build Upon

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A. Introduction

There is growing demand by consumers in the marketplace for solar photovoltaic (PV) generated electricity. Consumers want to support PV even though they may not be able to afford to have their own PV system on their roof. By trading PV "certificates"[1] " in the wholesale market, aggregators or utilities can offer a certificate-backed retail product to consumers, allowing them to support the use of PV without having to make a large investment. This can occur in the retail market where consumers either have the ability to choose a green energy option offered by a load-serving entity (LSE)[2] or through a green pricing program offered by a utility company.

It is difficult for PV to participate in the wholesale energy market for a variety of reasons. Most PV installations are below the size recognized by Independent System Operators (ISOs), which prevents them from participating in ISO forward or real-time energy markets. Scheduling is difficult because of PV's intermittent nature. Many PV systems are metered on the customer-side, which are not accommodated by existing metering protocols. The use of certificates provides a way for PV to overcome some of these obstacles and participate more fully at the wholesale level.

PV manufacturers and system integrators are continually looking for ways to generate additional revenue from PV installations or reduce the cost of installed systems. Even though PV systems have shown some reductions in cost, the economics continue to present challenges to the industry. PV certificates, representing the positive technology and environmental attributes of a PV system, offer a way to generate additional revenues from PV installations and improve their economic viability. Developing methods that enable PV to gain additional revenues through certificate sales will allow PV to be more price-competitive.

Renewable certificates are non-physical products, representing the air, water, land, and other benefits or avoided impacts associated with renewable energy production. A renewable generator delivers megawatt-hours into the electrical grid, where the electrons from renewable plants are mixed with the electrons delivered by every other power plant, and flow where physics dictate, as shown in Figure 1 below. The renewable certificates correspond to the meter reads of the generating plant, usually

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[1] Renewable power can be broken into two major components: 1) the actual electrical megawatt-hours (MWh) or kilowatt-hours (kWh) that enter the electrical grid and are common to any power facility, whether powered by a renewable fuel or not; and 2) the renewable attributes, representing the positive environmental attributes associated with the MWh or kWh of renewable power. These attributes are commonly referred to as "renewable energy credits", "green tickets", "green certificates", "tradable renewable certificates", or "green tags". In this paper, we will use the term "renewable certificates", or just "certificates".

[2] In this paper, we will refer to a non-utility entity that sells energy to end-use consumers as "load-serving entities", or LSE. This term will be used to encompass energy service providers, alternative providers, etc.

measured in megawatt-hours (MWh). The certificates are then traded at a price representing the wholesale premium for the renewable energy production.
Over the past couple of years, some in the renewable energy community have begun to accept the concept of renewable certificates. For example, in Texas, the renewable energy program associated with the electric industry restructuring is built around the use of renewable certificates. The proposed renewable portfolio standard for California also envisions the use of certificates. However, overall acceptance of renewable certificates is not specifically stated in many regions and states, providing a challenge not only for photovoltaics, but for all renewable technologies.

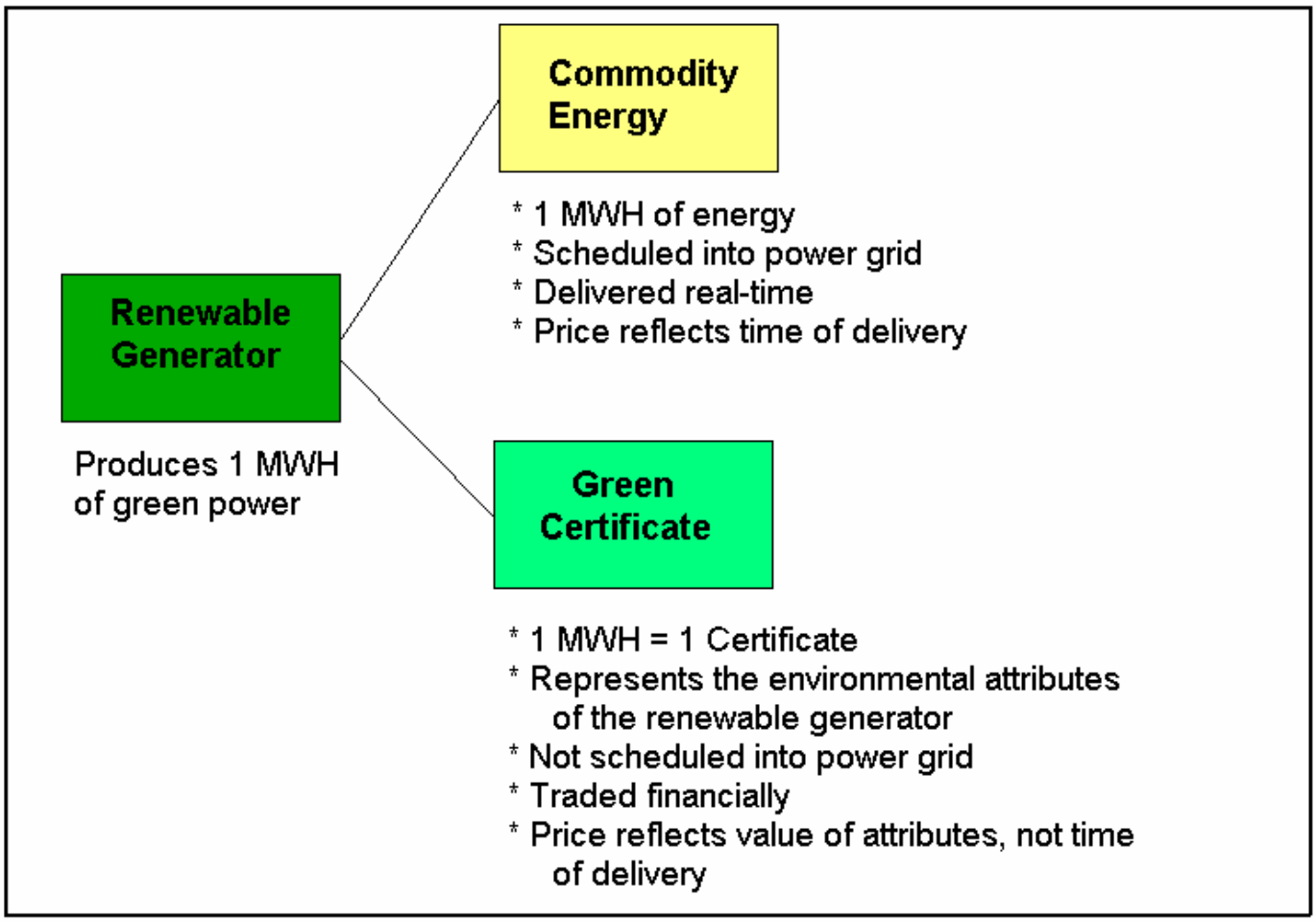

Figure 1. Delivery of Power into the Grid from a Renewable Generator

In most cases where certificates are used, an LSE purchases power from the general commodity market, and couples it with renewable certificates, to present a renewable energy product for their customers. Retailers have also emerged that offer a certificates-only product to their customers, providing an easy way for consumers to support renewable energy development through their dollars in cases where they cannot or do not want to choose an alternative provider for their commodity electricity. Through their

purchase of renewable certificates, consumers send extra dollars directly to renewable generators, supporting their production of environmentally preferable power.

This paper presents the current status of the wholesale and retail markets for renewable certificates, and looks at the specific issues affecting PV. The objective is to configure a PV certificate that will satisfy these markets, considering the unique characteristics of PV, in order to capitalize on this additional revenue source. First, the status of certificates in the wholesale market is described. Second, existing and emerging certificates-based products in the retail market are presented. Third, issues about verification of renewable certificate products are discussed. This leads into the fourth major discussion area, which is metering. Recommendations are made as to acceptable protocols for net metering and utility-side metering situations. These are important for verifying PV production and the associated certificate payment by the buyer. Fifth, sizing and pricing of PV certificates are discussed. And last, aggregation of PV production is presented as a way to develop a supply of PV certificates. The business challenges faced by aggregators are then discussed. The conclusion presents a set of action items that define the next steps toward configuring and successfully marketing PV certificates.

B. Status of Renewable Certificates in the Marketplace

1. Wholesale Market

The first wholesale market for renewable certificates evolved in California in the APX (Automated Power Exchange) Green Power Market. In response to a growing green retail market that emerged in 1998 and 1999 under the state's electric industry restructuring, both generators and LSEs found it convenient and economic to sell or buy renewable energy in its two components, commodity energy and green certificates. On the commodity energy side of the equation, it assured the generators that they were receiving a competitive price for their power and it allowed the LSEs to purchase the commodity portion of their power at the same price as everyone else. The green certificates were "created" based on the meter reads of the generators. The state agencies accepted the concept of certificates provided that the LSEs purchased the commodity energy and certificates from the same wholesale market in which the generators sold them. In effect, the certificates and commodity energy were sold unbundled by the generator, then re-bundled by the LSE for purposes of disclosure and marketing claims. The main renewable technologies that participated in this market included wind, geothermal, biomass, landfill gas, and small hydro facilities. At its peak, there were probably over 1000 megawatts of renewable power plants receiving premiums for their environmentally preferable power, including about a hundred kilowatts of photovoltaics.

A good description of how certificates work for generators participating in ISOs is found in a concept paper prepared for New York: "Unbundled renewable energy pricing is the pricing methodology used in the wholesale power market in the New York ISO and elsewhere to achieve price visibility and comparisons among different sources of supply in active markets. The unbundling creates a separate price for the renewable energy attributes over and above the price of commodity energy in the ISO. The renewable energy attributes are tracked as a renewable energy certificate (REC) with a price that reflects just the adder or premium paid for the power from the renewable source over

and above the spot price for power delivered to the ISO during the same period. For every unit of renewable electricity generated, an equivalent amount of RECs is produced. When RECs are sold, the buyer owns any and all environmental attributes associated with that amount of energy delivered into the ISO, but must match the RECs with spot market energy purchases to claim the rights to renewable energy supply from the ISO."[3] The problem of small generation units like PV that are not recognized by ISOs is discussed in the "Marketing and Aggregation of PV Certificates" section of this paper.

Table 1 below shows the kilowatts of PV installations that have been built recently for green markets. It includes those built specifically for deregulated markets and PV installed for utility green pricing programs. A comprehensive listing of these installations is found on this DOE-sponsored web site: www.eren.doe.gov/greenpower/summary.

Table 1
PV Installed for Green Markets[4]

Deregulated Markets	Size (kW)
- Total Installed	337
- CA	206
- New England	58
- Pennsylvania	73
- Total Planned	295
Utility Green Pricing Programs	
- Total Installed	3,891
- Total Planned	1,570

In California and elsewhere, regulatory acceptance of renewable certificates came slowly. Additionally, a number of market participants and stakeholders were wary of separating the kWh from the environmental attributes, fearing this would cause consumer confusion. The result was that certificates were unbundled from the commodity energy at the wholesale level, but re-bundled by the electric service provider to present a fully bundled renewable product to the ultimate consumer. The application in the use of certificates varies: some states view the use of certificates as a means of substantiating renewable claims for bundled renewable products whereas other states are moving toward the certificate as the ultimate product. Ultimately, market success at the wholesale level has brought both regulators and others to the point where these concepts are becoming more widely accepted.

In some states, specific rules address the use of renewable certificates, as shown in Table 2 below. In some cases, these rules are associated with mandated renewable portfolio standards (RPS) or disclosure requirements. Renewable portfolio standards set a specific requirement for how much renewable content there must be in the overall energy mix. There are other states (e.g. Pennsylvania, Ohio, Washington, Colorado)

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[3] "A Renewable Energy Marketing Program in the Niagara Mohawk Territory: Concept Paper", Community Energy, Inc., November 12, 2001

[4] Swezey, Blair and Lori Bird, "Estimates of Renewable Energy Developed to Serve Green Power Markets", National Renewable Energy Laboratory, January 2002.

that do not address renewable certificates at all, although there are wholesale transactions occurring that use certificates.

Table 2
States Where Specific Rules Support Renewable Certificates

State Rules Support Renewable Certificates	Use
California (1)	Open Market
Nevada	RPS
Texas (2)	RPS
Wisconsin	RPS
Massachusetts	RPS
Arizona	RPS
ISO-New England (3)	GIS
New York (4)	Open Market
Oregon (5)	Green Pricing

(1) Rules support use of certificates for marketing claims in direct access market. Direct access has been subsequently suspended retroactive to 9/20/01. Certificates included in proposed RPS legislation.
(2) The Texas RPS has specific MW goals for new Texas-based renewables. Each energy service provider must purchase an amount of renewable certificates from these new renewable projects based on their market share of the retail market.
(3) ISO-New England "Generation Information System" will use certificates to track fuel resource mix of all generation (not just renewables). Includes Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.
(4) "Conversion transactions" (certificates) are addressed in disclosure regulations.
(5) Green pricing programs operated by utilities require suppliers to specifically use "tags".

The use of renewable certificates provides a number of advantages in the wholesale market: These specific advantages include:

- Certificates can cross geographic or regional boundaries that the actual kWh cannot cross.
- Certificates provide a simple method of verification for claims of fuel source.
- Generators can maximize their revenue for both energy and certificates by selling into the highest market for each.
- Intermittent generators avoid the need to match their generation with the hourly load of the buyer.
- Clear price signals are sent to the market as to the value of the premium for renewable power.

2. Retail Market

Certificates can play a role in two types of green energy products: 1) certificate-only products where the consumer purchases the renewable certificate as a single transaction, and probably continues to purchase their power from their local utility, and 2) green products in which the consumer purchases bundled green power (commodity power + certificate) from the LSE. The first type of product is found in some utility green-pricing programs and in utility territories where there is no consumer choice to purchase a green energy product. The second type is found in deregulated markets and in some utility green-pricing programs.

At the retail level, educating the consumer about a certificates-only purchase is more complex than a bundled green power product. In order for consumers to drive the market for renewable certificates, the marketing message needs to explain how these purchases provide the financial incentives for renewable plants to input environmentally-preferable power into the grid.

a. Certificate-Only Products

Examples of existing and emerging certificates products offered into the market are described below.

Sterling Planet
Sterling Planet is the first retailer to emerge that offers consumers only a certificates-based product. Recognizing that there are consumers who are tied in with their utility company, but may wish to support renewable power, a consumer can continue to receive their power from their utility company, but then purchase certificates directly from Sterling Planet. Additionally, Sterling Planet is developing green pricing programs for regulated utilities, and providing the source of the renewable certificates that the utilities offer to their customers. They hope that the utilities will use the funds generated from these certificate sales to invest in local renewable projects. Currently Sterling Planet does not operate any renewable generation themselves, but procures certificates from renewable generators that meet certain criteria. Consumers can also purchase certificates directly from Sterling Planet's web page, www.sterlingplanet.com. Sterling Planet purchases most of its certificates from wholesaler, Automated Power Exchange, www.apx.com.

Sterling Planet is actively working to offer PV certificates to their customers. They are working with utilities to install PV plants, then sell the resulting PV certificates to interested consumers.

Wind Certificates
A number of wind projects are offering wind certificates independent of the MWh production. These include the Madison, NY Wind Plant operated by the PG&E National Energy Group (www.purewind.net), a wind project operated by the municipal utility in Waverly, Iowa (www.waverlyia.com/wlp), Navitas, an independent power producer and owner of Northern Alternative Energy (www.windpower.com/windwatts), the *Wind*Builders program operated by NativeEnergy (www.nativeenergy.com), and Vision Quest Wind Electric in Canada.

Community Energy, Inc.
Community Energy, Inc. (CEI) sells certificate products but also bundles commodity energy from the grid operator along with renewable certificates to provide a bundled renewable product to consumers. CEI partners with renewable energy developers and retailers to market renewable attributes. For example, CEI has marketed all of the renewable attributes from new Pennsylvania wind farms to various customers. It markets the attributes in a 100 kWh block product, which it sells at retail for $2.50 per block (2.5 cents/kWh). In some instances, CEI will procure the commodity energy to provide a bundled renewable product to its customers, and in other cases, it will sell only the attributes. One of their retail customers is the state of Pennsylvania, which has committed to purchase 5% of its energy needs from Community Energy's renewable portfolio. Community Energy is delivering a combination of wind, hydro and solar

certificates, along with commodity energy from a wholesale supplier within the PJM control area, to supply a bundled renewable product to the state. The product will be a combination of wind, solar, and hydro-based renewables. For Penn State, Community Energy is supplying just the certificates and the University continues to purchase its commodity energy from its existing supplier. CEI is partnering with solar energy developers/facilities to source PV-based certificates for their product offerings. Another big development for the company is partnering with PECO to offer its block product to the PECO default customer base. In this case, for an additional amount per month, utility customers can choose to support wind energy, similar to a green pricing program, but offered by a private company. For more information, go to www.newwindenergy.com.

LADWP
The Los Angeles Department of Water and Power (LADWP), a municipal utility serving portions of Los Angeles, is offering green certificates both to residents of Los Angeles and others who wish to support the "Green LA" program. These certificates are generated from renewable resources installed by the utility (www.greenla.org).

Bonneville Environmental Foundation
The Bonneville Environmental Foundation (BEF), based in Portland, Oregon, sells environmentally preferred power to regional utilities in the Pacific Northwest, and uses the revenues to fund new renewable installations and watershed recovery projects. They have also made a number of green tag sales to relatively large users in the commercial, governmental and institutional sectors. BEF is very concerned about credibility, and makes sure their customers understand what they are and are not buying. They have recently opened a new website to specifically sell green tags to consumers over the internet: www.greentagsusa.org.

SunPower
Sun Power Electric, a division of Conservation Services Group, installs solar systems in the northeast and sells blocks of solar-generated electricity. Their customers do not change electricity suppliers, and continue to receive their bill from their utility company. In essence, customers are purchasing only the renewable certificates from their solar installations, although it is not advertised as such on their web site: www.Sunpower.org.

Other Certificates Products
Certificates can also be purchased through the Environmental Resources Trust (www.ert.net/ecopower/index.html). Natsource, a trading company based in New York City, brokers renewable certificates from all over the world. Another certificates-based company has started up in Colorado, called Renewable Choice Energy.

b. Bundled Green Products

Examples of existing and emerging bundled products, consisting of commodity energy plus certificates, offered into the market are described below.

Green Mountain Energy Company
Green Mountain Energy has been the most active green energy retailer in all of the states where deregulation has occurred. Green Mountain has helped to develop several hundred kilowatts of new renewables, including PV and wind, by taking long-term power purchase agreements and blending the PV output in its products. They have brought

new solar on line in California, Connecticut, Pennsylvania, New Jersey, and Texas. They are also developing the certificate-backed green pricing products for the Oregon utilities as found at www.greenmountain.com.

3. Demand for Certificates Products

While there certainly is an adequate supply of certificates products offered in the market, it begs the question as to whether there is sufficient demand to support the ever-growing supply. For solar, this may not be a problem. As stated by a spokesperson from Sterling Planet, "Solar is [the] preferred technology – [but there is a] shortage of supply".[5]

a. Deregulated Markets

The demand for green power in states with deregulated markets has fallen short of expectations. In California, a market for renewable products grew during 1998 to 2000, but has virtually disappeared with the current turmoil in the market. The California Public Utilities Commission has retroactively suspended direct access as of September 20, 2001. Except for a few remaining green customers and some muni green programs, there is essentially no opportunity for consumers to choose green through an LSE or utility. However, this could potentially present an opportunity for companies such as Sterling Planet to market certificates-only products to the captive utility customers.

In Pennsylvania, where deregulation has been most successful, about 80,000 customers have switched to cleaner or renewable energy electricity products[6], representing over 13% of the customers who have switched providers. For pure renewable products, almost 4% of residential customers and 0.5% of commercial customers had purchased a "green-e" certified renewable product in Pennsylvania[7]. With rising wholesale electric prices, the participation in Pennsylvania slipped in 2001. Over 34.5 MW of wind projects have been installed in Pennsylvania since deregulation, with another 70 MW due to be online in 2002.

As of January 1, 2002, all customers in Texas have the option of choosing an alternative provider. However, all customers will be purchasing some renewable power because of the renewable portfolio standard. At this point, two retailers are offering 100% green bundled products in those service areas that are now open to competition. They are Green Mountain Energy and Reliant Energy Retail.

b. Renewable Portfolio Standards

A number of states have adopted a renewable portfolio standard (RPS), which requires a certain percentage of renewable energy in the overall electricity mix.[8] The renewable energy community generally agrees that certificates associated with renewable production used to meet RPS requirements cannot be re-sold, as this would constitute double counting. Some states, including Texas, Massachusetts, and Wisconsin, explicitly state this in their RPS standards. Other states have not made explicit statements about this, because they either have not yet discussed this aspect, or have

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5 Presentation by Mel Jones, Executive Vice President and COO, Sterling Planet, July 30, 2001.

6 The majority of these purchases in Pennsylvania were for a "cleaner" product, which was natural gas-based, rather than renewable energy-based.

7 Green-e Verification Results, Year 2000.

8 States with RPS requirements include Connecticut, Maine, Massachusetts, New Jersey, Texas, Wisconsin, and Pennsylvania (portions). A 20% RPS has been proposed in California. A federal RPS, ranging from 8.5% to 10%, has also been proposed.

chosen not to address it at this time. Thus consumer demand for certificates in these states would need to come from electricity customers that want a higher percentage of renewables in their electricity supply than the RPS requirement. Short descriptions of three of these programs follow.

Arizona
The State of Arizona enacted an Environmental Portfolio Standard (R14-2-1618) in April 2001, which has a solar-specific component. The standard requires that retail energy sold by LSEs have 0.2% from new solar resources or environmentally-friendly renewable electricity technologies. New solar is defined as photovoltaics and solar thermal resources that generate electricity installed on or after January 1, 1997. The percentage requirements increase over time, starting at 0.2% in 2001, 0.4% in 2002, 0.6% in 2003, -.8% in 2004, 1% in 2005, 1.05% in 2006, and 1.1% from 2007 to 2012. Up to 2003, solar electric must make up 50% of the renewable component, rising to 60% from 2004 onward. In 2001, 10% of it can be from R&D facilities, and in 2002 and 2003, 5% can be from R&D facilities. Starting in 2004, there is no R&D component. An Environmental Portfolio Surcharge is on each customer's bill to fund this program.

Wisconsin
The Wisconsin program requires LSEs to meet a certain minimum percentage of their retail sales with renewable resources, and gradually increases the percentages each year. It allows LSEs to purchase "renewable resource credits" (certificates) to meet this requirement, and will establish a certificate trading program that the state will administer.

Texas
The Texas program set out specific goals in terms of MW of new renewable facilities located within or delivered to the Texas grid. These goals are 400 MW by 2003, 850 MW by 2005, 1400 MW by 2007, and 2000 MW by 2009 through 2019. Texas has already met the 2003 goal, with 712 MW of new renewables installed as of the end of 2001[9]. The MW amounts are converted into equivalent MWh energy requirements using an average capacity factor. Based on its annual retail market share, each LSE must purchase its corresponding amount of renewable energy credits (RECs, which are renewable certificates). Based on today's electricity consumption, this represents about a 3% renewable energy content. The Texas Public Utilities Commission enforces compliance and the Texas ISO (ERCOT) administers the certificate tracking and trading program. LSEs who do not meet their required REC purchases are charged stiff penalties. To date, all LSEs participating in the Texas program have purchased certificates through long-term bilateral contracts with renewable facilities in a bundled energy and certificate purchase[10]. The program allows utility-sited PV, customer-sited PV, and off-grid PV as eligible facilities.

c. Utility Green Pricing Programs

These programs currently represent the biggest market for PV certificates. A number of utilities are already instituting green pricing programs, some of which include photovoltaics. Certificates provide the easiest way for utilities to offer solar to their

9 www.texasrenewables.com/mymodule/mypage.asp

10 Wiser, Ryan and Old Langniss, "The Renewables Portfolio Standard in Texas: An Early Assessment", Environmental Energy Technologies Division, Lawrence Berkeley Laboratory, LBL 49107, November 2001.

customers. The Bonneville Environmental Foundation (BEF) has successfully partnered with a number of northwestern utilities and munis to offer green power and green tags. A portion of the output from the 30 kW "Solar Ashland" project is green tags, which BEF resells. A new PV project, at the site of a terminated nuclear plant in Hanford, WA, has 50 kW installed, out of the ultimate 1 MW planned. The power is being sold to BPA and the green tags are going to BEF for resale. Sterling Planet plans to partner with utilities on green pricing programs, providing them with the ability to offer renewable power to their customers solely through the purchase of certificates.

d. Corporate Purchases

Another potentially large market for PV certificates is the corporate market. Some companies have announced their intention to purchase renewable power over the next few years. For example, the "Green Power Market Development Group" is a collection of 10 large companies that are attempting to "develop corporate markets for 1,000 MW of new, cost-competitive green power by 2010"[11]. These companies include Alco, Cargill Dow, Delphi Automotive, DuPont, General Motors, IBM, Interface, Johnson & Johnson, Kinko's, and Pitney Bowes. The group's web site explains how purchasing certificates is an easy way to accomplish this without changing their current electricity provider. Kinko's has already committed to a purchase of certificates from PG&E's Madison wind plant for a portion of their New York demand. The Bonneville Environmental Foundation has made a number of sales to corporate purchasers, including Batdorf & Bronson Coffee Roasters, CH2M Hill (Northwest Region), Climate Solutions, Environmental Protection Agency (Region X), Global Energy Concepts, Idaho Power Company, and Xantrex Technology.

4. Green-e Standards for Tradable Renewable Certificates

Green-e is a program under the auspices of the Center for Resource Solutions. They provide product certification for green electricity products and have adopted standards for certificate-only based products, which they refer to as "TRCs". They have used a stakeholder review process to develop specific recommendations for TRC products that they hope will be employed wherever TRCs are bought and sold. The TRC Standard is part of the Green-e Code of Conduct, found in Appendix B of the Green-e TRC Contract, which can be found at www.green-e.org. Their recommendation for certificate-based only products is that the product contains at least 150 kWh/month of new renewables, with "new" defined to include eligible renewable facilities that began operation after January 1, 1999.

The TRC Standard says the following about customer-sited facilities, which would apply to PV: "Any on-grid customer sited facilities that meet the eligible renewables definition are eligible. Customer sited off-grid renewables are not eligible. Any generation unit less than 10 kW may use a conservative engineering estimate of output, but systems over 10 kW must be metered. CRS must pre-approve the estimation methodology."

Additionally, it states the following about disclosure from customer-sited facilities: "Generator cannot claim to be selling renewable electricity if they sell the TRCs separately. This relates to legal representation only. CRS will provide guidelines on how to disclose claims related to customer-sited renewable energy sources."

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11 www.thegreenpowergroup.org

These disclosure guidelines for PV were left sufficiently broad to enable others, including the Pace Energy Project's efforts in this paper, to refine the size, metering / verification, and claims issues related to PV.

5. Role of Subsidies for PV

Some discussion has surfaced as to whether certificates can be claimed from a system that has received additional subsidies for its installation. For example, if a system in California has received funding from the California Energy Commission's Emerging Renewables Buy-down Program, that system has received a grant between $3 and $4.50 per AC watt installed.

Other renewable technologies, including wind and biomass, also receive subsidies, in the form of production tax credits, or production incentives. These technologies sell renewable certificates or command a premium for their power. These public subsidies represent funding sources for the capital investment of these projects, and do not affect the ownership of the system or its output. Therefore, we do not believe there is any reason that PV systems whose capital costs have been partly subsidized should be treated any differently than other renewable technologies.

C. Production Verification

When product differentiation is attempted with a commodity like electricity, the consumer needs information to have assurance that the extra "value" has been received from the extra dollars paid. With renewable energy or certificates, some type of verification is required. Some states have adopted disclosure guidelines for consumer protection. Other issues with renewable certificates include problems with double counting and disaggregating the renewable attributes into further differentiated products.

1. Disclosure to Buyers

The National Association of Attorneys General (NAAG) has adopted a set of environmental marketing guidelines for electricity, and specifically discussed "tradable certificates" or "tagging" systems. The guidelines state that if a state adopts a method of substantiation of product claims that uses a tagging system, that disclosure to consumers makes it clear that this system is being used and that certificates not be double-sold.

Some states have developed standards for "Power Content Labels" that define what must be disclosed to customers who purchase a renewable electricity product. At this point, these are all geared toward renewable electricity products where the certificate is bundled with the electricity. These typically include disclosing the renewable technology mix, and might include other information about emission levels and comparisons with the overall utility system mix. Green-e also has a disclosure label for renewable products where the certificate is bundled with the electricity.

Green-e has recently adopted a disclosure label specifically for certificate-only products, which identifies the percentage of each renewable technology in the product and the generation location, and states that the product was configured using renewable

certificates. The label itself does not go into detail about what certificates are, as this is fairly complicated. The label directs the customer to call the Green-e toll-free number or visit a website for detailed information about certificates.

2. Disclosure to Sellers

For PV systems, disclosure extends to the sellers as well. The PV owner must realize that they might be giving up the "claiming rights" of the environmental attributes associated with the installation and are thus buying only the physical kilowatt-hours. Many PV owners are homeowners or businesses that don't follow the details of the energy markets. These PV system owners may be unaware of the implications of selling PV certificates from their systems. Therefore, it is important they understand the certificates market before participating.

Because of the high expense and long payback for a residential solar system, many homeowners who make the decision to purchase a system usually do so because they want to improve the planet, rather than solely for economic reasons[12]. For this category of PV-owners, it is important that they understand what they are giving up by selling the renewable attributes. At this point, PV projects do not produce allowances that have value in the SO2 or NOx markets, so selling the attributes does not give someone else the right to pollute. If this changes in the future and rules are developed that assign certain SO2 or NOx allowances to PV systems, certain PV owners may choose not to participate. By not selling their certificates, they are retiring these SO2 and NOx allowances. If they sell their certificates, they may perceive this as just moving the pollution from one point to another, which may not be palatable to some PV owners. Another option is to "sink" the certificates by selling or donating them to an environmental or health-based organization, or other worthy cause. By doing this, it eliminates the possibility of having the certificates traded by others for the right to pollute.

Commercial and industrial customers typically have more resources to investigate and understand the options. They may be more inclined to install a PV system for the peak energy savings, and sell off the environmental attributes to another entity to improve the project economics.

3. Double-Counting

Double counting occurs if the same renewable certificate associated with a particular MWh of electricity production is claimed by multiple parties. The MWh of production are verified by meter reads, often provided by the utility company or a third-party. Currently, generators often sign affidavits that the associated renewable certificates have not already been sold to another party. In the long run, this does not provide an ironclad audit trail that can assure the absence of double-counting. Particularly when certificates from the same generator might be sold in multiple geographic areas, there is no single source that can verify that the same certificates were not sold to different parties[13].

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12 Based on author's experience marketing solar systems to interested homeowners.

13 For example, a generator in State A might sell its commodity energy into State A's ISO market and its certificates to an LSE in State A. The LSE re-bundles these certificates with commodity energy it purchases in State A and sells it as green power to consumers in State A, The LSE receives meter reads that verifies the production occurred. This same generator also sells its

The Green-e standard also has requirements with regard to how to report and claim environmental benefits when utilities are involved in transactions, either through utility-owned rate-based renewable resources or independently owned renewable resources that sell commodity energy to utilities separately from certificates.

Specific PV-related double-counting issues arise because PV installations are often visible to the public. The question then arises, if a homeowner has a PV installation on their roof that their neighbors can see, does this prevent them from selling the associated renewable certificates? Can they claim that they installed the system only to receive the kilowatt-hours from the installation, and not the environmental benefits also? Other issues arise in connection with "net-metered" systems, which are covered in the "Metering" section.

The Green-e subcommittee on solar verification of TRCs discussed these issues but no specific language was adopted. Our position is that homeowners can sell the certificates associated with their solar production without running into issues of double counting of environmental claims. Commercial and industrial installations can sell their certificates if take the position that they are "hosting" a solar installation on their facility rather than saying they are "solar-powered". Additionally, if a commercial or industrial facility wants to sell their certificates, they should not overtly publicize their solar installation, but can claim to have a distributed energy system.

4. Disaggregation of Certificates

Disaggregation of renewable certificates refers to breaking a certificate apart into its component parts. These parts include technology, water, land, and air-related avoided emissions attributes. Although there are no existing programs or limits established for renewable generation, it is possible that in the future renewables will receive credit for avoided air emissions such as CO2, SOx and NOx offsets. Some companies are already making such trades to hedge future risk, as evidenced by a German company purchasing carbon offsets associated with a wind facility in Canada. Our position is that the certificate should remain whole at this point until further discussion and agreement about disaggregation has taken place.

5. Verification Needs

The development of certificates-based products points out the need for better verification methods. Particularly if renewable certificates are disaggregated in the future, tracking which attributes have been sold from a particular certificate is essential to maintain confidence in the products and markets. Some regional verification and tracking efforts are underway as part of RPS requirements. The need for a national database that can tie together the regional efforts is beginning to be recognized. A national database or regional databases that can share similar information is needed to track certificates from birth to retirement and to allay any fears about double counting. Additionally, if

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certificates to a retailer that is selling a certificates-only product in State J, which does not have electric choice. The generator could provide these same meter reads to the retailer to verify that renewable generation did enter the grid. Since the retailer in State J is not in the same ISO control area, it cannot necessarily verify that these certificates have already been claimed for sales in State A. A centralized national tracking system could prevent this, as all LSEs and retailers in any control area could verify their claims.

aggregation starts to occur more frequently, wholesale purchasers could use the database to determine if the certificates they are purchasing are whole.

D. Metering Issues

PV certificates are generated based on the meter reads of the PV systems. However, PV is often metered on the customer side of the meter. Existing protocols that only consider renewable output as measured on the utility-side of the meter need to be modified to handle PV installations. Net-metered installations bring up other issues that need to be addressed.

1. Net Metering (including Customer Side Metering)

Customer-side metering, which includes net metering, is common with PV systems, where the entire output of the PV system is measured on the customer-side of the meter.

Net metering is a method for measuring the net energy consumption at a residential or commercial installation, where usage of electricity from the grid runs the meter forward, and delivery of excess PV-generated electricity into the grid runs the meter backward. During the monthly meter reads, only the net amount will be recorded. On an annual basis, there is a true-up and the customer pays the net due (if any) to the utility company.

There are currently 36 states that require utilities to offer net metering to their customers[14]. In California, if the customer produces more power on a net basis than they consume, they do not receive compensation for the excess generation. Hence, systems are sized to be slightly smaller than a facility's overall annual electricity usage. Because of the "energy crisis", the net metering law in California was modified in 2001 to increase the allowable size of net metered systems. The original cap of 10 kW was increased to 1,000 kW (or 1 megawatt). There was also a cap of 0.1% of the utility's 1998 peak demand as the total installed capacity that could be net metered. This cap was also eliminated. And finally, the net metering law in California now allows for time-of-use pricing for determining the net price. Therefore, customers on a time-of-use tariff, which has an on-peak rate of about 32 cents/kWh and an off-peak rate of 8 cents/kWh, will be credited the on-peak price for any kWh of PV they deliver into the grid during on-peak hours. This can greatly improve the economics of an installation where the user has low energy usage during on-peak hours.

a. Claiming Issues with Net Metering

There is some debate as to whether all the electricity produced in a net-metered installation has certificates associated with it, since some of the energy is used on-site. Some take the position that only the excess production beyond the on-site usage has associated PV certificates. Others take the position that PV certificates are generated for all kWh or MWh generated by the PV system, no matter where the kWh are consumed. The physics of the situation result in some of the electrons flowing to the on-

[14] States with net metering programs include Arizona, Arkansas, California, Colorado, Connecticut, Delaware, District of Columbia, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Maine, Maryland, Massachusetts, Minnesota, Montana, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Texas, Vermont, Virginia, Washington, Wisconsin, Wyoming. Source: www.eren.doe.gov/greenpower/netmetering/nmtable.shtml.

site loads, but this still provides the positive result of a decrease in a fossil-based generation. Still others argue that, since the net-metered customer is receiving the full retail rate from the utility for the solar-generated electricity, certificate ownership transfers to the utility.

We take the following position. All of the kWhs or MWhs generated by the solar system have associated PV certificates. The owner of the solar facility can make claims to all of these certificates, whether or not it is a net-metered facility. The solar production reduces the need for the utility to produce polluting power to serve this load, therefore the environmental attributes associated with the solar production have value. The utility is paying the full retail rate for the solar production, which includes not only the commodity value of the power, but also the transmission, distribution, and other portions of the rate. However, the utility is receiving the power in the distribution system, and is receiving the benefits of distributed generation, which includes avoided transmission and distribution costs[15]. The utility is not paying the full solar rate, which includes the environmental value of the solar power. In essence, the utility is paying a royalty to the solar owner for hosting this generation out in the distribution system, similar to how a rancher receives a royalty for hosting wind turbines on his/her ranch. Therefore, assuming the PV owner does not have a sign on his/her building claiming that it is "solar-powered", all of the solar production has certificates associated with it. The PV owner can "retire" these certificates, or can sell them to improve the economics of the installation.

b. Metering Options Associated with Net Metering

Since net-metering systems will not show the cumulative total of PV generated during any particular time period from a site, additional measurement is required to determine the total PV generation and associated PV certificates from a net-metered site. The goal is to determine the total AC output delivered to the grid and on-site loads.

For PV systems that do not have batteries associated with them, the solution can be simple. Some inverters (e.g. Sunny Boy) have accumulators that keep a running total of the kWh that have passed through the inverter. Others zero out the production every day (Trace). For those systems where an accumulator is not present, a simple utility style meter can be installed between the inverter and the utility meter to cumulatively measure the total AC output of the PV system in kilowatt-hours before it is delivered to any on-site loads or net-metered to the utility. These can be installed for about $150 - $200 and manually read as needed.

Some grid-connected PV systems have battery backups so the power will stay on in the event of the utility grid going down. The selected circuits backed up by the batteries will continue to have power, and the PV will continue to operate to re-charge the batteries and power the backup circuits. However, the overall measurement of PV output is more complicated. Measurements can be made on the AC side, or on the DC side with loss factors applied. Since the AC deliveries to the grid are how the certificates are measured, measurement of the output on the AC side is the preferred method.

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[15] Farmer, Brian K, Howard Wenger, Thomas Hoff, Charles Whitaker, "Performance and Value Analysis of the Kerman 500 kW Photovoltaic Power Plant", American Power Conference, April 1995, and Shugar, Daniel, "PV in Utility Distribution Systems", *Solar Today*, ASES, September/October 1992, pp. 20-21.

For measurement on the AC side, two meters are required as there are two AC outputs from the inverter. One needs to measure the AC output between the inverter and the backup circuit panel and the other needs to measure the AC output between the inverter and the utility meter. The total AC output is the sum of these two meter reads.

Measurement on the DC side ignores operational variables surrounding inverter efficiency, battery maintenance and performance, and other operational aspects of the system. If one assumes that the batteries are performing and maintained properly, and the inverter is set properly, certain scaling factors could be derived. The DC output could be scaled by 85% for a battery-based system with a MPPT (maximum power point tracking) charge controller or 80% for a battery system without a MPPT charge controller[16].

There is then the question as to who would read the meter and verify the validity of the PV certificate claim. We suggest that the homeowner read the meter annually for calculating the number of certificates generated, with the certificate aggregator periodically checking the meter read. Based on the size of the system, the aggregator will know whether the homeowner's meter read is in the range of reasonable values.

2. Utility-Side Metering

Utility-side metering of PV systems removes the problems cited above with net metering, as the entire output AC of the PV system is going into the grid, and the utility company or a neutral third party can read the meter. PV certificates can be generated directly from this meter read.

Utility-side metering is generally more common with larger systems, where the entire output is being sold to the utility under a QF contract, or to an LSE that is providing PV power to their customers. This method is used for a number of residential systems in the SMUD (Sacramento Municipal Utility District) PV Pioneers program, where the homeowners are essentially allowing SMUD the use of their roof, but the system output is measured on the utility side of the meter.

3. Production Forecasting Using Satellite Data

Research has been underway at the State University of New York at Albany on using satellites to simulate photovoltaic system performance[17]. Using irradiance models and meteorological data, such satellite simulations could ultimately be used as predictors of PV performance in cases where regular meter data is unavailable. Yearly true-ups of the satellite-predicted output versus the actual metered output could be used to fine-tune the satellite simulations. Ultimately, the satellite simulations could be used as an alternative to meters for those installations where metering is prohibitively expensive or unavailable.

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16 Discussion with Dave Lehmicke, Electrical Engineer, EcoEnergies, Inc., March 2002. MPPT refers to a Maximum Power Point Tracking charge controller that adjusts inverter operation to maximize output of the PV system.

17 Perez, Richard, M, Kmiecik, C. Herig and D. Renne, "Remote Monitoring of PV Performance Using Geostationary Satellites"

4. Negotiated Agreements

Arizona Public Service (APS) is finalizing a small-scale (<5 kW) PV program whereby customers will install PV systems and APS will have the rights to the renewable credits generated by the systems. The systems must meet the interconnection requirements set by APS and be appropriately installed and inspected. APS and the Arizona Corporation Commission have agreed on a negotiated output for PV systems to avoid the need and cost of extra metering. They have agreed to assume that these small scale PV installations will produce 1860 kWh/year per kW installed. This number was based on input from technical professionals, NREL studies, APS data collected over the last 15 years, and loss estimates.

E. PV Certificates: Standard Sizing and Pricing

There is only a small amount of photovoltaics operating compared to other renewable technologies, and measurement is typically in terms of kilowatt-hours. However, power and certificates from all other technologies are generally traded in MWh blocks. The cost premium that photovoltaics requires compared to other technologies make it a more difficult sell, even though surveys indicate that consumers prefer, and will pay extra, for solar energy over other renewable technologies.

PV installations that can participate in the certificates market range from small residential systems to large commercial installations. Typical residential systems can range from less than 1 kW to 10 kW in size. Small commercial systems range from about 10 kW to 100 kW. Large commercial and industrial systems that have been installed to date range from 100 kW to 500 kW.

Table 3 shows the number of certificates likely to be generated from different size systems over specific times[18]. Commodity power is typically traded in MWh blocks, and the equivalent revenue to the PV owner for certificates sold at various wholesale prices is shown in the table. In discussions with retailers, the wholesale price paid for PV certificates has ranged from $20/MWH to $125/MWH. Since PV certificates are typically blended with other renewables to produce a reasonably priced retail product, a price of about $50/MWh is likely to be most realistic. This price would justify the expense of installing the additional metering to sell PV certificates (estimated to be about $150).

Table 3
Wholesale Value of PV Certificates

System Type	System Size (AC)	Annual Production (kWh)	Annual Value @ $20/MWh	Annual Value @ $50/MWh	Annual Value @ $125/MWh
Residential	1 kW	1,825	$37	$91	$228
	2.5 kW	4,563	$91	$228	$570
	6 kW	10,950	$219	$548	$1,369
Small Commercial	10 kW	18,250	$365	$913	$2,281

[18] Assumes annual average of 5 kWh/day per kilowatt installed. Therefore 1 kW installed would produce 1 kW * 5 kWh/day * 365 days/yr = 1825 kWh/yr

	50 kW	91,250	$1,825	$4,563	$11,406
	100 kW	182,500	$3,650	$9,125	$22,813
Large Commercial	500 kW	912,500	$18,250	$45,625	$114,063

Table 4 below provides some information on selected utility green pricing programs, to show the range of premiums that are being paid for bundled solar power products (energy and attribute). As shown in the right-most column, the equivalent $/MWh prices range from a low of $30/MWh to a high of $549/MWh.

The Arizona Public Service Solar Partner Program allows grid-tied customers to pay a premium, which goes toward the development of new solar generating capacity. They sell the blocks (energy and attribute) for $2.64 per 15 kWh block of solar generated electricity per month[19]. This is equivalent to $176 for a 1 MWh equivalent of energy plus attribute. Assuming $20 to 25/MWh for commodity energy, they are asking an equivalent retail price of $151 to $156 for the PV attribute. This price is fairly consistent with the actual cost to produce photovoltaic power.

By comparison, another green pricing program by Madison Gas and Electric Company prices new wind at $5 per 150 kWh block (energy and attribute). This is equivalent to $33 per MWh for energy plus attribute. If the utility has a long-term contract to purchase the wind energy at 3 cents/kWh, this allows them a 10% margin to cover their costs and make a small profit. Assuming a commodity energy price of $20 to 25/MWH, this puts the retail value of the wind attribute at $8 to13/MWh.

Table 4
Solar Green Pricing Programs and Premiums

Utility Company	**Amount of PV Installed**	**Size of Block**	**Retail Price per Block**	**Equivalent Price in $/MWh**
Southern Company	1 MW solar total	100 kWh blocks	$6/block/mo	$60/MWh
Arizona Public Service	Solar Partner Program: 172 kW currently installed on public buildings	15 kWh block	$2.64/block/mo or 17.6 cents/kWh	$176/MWh
Salt River Project	100 kW project	100 kWh block	$3/block/month	$30/MWh
SMUD	PV Pioneers I: 2-4 kW systems on residential		$4/month for 10 years	

19 "APS Solar Programs", presented by Cassius McChesney at the 5th National Green Power Marketing Conference, August 2000.

	rooftops			
Detroit Edison	Solar Currents: 100 watt block	Estimated 12 kWh/ month[20]	$6.59/month	$549/MWh
Ashland Municipal Utility, Oregon	Solar Ashland: 25 kW on public buildings	Contribution	$4/month donation	

Table 5 below provides information on the existing renewable certificate programs and shows the range of premiums for certificates only. The prices range from a low of $10/MWh for SMUD's Community Solar program to a high of $40/MWh for new wind certificates from PG&E's Madison Windplant in Madison, New York. For solar only certificates, the range covers SMUD's $10/MWh Community Solar to SunPower's $36/MWh solar block.

Table 5
Green Certificate Programs and Premiums

Company	Resource Mix	Size of Block	Cost per Block
Bonneville Environmental Foundation (www.greentagsusa.org)	New Solar PV, New Wind	1 MWh	$20/certificate
PG&E National Energy Group (www.purewind.net)	Wind	1 MWh	$40/certificate (=$40/MWh)
Sterling Planet (www.sterlingplanet.com)	Mix from APX	472 kWh	$10/certificate (>$20/ MWh)
Waverly, Iowa "Iowa Energy Tags" (www.waverlyia.com/wlp)	Wind	2,500 kWh (2.5 MWh)	$50/tag (=$20/ MWh) Purchase is tax deductible.
Navitas (www.windpower.com)	Wind	1 MWh	$25/MWh
SunPower (www.Sunpower.org)	Solar	2,000 kWh (2 MWh)	$72/block (=$36/MWh)
LADWP (www.greenla.org)	Non-specific	One-time purchase of a certificate, with no quantity specified, for non-LADWP customers	$5/certificate
SMUD "Community Solar"	PV	Additional payment to support Community Solar	$10/MWh ($0.01/kWh)

[20] Each customer "owns" a 100-watt block of a central station PV installation. Assuming an average of 4 hours/day of solar insolation, the monthly production would be 100 watts * 4 hours/day * 30 days/month = 12,000 watt-hours (12 kWh) per month.

F. Marketing and Aggregation of PV Certificates

One of the biggest challenges to marketing PV certificates for any potential seller is aggregating enough certificates to make it financially worthwhile. It could be very cumbersome and expensive for a broker or retailer to contract with every individual owner to sell certificates from small residential systems. However, as there are increasing numbers of these systems, their aggregate will start to represent a sizable number of kilowatt-hours. If there is an entity willing to aggregate a collection of residential systems, a market could develop for the certificates generated from these small systems. For the larger commercial systems, the task is less onerous to develop a certificate product and improve the economics of the installation.

Another problem involves grid operators that do not recognize transactions below 1 or 5 MW. For example, in the New York ISO, which is implementing the NYS Environmental Disclosure protocols using conversion transactions, PV power is not recognized because of its size. Therefore the Public Service Commission will not be able to verify that a marketer purchased the power and certificates from a PV facility. If a tracking system is set up to follow certificate transactions in New York, this should be designed to include PV for verification purposes.

One solar developer in the New Jersey / Pennsylvania area indicated that an LSE had talked about purchasing PV-produced power from their customers at a premium rate (~25 cents/kWh), then reselling them blended green power at their lower rate (~6 cents/kWh). The blended product might have only 1 to 5% PV in the mix, so that the weighted average cost of the overall green product is at an acceptable retail price point. This provides a high return to the PV owner, and allows the LSE to include some solar power in their retail product that is offered to all of their retail customers. This concept has not been implemented as of the date of this paper.

Selling only the renewable certificates from PV installations can be easy and flexible. It does not require the PV installation to be in a deregulated electricity market and the certificates can be offered to a buyer in any geographic area, provided this is properly disclosed. Two levels of companies are required to turn this concept into a reality: 1) solar developers or other companies familiar with solar that will work with homeowners, and commercial and industrial installations to a) sign contracts, b) measure production, and c) aggregate certificates at a wholesale level; and 2) utilities offering green pricing programs or LSEs, that will sell the aggregated certificates to buyers. Verification is needed to assure that double-counting does not occur.

Another possible vehicle for selling PV certificates is through groups that have fund-raising needs. For example, a school that installs a PV system could sell PV certificates to the school families and the community as a PTA fundraiser to help fund the installation. This is equivalent to a group buy of certificates, but with the added benefit that the purchasers are permanently retiring the certificates with no plan to offset other emissions.

G. Conclusions

The first part of the conclusions summarizes the general findings and key principles identified throughout the paper that we recommend be embodied in a PV certificate. The second part proposes a test of the model through specific action items. This is the first step in moving a trial PV certificate initiative forward in the near future.

1. Key Findings Surrounding PV Certificates

- The use of certificates in green markets is increasing across the United States.
- Certificates provide distinct advantages in marketing a renewable product to consumers.
- Standards are being developed for certificate-based products.
- The largest markets to date for PV certificates have been utility green pricing programs, due mainly to the quantity of programs.
- A national database is needed to track certificates for all renewables, including PV.
- Satellite-predicted output of PV systems may be possible to use in estimating PV certificates, to be later fine-tuned through actual meter reads.
- If PV certificates can be sold for a $50/MWh (5 cents/kilowatt-hour) premium, this produces an income stream high enough to justify installing a separate meter to measure the PV production, even for small net-metered residential systems.
- Utility green pricing programs are selling bundled PV energy and certificates over a range of $30 to $549 per MWh.
- PV certificates are being sold in a limited fashion over the internet at a range of $10 to $36 per MWh (1 to 3.6 cents/kWh).
- “Solar aggregators” are needed to aggregate a number of PV installations to offer a sufficient number of PV certificates to retail providers, utilities or brokers.

2. Key Principles to be Adhered to in Configuring PV Certificates

- Verification of PV certificates is necessary to provide assurance to consumers about the validity of the product they are purchasing.
- Owners of PV systems that sell certificates need to understand the implications of selling off the environmental attributes of their solar installation.
- To avoid double-counting, the owner of a solar installation can sell certificates if they are not otherwise claiming the solar attributes from a public relations standpoint.
- Until standards and systems are developed and accepted for measuring and tracking disaggregated certificates, PV certificates should not be disaggregated.
- For net-metered systems, an annual meter read by the homeowner, periodically checked by the aggregator, is sufficient to determine the number of PV certificates generated each year.
- For utility metered systems, meter reads by the utility or an independent third-party are sufficient to determine the number of PV certificates generated from a facility.

3. Proposed Actions for a Trial PV Certificate Initiative

There are several specific action items needed to test a trial PV certificate initiative. These can be grouped into supply-based, demand-based, and policy actions.

<u>a. Supply-Based Actions</u>

- Find at least two companies that will take on the role of aggregator – on both the East Coast and the West Coast.

- Set up a pilot program to start aggregating PV certificates from multiple installations, including homeowner net metered systems, commercial net-metered systems, and large-scale utility-metered systems.

- Evaluate, recommend, and implement alternative metering / measuring and reporting options for the annual production from the PV systems participating in the pilot program. These will possibly include satellite estimates, homeowner readings, and utility meter readings.

- Propose appropriate verification measures to assure buyers that they are getting what they pay for. These can be attestations, affidavits, or participation in a regional certificate database. A sample attestation and affidavit are found in Appendix A and B.

- Select current PV owners (residential, commercial, and industrial) and offer them the opportunity to participate in the pilot PV certificate program, with consideration of the claiming issues.

b. Demand-Based Actions

- Find buyers of the aggregated certificates that fall into the following categories:
  - utilities with green pricing programs
  - LSEs offering blended (energy + certificate) products to consumers in deregulated markets and/or in RPS programs
  - corporations with green purchasing programs (both one-time and multiple purchases)
  - retailers (such as Sterling Planet) to serve customers in deregulated and regulated market
  - certificate brokers
  - organizations that can serve as a renewable "sink"

- Ascertain that the RPS programs, disclosure requirements, and/or ISO requirements allow participation by PV.

- Negotiate the price point(s) for the PV certificates between the buyers and sellers.

- Publicize the pilot project to help move the market toward more purchases of PV certificates through the following means:
  - News releases
  - Presentations at conferences
  - Notification to regulators and government agencies (NARUC, state regulatory and energy agencies, DOE, EPA, etc.)

c. Policy Actions

- Evaluate policy guidelines for RPS programs, disclosure requirements, and others to ascertain the ability for PV to participate equally with other renewable technologies.

- Provide policy recommendations where appropriate to enable PV to participate.

Appendix A
Sample Generic Affidavit for Non-PV Renewable Certificates

Affidavit of
[Company]

I, _____, of [Company], hereby declare under penalty of perjury that the following is true and correct to the best of my knowledge.

1. I am an authorized representative of [Company] with personal knowledge of the facts stated in this Affidavit and am authorized to make this Affidavit on [Company]'s behalf.

2. [Company] owns and operates the [name of power plant] facility.

   This facility:
   A. Is located in _____.
   B. Uses [renewable energy source] as the predominant energy source to generate electricity.
   C. Uses approximately 0 percent (0%) fossil fuel to operate, as measured on a total energy input basis for all fuels annually.
   D. Has a generating capacity of __ MW.
   E. Was placed in operation on [month, day, year].

3. This facility generates renewable energy, consisting of 1) the actual electric energy, measured in kWh or MWh, that is delivered to _____'s transmission system like the production from any other power plant, and 2) all renewable energy attributes associated with renewable energy production. These attributes are represented by a "green tag/renewable certificate" that includes all environmental as well as any other attributes of production of electric energy by the renewable energy facility. [Company] certifies that the renewable energy attributes delivered to the Requestor are not also being claimed, delivered, and/or sold to any other entity.

Executed on this ___ day of _____, ____, in _____, _____.
Month Year City State

By: _____ Title: _____

The Affidavit above was executed in my presence by the Declarant, an authorized Affiant of [Company].

_____ _____ _____
(witness signature) (printed name) (date)

Appendix B
Example of a Green Tag Attestation: Pacificorp

Generator Name	Generator ID Number	Fuel Type	KWh of Energy	Period Delivered

As an authorized agent of Selling Company Name ("the Power Provider"), I declare under penalty of perjury, that the information provided on this form is true and correct to the best of my knowledge. I further declare that the green tags environmental attributes a) are from eligible renewable generators where energy is claimed as renewable, b) were not sold to any end-use customer, c) were not used for on-site generation, and d) were sold to PacifiCorp and only to PacifiCorp. I attest that the above statements are true and correct.

Signature: _____ Date: _____

Name: _____ Title: _____

Place of Execution: _____

The information provided in this Form may be used by PacifiCorp and PacifiCorp's auditors, on a confidential basis, to substantiate and/or verify the accuracy of advertising and/or product content claims of PacifiCorp or its customers. This information will remain confidential to PacifiCorp unless a state or federal government agency specifically requests verification of the accuracy of advertising and/or product content claims of PacifiCorp or its customers. PacifiCorp shall be entitled to disclose publicly the fact that it purchased energy or environmental attributes from the generating units identified herein. For additional release of information in this form, PacifiCorp must obtain the approval from the authorized agent.

Appendix C
Key Items to be Included in a PV Certificate Agreement

This agreement will specify the:

- owner (homeowner, commercial establishment, utility)
- metering method (net metering, utility-side metering, etc.)
- metering hardware requirements
- meter reading frequency
- meter estimating via satellite (if applicable)
- attribute disclosure limitations
- price to be paid for attribute
- frequency of payments
- follow-up meter reading by aggregator