

REPORT # 04-09



SEPA

solar electric power association

Distributed Photovoltaic  
Generation for Regulated Utilities



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## Foreword

Imagine many climbers ascending a mountain. The rugged terrain, ice and jagged rocks force the climbers to stay tied together by ropes, move as one and communicate as they go. For one member to break free of the rope, it not only hinders the safety of the group but increases the likelihood that should he slip there will be no life-line to save him. To make it to the top, each climber must work with the others to keep the group strong. The push to install renewable energy resources is one such mountain that utilities, consumers and communities must climb together – to go it alone could prove difficult, and some would say perilous, because of the large stakes at risk with securing American energy independence.

There are tremendous organizational and financial obstacles that make it difficult for these constituencies to find common ground. Traditionally, utilities have built large centralized generation facilities often located far away from those that the power plant was made to serve. However, the coming of distributed generation is likely to change the manner that stakeholders—utilities, consumers and communities—contribute to energy production. Many great minds have already stated that within the coming decades distributed renewable generation sources are going to become an important component of meeting America's energy needs. But, how does this new model of generation fit within existing legal doctrines? Are there greater opportunities for public participation? Who should pay for the new distributed infrastructure?

These are the sorts of questions that I have dealt with for decades as a former utility analyst and as Chairman of a state utility commission. While there are no clear answers as to how these questions are going to unfold in the long term, I can say that we have a good indication of what utilities can do in the short term. One of those potential short term options available to utilities is discussed in this report.

What you have before you is an analysis of how a utility could approach the regulatory aspects of installing distributed generation solar photovoltaic arrays. At the base of the approach presented here is the notion that utilities and their customers can create a new sort of relationship that is ultimately more beneficial to each. Included in this report are the policy arguments and documents necessary to make a case to a public service board that some type of distributed solar arrangement between utility and customer is not only financially prudent, but socially desirable as well.

My message to utilities, customers and communities is that there is no time like the present to create the necessary partnerships for America's energy future. The sooner we get started, the sooner we can all get to the top of the mountain.



Michael Dworkin  
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# Introduction

Photovoltaics are part of America's energy future. Recent developments in solar technology, markets, business models, as well as federal and state policies, have increased the potential of wide spread distributed photovoltaic generation into the electric grid. The predicted decrease in the cost of photovoltaic systems during the next decade, the likelihood of increasing costs of other generation options, and the removal of the utility exclusion from the federal solar investment tax credit have made photovoltaics a viable ownership option for utilities to consider. Indeed, some state renewable portfolio standards have a solar specific requirement, and utility ownership of PV can potentially act as the least-cost compliance mechanism for a portion of the required generation.

Solar power is progressing toward becoming a viable generation option for electric utilities. The market and manufacturing growth exceed most other generation alternatives. Systems design and technology advancements are moving solar into the mainstream. Grid-connected PV deployments since the late 1990's have been largely end-user owned, end-user sited installations. The exception has been several publicly owned and municipal utilities with innovative programs for deploying distributed solar.

However, a number of investor-owned utilities have made large utility-owned, distributed PV

announcements in 2008, the sum of which equals more than twice the total installed capacity in 2007. Looking ahead, other utility planners should explore how regulatory standards and laws will apply to the utility-owned, customer-sited photovoltaic option. Central to this idea is the presumption that photovoltaic assets can be owned and rate based in the same manner as other generation assets.

This report is designed to assist three groups of participants in the regulatory process: (1) utility system designers and business planners, (2) regulatory commissioners and (3) the general public. It breaks down important issues concerning the regulatory context of utility-owned distributed generation PV assets and their implementation.<sup>1</sup> Some of the relevant questions and answers include:

- ▶ Whether and how a utility can earn a rate of return on its photovoltaic assets?
- ▶ Does photovoltaic generation offer specific business or social benefits?
- ▶ What are some of the business models a utility should consider in a future of widespread solar deployment?
- ▶ What would administrative documents such as a new tariff or expert testimony look like?

This analysis looks at both the regulatory and practical issues surrounding the installation of distributed generation photovoltaics as a foundation for utility's initial steps toward implementation. Though there are a wide variety of customer types, generation options and regulatory limitations from state-to-state, common elements can be drawn that are instructive across these variations. Also included are several administrative documents that provide a 'rough' estimation of what these documents might look like in a regulatory proceeding for utility-owned distributed PV.

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<sup>1</sup> It should be noted that while this report targets regulated utilities, the concepts and ideas enumerated here apply to municipal power authorities and electric cooperatives as well.

# Rate Basing and Cost Recovery Principles

Large scale photovoltaic (PV) investments are still a unique proposition in the regulatory environment. Until recently, the regulatory mechanism for utility investments in solar, even within a renewable portfolio standard framework, has been solely through cost recovery, similar to energy efficiency or demand side management (DSM) investments. Utility investments in solar have not traditionally been treated as rate based generation assets, that is, in a similar manner to traditional generation assets which earn a rate of return for the utilities' investors. As utility owned PV investments are considered for inclusion in the rate base, regulators will be challenged with evaluation processes that cross over from DSM and the extended values considered for this cost recovery and generation needs.

As with all unknowns, PV rate base project filings will likely be examined closely because most public service boards will not have considered its utility deployment, heard expert testimony on it or developed an evaluation process. However, while large scale PV might be relatively new, the same traditional principles of rate base or cost recovery apply to solar as to other generation assets.

Traditional rate base regulations are premised on two basic factors: the whole of a utility's assets and a fair rate of return on these assets.<sup>2</sup> Utility assets, known as a "rate base," are all of

the generation, transmission and distribution capital-property needed to provide electricity to rate payers. Rate payers are all of the residential, commercial and industrial customers that purchase electricity from the utility in their service area. U.S. regulatory doctrine has evolved the notion that customers should only pay a "fair" rate of return on a utility's rate base. In this way, a utility only profits from a return on its assets. The cost of wages, non-generation equipment, maintenance, and third-party energy purchases are merely reimbursed by rate payers.

In the U.S., this form of rate development is called rate-of-return regulation, also known as cost-of-service regulation. It essentially allows utilities to pass through those costs which are deemed necessary by the state regulatory body to ensure that an adequate level of service is provided to customers. During periodic regulatory reviews, expenditures that are deemed appropriate by the regulatory commission are added to the rate base. In order that appropriate levels of capital investment are undertaken, supervising regulatory bodies estimate appropriate rates of return for the regulated utility, based largely on the cost of capital to the utility.

Figure 1 depicts how a utility's revenue requirement is calculated. A revenue requirement is the gross amount of dollars necessary for the utility to collect from rate payers in order to meet its financial needs and still receive a fair rate of return. The revenue requirement is used in designing individual rates for each customer class.

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<sup>2</sup> James C. Bonbright, Albert L. Danielsen and David R. Kamerschen, *Principles of Public Utility Rates* 200 (Public Utilities Reports, 1988). Traditional rate recovery is measured by a fair return "on the excess in operating revenues over operating expenses for which a commission will make provision in a rate case as a component of the company's annual revenue requirements." See also, Charles F. Phillips, *The Regulation of Public Utilities* (Public Utility Reports, 1993) 176-187 (describing rate recovering standards used throughout the United States); Joseph Tomain and Richard Cudahy, *Energy Law* (Thomas-West, 2004) 122 (noting the goals and standards of energy regulatory ratemaking).

## Calculating Utility Rate Recovery

1. Rate Base  $\times$  Rate of Return = Return on Assets
2. Return on Assets  $+$  Operations & Maintenance = Revenue Requirement

Rate recovery includes an allowed return on utility assets, plus the costs incurred by the utility in operating and maintaining those assets.

### **FIGURE 1: Calculating Utility Rate Recovery**

The revenue requirement, allocated by cost-of-service per customer class, is then divided by the forecasted kilowatt-hour (kWh) sales to determine rates.<sup>3</sup> In addition to this revenue requirement rate, there are cost recovery additions such as energy conservation (ECCR), environmental (ECR) and construction (CCR). To date, most utility investments in PV such as customer incentives and renewable portfolio standard (RPS) compliance costs are included in the rates through cost recovery adders.

At the center of electric utility regulation is the state regulatory commission,<sup>4</sup> which has the power to apply rate-making standards or processes to a utility's proposed generation investments for rate base, operating expenses, as well as specific tariffs or rate schedules for consumers.<sup>5</sup> Regulators have also mandated various energy efficiency investments, demand side management investments and renewable

portfolio standards.<sup>6</sup> In this way, a state's regulatory commission is a quasi-judicial rate-making body that approves electricity rates once they are set by utilities.

While all states differ somewhat in their procedures, all states follow a typical review process is that described in Figure 2.

Most commissions require an integrated resource plan (IRP). The IRP evaluates new energy resources that consider a full range of alternatives, including conventional generation, renewable generation, power purchases, energy conservation and efficiency, and load management programs to provide sufficient and reliable electricity service. The overall IRP objective is to balance demand and supply resources on a consistent and integrated basis for the development of an overall plan to meet customer service needs. In fully regulated states, the external cost values of renewable and demand options may not be fully included. IRP is difficult to impossible in deregulated states due to the separation of generation and supply.

As part of the IRP process, or through a separate filing that is related to the IRP goals, a utility will propose a supply or demand side investment for rate base or cost recovery. This may be a percentage increase across all customer class tariffs or apportioned by customer class reflecting the relative cost of service. If the tariff impact is challenged by the regulatory board, a consumer or the state public advocate, then the regulatory commission will initiate a rate proceeding in which the commission reviews the proposed changes to the utility rates. In drafting its decision, the commission uses the state's statutory based legal standards, and comments from intervening stakeholders, in deciding whether the rate impact is fair. At the conclusion of the review,

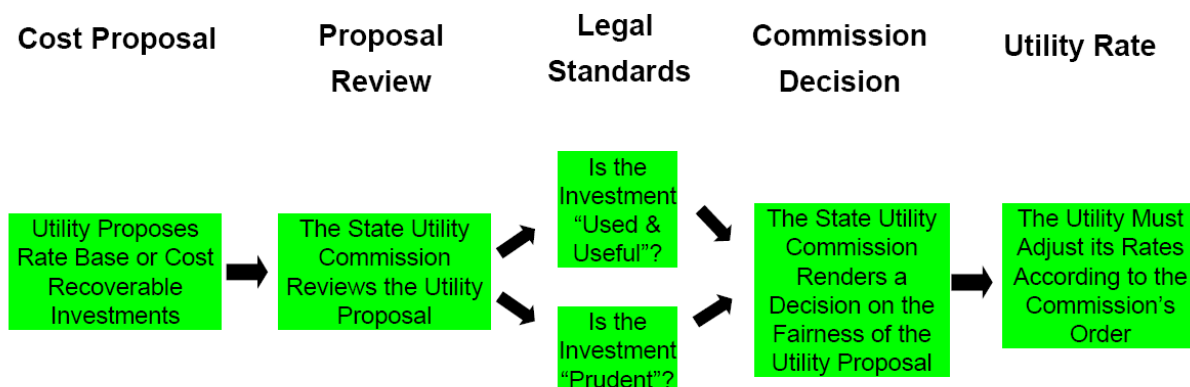
<sup>3</sup> It should be noted that there are other complexities such as fixed costs used to determine service and demand charges, and time-of-use considerations.

<sup>4</sup> Regulatory commissions can be referred to as public service board, public utility commission, board of public utilities or commerce commission.

<sup>5</sup> Indeed, the Federal Energy Regulatory Commission can bestow upon state rate-making authorities other responsibilities that are not present under state law. See 16 U.S.C. § 824(a) (1994). Additionally, the Federal Energy Regulatory Commission (FERC) regulates all interstate transmission of electricity, matters arising from issues of generation sources, asset siting and intrastate transmission are handled by a state's own regulatory commission.

<sup>6</sup> In some cases renewable portfolio standards have been imposed by legislators, but always the details and processes are determined by the regulators.

## State Regulatory Process\*



\* State Regulatory Procedures will vary from state to state.

Though standards and processes differ from state-to-state, a typical review proceeds in these basic steps to decide the fairness of the utility's costs to consumers and rate design.

### FIGURE 2: State Regulatory Process

the utility must adjust its rates according to the commission's order.

Generally, there are two standards used by a utility commission to interpret state laws: (1) the "used and useful" standard, and (2) the "prudence" standard.

#### THE USED AND USEFUL STANDARD

One common regulatory standard requires that a utility's assets must be "used and useful" for the delivery of service to the public.<sup>7</sup> Since a commission's core duty is assuring rate payers purchase reliable electricity services at the lowest possible price, which provides a fair and adequate return to electric utilities, the "used and useful" standard ensures that utility assets are not squandered or wasted.

Each state has specific rules and laws that govern the precise manner in which the state regulatory commission applies the "used and useful" standard. If an electric utility disagrees with a decision, it can challenge the decision at

the commission, or in court. However, it must demonstrate more than a mere difference of opinion. Rather, the electric utility bears the burden of proving that considerable, reversible error has occurred and that there is some "fatal flaw" in the commission's decision.<sup>8</sup> This is a difficult hurdle for utilities to overcome, and unless there is a clear and obvious mistake in the commission's order, utilities rarely appeal decisions.

One example of the application of the used and useful standard by state commissions is the decline of the nuclear power industry in 1970s and the cancellation of numerous nuclear projects across the United States. After cancelling nuclear projects due to cost overruns, faulty construction, negative public sentiment and/or an excess of generating capacity, most electric utilities attempted to recover their embedded costs in the cancelled plants.<sup>9</sup> Many

<sup>7</sup> See generally, Kenneth Wilson, *Electric Utility Deregulation: The Recovery of Stranded Costs*, 33 New Eng. L. Rev. 557 (1999).

<sup>8</sup> See, *Metropolitan Washington Bd. of Trade v. Public Serv. Comm'n*, 432 A.2d 343, 352 (1981).

<sup>9</sup> E.g., see, *Duquesne Light*, 488 U.S. at 302; *Washington Util. & Transp. Comm'n v. FERC*, 26 F.3d 935 (9th Cir. 1994); *Barasch v. Public Util. Comm'n*, 532 A.2d 325 (Pa. 1987).

state legislatures responded by enacting statutes precluding an electric utility from charging in its rate base any investments not considered “used and useful” to the general public.

The Supreme Court had previously paved the way for states to apply the standard by establishing that investors should receive fair market value for any utility assets dedicated to public use which are “used and useful.”<sup>10</sup> Prior to the 1940s courts used a more liberal “fair market” standard.<sup>11</sup> The fair market standard required a court to estimate the current market value of the property and then establish rates that would compensate the utility investors for the fair market value use of the assets. The underlying assumption supporting the fair market analysis is that consumers should pay for the market value of any electric utility property considered for the benefit of the public.

In the case of cancelled nuclear power many state commissions found that abandoned plants were not “used and useful” in pursuit of the public benefit. Many commissions reasoned that if an unfinished nuclear project was not contributing to the grid base load, utility investors did not need to be reimbursed for their losses. The economic investment risk became so large that utilities stopped considering nuclear investments altogether. However, as capacity reserve diminishes and base load nuclear is perhaps a favored option environmentally, utilities are filing for siting, design, and construction cost recovery far ahead of plant commissioning.<sup>12</sup>

### THE PRUDENCE STANDARD

States without a “used and useful” standard tend to have a “prudence” standard requiring utility investments to be prudently designed, installed and managed.<sup>13</sup> Though the prudence standard does not specify anything about the use of energy conservation or efficiency, in the right environment it implies that both might be used. Regulated electric utilities have a statutory obligation to plan and build facilities to meet the

projected demand of their customers, and investments made by a utility may initially seem prudent, but intervening events can radically change the projected growth demand and make prior prudent decisions obsolete.<sup>14</sup>

The prudence standard is based on the ability of electric utilities to recover costs through the rate-making process. During this process, the regulatory commission essentially strikes a balance between the interests of the utility investor and the interests of the consumer. Investors operate under the principal of receiving a fair rate of return on their investments balanced by the presence of the risk of loss.

Regulatory commissions use the magnitude of the risk of loss as a determinant of the rate of return a utility investor is entitled to receive. When a utility’s assets are subject to a minimal risk of loss, a state regulatory commission will normally find it prudent to grant the utility nearly a full rate of return for these non-risk investments. However, when a utility exposes itself to a risk of loss or a risk of unnecessary consumer price increases based on imprudent decisions, the utility will likely be forced to absorb the resulting financial consequences of the risk. Thus, a state regulatory commission will only allow utilities to recoup costs from “prudent” investments. The financial consequences of imprudent investments cannot be passed on to consumers.

### STANDARDS TO MAXIMIZE THE PUBLIC GOOD

The application of the “used and useful” and “prudence” standards are applied differently in each state. Some states focus solely on the financial viability of the project when interpreting these standards.<sup>15</sup> Others states include

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<sup>14</sup> See e.g., *Duquesne Light Co. v. Barasch*, 488 U.S. 299, 302 (1989). In 1967, an electric utility became involved in the construction of several nuclear power plants which were deemed prudent based on present load growth, however, intervening events caused the construction to be halted and the plants were canceled with the utility expending nearly \$35,000,000.

<sup>15</sup> See, Michael Dworkin et al., *Revisiting the Environmental Duties of Public Utility Commissions*, 7 Vt. J. Envtl. L. 1, 2 (2006) (noting that some state public service boards fail to apply their statutory based standards to rate making decisions).

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<sup>12</sup> Site the FLPSC approval for 10% and 7% across the board rate increase for nuclear expected to commission in ~2023

<sup>13</sup> *Id.*

environmental standards<sup>16</sup> independent of the least cost of supply and demand balance of integrated resource planning. Still others will reflect back on the IRP to determine maximum benefit, least cost investments to meet state energy requirements.

This optimization of public welfare in utility regulation is a balance between the financial need of keeping a utility profitable, the generation needs of the public, and the consequences (economic, political, environmental and land use) of generation/demand choices to the served community. Regardless of whether a state is deregulated or applies IRP, processes to evaluate both the direct and indirect values of distributed PV may tip the “consequences” of the regulatory standard balance in favor of a solar generation utility investment.

Utilities should consider how specific state commissions’ interpretations of these two standards affect what is considered to be a required investment. Arguments in favor of a particular rate recovery schedule need to be framed within the context of the specific statutory language codified by each state.

Some examples of statutory language include the following:

- ▶ California has codified these standards by stating that, “Every public utility shall furnish and maintain such adequate, efficient, just, and reasonable service, instrumentalities, equipment, and facilities... as are necessary to promote the safety, health, comfort, and convenience of its patrons, employees, and the public.”<sup>17</sup>
- ▶ Florida law establishes that, “All rates, contracts, and charges... shall be fair, just, reasonable,

and sufficient, and the service rendered to any person shall be rendered and performed in a prompt, expeditious, and efficient manner.”<sup>18</sup>

- ▶ Ohio includes that, “The public utilities commission, when fixing and determining just and reasonable rates shall determine... the valuation of the property of the public utility used and useful in rendering the public utility service for which rates are to be fixed and determined.”<sup>19</sup>
- ▶ Texas law simply establishes a, “just and reasonable” approach by stating that, “The regulatory authority shall ensure that each rate... is just and reasonable.”<sup>20</sup>
- ▶ Vermont’s statutory language states that the commission should attempt to maximize the, “net value to customers in the service territory,” and judge the prudence of a decision by whether it was, “the lowest life cycle cost, after safety concerns are addressed.”<sup>21</sup>

One important point is that all states are different. The examples cited above offer a broad overview of what a utility may encounter when defending its rate recovery plan. Ultimately, the key is for utilities to make the argument that their generation and power delivery investments meet the “used and useful” and “prudence” standards through the application of state specific statutes.

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<sup>16</sup> Vermont defines its PSB utility policy as attempting to meet “the public’s need for energy services, after safety concerns are addressed, at the lowest present value life cycle cost, including *environmental* and economic costs, through a strategy combining investments and expenditures on energy supply, transmission and distribution capacity, transmission and distribution efficiency, and comprehensive energy efficiency programs.” See, Vt. Stat. Ann. tit. 30 § 218c(a) (2000).

<sup>17</sup> Ann. Cal. Pub. Util. Code § 451.

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<sup>18</sup> West’s F.S.A. § 364.03.

<sup>19</sup> Bald. Ohio Rev. Code Ann. R.C. § 4909.15.

<sup>20</sup> V.T.C.A., Utilities Code § 36.003.

<sup>21</sup> Vt. Stat. Ann. tit. 30 § 218c(a).

# Customer-Sited PV: Models of Ownership

Customer sited power delivery assets owned by utilities at the distribution level is not a new idea. Utilities have been installing meters, transformers and wiring for decades on customer property. However, the distributed nature of PV generation extends the scope of *generation assets* to the distribution level, which is generally uncommon. With this shift in design, utilities will no longer merely be bringing electricity to the customers they serve, but generating electricity at their locations as well.

From net metering laws, designed to promote the early deployment of distributed generation, to today's automated metering and green power programs, the relationship between the utility and distributed energy resources is evolving. In the future higher levels of PV deployment and new capabilities in smarter distribution systems will expand options for PV in the grid.

This expansion begs the question of how to organize the relationship between utility and customer? The rate of return, responsibility for generation and upkeep all depend on who owns the PV system sited at the customer property. In order to maximize the benefits flowing from the adoption of customer-sited PV, utilities will need to find the proper business model to use.

## UTILITY BUSINESS MODELS

The Solar Electric Power Association (SEPA), in collaboration with utility, business and PV industry representatives, recently completed a utility solar business models project, and found that there are multiple solar business models that could provide the potential benefits to utilities.<sup>22</sup> Roughly categorized, the models fell into categories of utility ownership, financing, and energy purchases. Central to the discussion was the necessity for all business models to provide the utility a fair rate of return,

to produce desirable social benefits to the community, and provide electricity at a price consumers could afford.<sup>23</sup>

A utility business model is different from most concepts because, unlike a conventional business, regulated and public utilities must take into account the needs and ultimately the desires of the public. Both investor-owned and publicly owned utilities are government-sanctioned monopolies charged with providing essential services to the public and advancing broader societal interests. Therefore, all types of utilities must not only consider the best way to guarantee financial health, but also broader social goals, touching upon the environment, consumer well-being and equity, as well as complying with regulatory mandates.<sup>24</sup>

Utilities acknowledge a shift in theory and practice in the effort to change the way they work with customers. On the one hand, the nature of a monopolistic grant means that there are no market pressures driving innovation and helping utilities to realize change as new technologies become available. However, facing possible major changes in the way electricity is generated and delivered, utilities are looking at new strategies and non-traditional business models. As the SEPA report makes clear, "to create, capture, deliver and sustain value from these opportunities, EPRI and other SEPA collaborators confirmed that most utilities will need to adopt novel, somewhat pioneering perspectives – not a trivial exercise for large, complex organizations with a long and successful history of a rate of return business."<sup>25</sup> Within the SEPA business models report, utility ownership of PV was one of the three broad categories. This report will focus on utility shared or sole ownership of distributed PV generation for which net metering does not apply.<sup>26</sup>

<sup>23</sup> *Id.* at 18.

<sup>24</sup> *Id.* at 14.

<sup>25</sup> *Id.* at 15.

<sup>26</sup> In most states, a utility's profits are tied to its electricity sales and any reduction in retail purchases through net metering provides a direct disincentive for the utility to utilize this configuration. Decoupling is a regulatory policy that can address this disincentive, but its implementation is not widespread in the United States, California being the largest exception.

<sup>22</sup> Solar Electric Power Association, *Utility Solar Business Models*, 17-23 (2008).

These configurations are normally connected on the utility-side of the customer's revenue meter in order to measure and account for the PV energy. On the utility side of the meter, the PV system has no effect on the customer's electricity consumption bill, and the location becomes merely a site host. The utility could either pay a premium rate (over the existing retail price), or a separate lease payment (either fixed or based on performance) to draw site-host customers into the market.<sup>27</sup> Contracts between the utility and customer for the PV power would likely last from 10 to 20 years.

#### UTILITY SHARED ASSET CONFIGURATION

Figure 3 (p13) shows a shared asset configuration. The utility would own the electrical controls and the power conversion assets (including the PV disconnect, meter and inverter). The property owner is relieved of the responsibility to provide ac power and maintain the inverter, but would be responsible to provide the array, including its up keep, and the wiring from the meter to the array.

In the shared asset configuration the utility view of potential for wide-spread deployment of PV shifts significantly relative to issues identified in the net metering case. The points of comparison are as follows:

- ▶ Utilities would have limited influence over location and sizing to better suit system economics and operations.
- ▶ There is more potential for streamlining interconnection, and for better control over the PV system output.
- ▶ The impact on kWh revenues could be negative, neutral or positive

<sup>27</sup> In the case of PV-DG, under model 2 one possibility of how the agreement between customer and utility could be structured is somewhat akin to the principle behind a feed-in-tariff. The utility would pay the customer the base rate per kWh and a PV premium amount X above the base rate (base rate + X = payment to customer). For example, imagine that the base rate for the customer is \$0.10/kwh and the PV premium rate is \$0.06/kwh. If the customer installs their own PV array and necessary wiring to the meter on the outside wall, any excess electricity produced by the PV array that is not consumed earns the customer \$0.16/kwh.

- ▶ With share asset ownership it may be easier to apply energy output to meet RPS requirements or to take renewable energy credits.
- ▶ The ownership model allows possible rate-based cost recovery for utility owned assets.

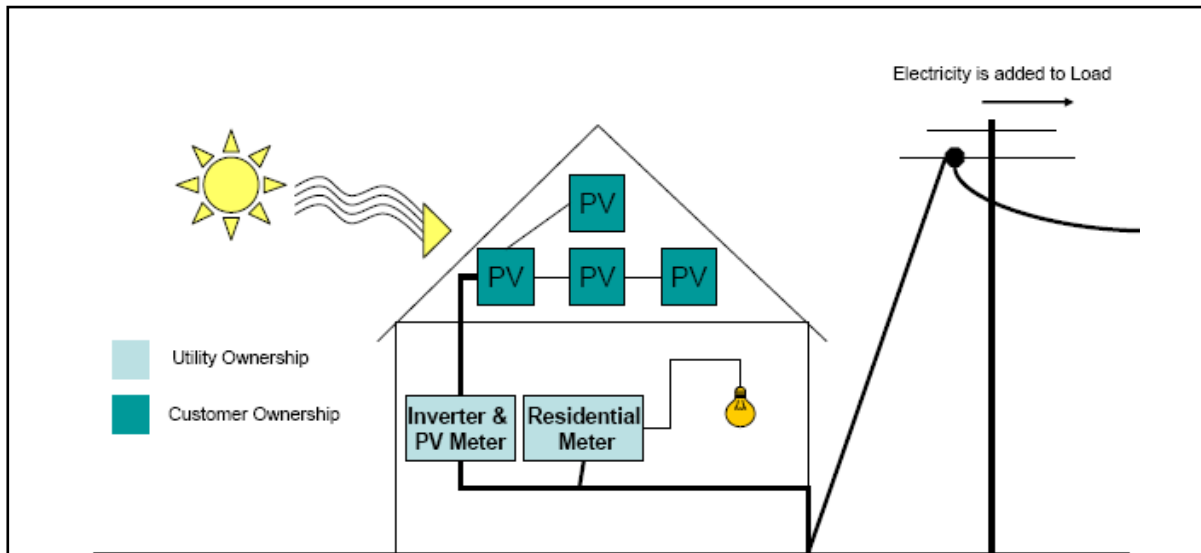
#### UTILITY OWNED AT CUSTOMER HOST SITE

Figure 4 (p13) shows the case of a customer sited system that is fully owned by the utility. The utility owns all of the PV assets, including the interconnection and generation assets associated with the installation of a PV array on the customer's property. The use of the site is handled under a lease agreement.

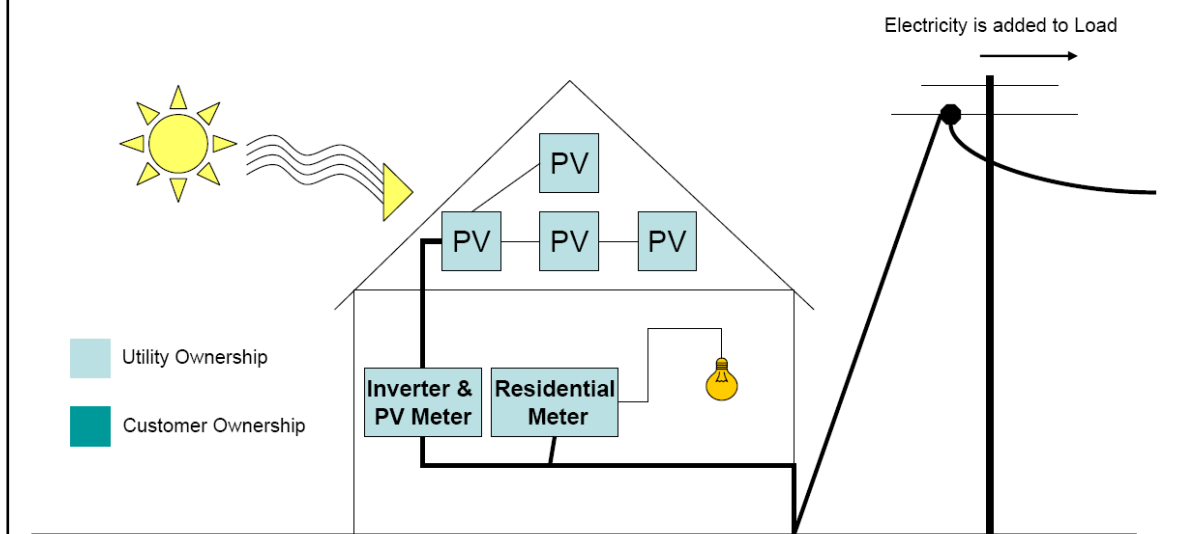
As a fully owned utility asset, many issues of wide spread deployment of PV are seen in a different light from the utility's view point. Some very positive technical and business potential points can be made:

- ▶ Utilities can consider the most beneficial sites and system sizes.
- ▶ There is a strong incentive for developing interconnection standards, procedures and related hardware.
- ▶ Revenue potential becomes neutral or positive for PV kWhs.
- ▶ Owning the system will make it easier to apply energy output to meet RPS requirements or to take renewable energy credits.
- ▶ Aggregation of REC or RPS credits is more straightforward.
- ▶ PV system control is enhanced relative to lineman safety and system related ancillary services.
- ▶ The case for rate-based cost recovery may be strengthened.

Utility ownership of PV systems would allow the utility to make design and interconnection improvements that make the PV systems more valuable to the electric grid. Fully integrating the systems should simplify interconnection and allow optimization of the electric system operation. It will also simplify the aggregation of renewable energy credits (RECs) generated by many different solar arrays. RECs are tradable certificates that are important in helping the utility meet potential renewable energy portfolio standards, or valuable as a sellable commodity to another utility needing the RECs.



**FIGURE 3: Utility Shared Asset Configuration**



**FIGURE 4: Customer Sited PV: Utility Ownership**



### **Southern California Solar Project**

Southern California Edison (SCE) has launched one of the largest PV installations, distributed or centralized, in the U.S. SCE plans to install up to 250 megawatts (MW) of PV systems on over 65 million square feet of roofs on commercial buildings in southern California. The project, as with Duke Energy, utilizes the third configuration where the utility owns all of the PV assets. SCE's Chief Executive Officer John Bryson stated, "This project will turn two square miles of unused commercial rooftops into advanced solar generating stations. We hope to have the first solar rooftops in service by August. The sunlight power will be available to meet our largest challenge – peak load demands on the hottest days." The project was prompted by recent reductions in the cost of installed PV generation, according to SCE. The request estimates the total project cost will be US \$875 million.

### **LIPA Solar Project in New York**

The Long Island Power Authority (LIPA) announced in the spring of 2008 its plans for the largest solar energy project in the State of New York. While LIPA is a municipal power authority and not a regulated utility, the project still provides an example of changes in the solar electric power market. The project calls for 50 MW of solar energy to be generated on Long Island. The project would provide enough power to sustain more than 6,500 households and reduce carbon dioxide emissions by 20,000 tons. LIPA expects the project will diversify Long Island's energy portfolio, strengthen the local economy, transform the solar photovoltaic marketplace, and reduce the state's dependency on fossil fuels. The utility envisions that the photovoltaic arrays will be installed at non-residential customer sites including; school buildings, on commercial and municipal rooftops, along parking lots, atop landfills, and at brownfield sites. LIPA and Long Island is already host to 90 percent of the photovoltaic systems purchased throughout New York State. The new 50 MW will account for nearly 1 % of LIPA's total annual demand and will be the single largest block of solar energy in the state of New York.

### **Duke Energy Photovoltaic Project**

Duke Energy of North Carolina is working on its original plans to install 20 MW of distributed generation photovoltaic, issuing an RFP for design and installation in the summer of 2008. As proposed, approximately 850 sites in its North Carolina service area, including homes, schools, stores and factories, will be used as sites for the new arrays. The \$100-million plan would take about two years to install. Duke plans to recover its \$100 million investment through North Carolina's Renewable Energy Portfolio Standard cost recovery mechanism. Over the life of the program, the company estimates the average customer's bill will increase no more than 25 cents a month.

During the subsequent regulatory approval process, the plan's installed capacity was reduced by half and the approved recoverable amount from ratepayers limited to an undisclosed amount from a previous centralized PV project contract to reduce ratepayer risk during the economic recession. Duke is currently evaluating the Commission's decision and their formal response.

# The Regulatory Context

Recent advances in costs, system design, technology, and policies (for interconnection, market mandates, and incentives) have made PV an additional choice for utility owned generation. While utility ownership is currently an emerging market scenario, it will add a new option to the continued growth in the parallel customer and third-party owned market. This new utility market scenario, along with other utility solar business models being developed, adds complexity not only to supply/demand forecasts but also to the regulatory nuances that utility planners need to understand.

Past state regulatory positions concerning utility asset investments typically involved comparisons with coal, gas, nuclear, or efficiency resources when determining whether it would be a least cost investment. Because traditional generation options have historically been less expensive than PV, utilities could not justify the installation. The recent increases in the cost of fossil fuels, concerns over global warming, and the need to buttress grid reliability are changing the nature of traditional utility generation portfolio planning. Integrating distributed generated PV with demand management, efficiency measures, future plug-in hybrid electric vehicles (PHEVs) and distributed generation technologies increases its potential value. An innovative type of IRP accounting for technical, economic and changing social values could redefine the regulatory evaluation process.

As the customer owned market has developed, an array of specific policies have emerged to address the state differences and to reflect the added values of distributed generation and particularly renewable DG. This menu of policies provides a foundation of regulatory process and allowances for consideration in development of utility rate based renewable generation.<sup>28</sup>

<sup>28</sup> The DSIRE database provides descriptions and details for all renewable energy policy, standards and regulations, [www.dsireusa.org](http://www.dsireusa.org)

## STATE RENEWABLE AND DISTRIBUTED GENERATION POLICIES

### 1. Net Metering and Interconnection<sup>29</sup>

Net metering is a tariff which initially emerged in the mid-90's to allow customer sited/owned PV (and other renewable generators) to capture retail electricity value for all energy generated. This is important for commercial and residential customers who cannot consume all the energy generated exactly when it is generated. Excess energy generated flows back to the distribution grid and either specifically reverses the customer meter, or the consumption, and a new generation account are netted against one another.<sup>30</sup> Over some time period, any excess generated is either granted to the utility or the customer is paid avoided cost.

The 2005 Energy Policy Act mandated that, "Each electric utility shall make available upon request net metering service to any electric consumer that the electric utility serves."<sup>31</sup> States have been left with the task of considering net-metering rules and interconnection standards. Net metering does

<sup>29</sup> One of the first opportunities to increase renewable distributed generation like PV was the Public Utilities Regulatory Policies Act, or "PURPA." Though PURPA's policies have in most respects become obsolete, it was an important policy step in the development of state net-metering laws.

PURPA was passed in 1978 as part of the Energy Policy Act, and created a category of non-utility-owned electricity producers called qualifying facilities (QFs), which are smaller-sized independent power producers (IPPs) that utilized renewable or "waste" (no or low commercial value) fuels, or which were high efficiency cogeneration plants. PURPA mandated that utilities buy the electricity output from IPPs at "avoided cost," while exempting the independent producers from the taxes and state utility regulation. Avoided cost is generically defined as the variable costs of fuel, operations, and maintenance if the utility were to produce the energy themselves, however, the actual calculation is both not a standardized formula, nor is it generally at a level at which renewable generators could earn a positive rate of return.

<sup>30</sup> Some tariffs require a second meter for tracking purposes; in other cases the consumption meter is not considered accurate enough in the reverse direction for tracking.

<sup>31</sup> Energy Policy Act of 2005, under Sec. 1251.

not account for the cost to provide the grid connection to each end user, and the cost of the distribution system used regardless of the direction of energy flow. Net metering was thought to resolve grid connection issues, but additional considerations beyond the tariff have caused interconnection standards to also develop. Currently 41 states have statewide net metering and 37 states have statewide interconnection standards.<sup>32</sup> The utility owned or shared ownership scenarios are generally not net metered and all electricity flows directly into the distribution grid even though the PV system may be located on a customer's property.

## 2. Public Benefits Funds

Public benefit funds emerged from deregulation activities to retain public or system benefits such as technical research, low income subsidies, efficiency, and renewable energy investments. These benefits were easily expensed under regulation, but at risk in a competitive energy market. The funds were established through a \$/kWh surcharge on a consumer bills, similar to cost recovery factors and most often used to fund renewable investment incentives.

## 3. Green Pricing Programs

Green pricing programs offer premium or green energy products to consumers, generally at a higher price. Typically administered by utilities, programs can offer a mix of renewable generation or one specific technology. The premiums are used to pay for utility owned generation or incentivize customer owned generation. Green pricing programs have often been used as the first point of entry for utilities in acquiring renewable energy in larger quantities, and their aggregate impact is an important part of renewable energy development (especially in smaller market areas). However, their overall importance has largely been supplanted by renewable portfolio standards as drivers of renewable energy markets.

## 4. Incentives to Reduce Capital Cost

Rebates are a common policy used to incentivize the installation of PV systems. Programs vary widely depending on the utility and the state. A typical rebate program offers residential and commercial consumers cash

payments when they install a PV system on their property, nearly always in a net metering arrangement. The rebate amount is either established by regulation, legislation or the utility, and is funded either through general revenue or systems benefits charges, small charges added to the general electric rate charged by the utility.

Tax credits and deductions also reduce the capital investment cost, but these incentives can be delayed by the tax year cycle and require the customer to have a tax liability in excess of the incentive value. It should also be noted that a tax credit provides the full value of the incentive, where as a tax deduction value is only equal to the tax rate factored by the incentive. In addition to many state income tax incentives, the Federal investment tax credit was extended eight year and modified to include utilities in October 2008.<sup>33</sup>

## 5. Performance Incentives

Performance incentive programs pay the consumer a ¢/kWh payment based on the electricity produced. Instead of an up-front payment when the PV system is installed, a production incentive provides continuing payments over time, and acts as a long-term security to obtain financing in lieu of a rebate if necessary. With the incentive dependent on the energy produced, continued system performance or reliability is enhanced. California and New Jersey, the two largest solar markets in the US, both use different forms of performance incentives, and in a sense, the structure can be indicative of a maturing market.

Feed-in tariffs are widely utilized in Europe. Unlike non-tariff production incentives that are configured on the consumer side of the meter through net-metering, feed-in tariffs are generally paid by utilities to solar power systems interconnected on the utility side of the meter. Normally, they are long term, fixed price contracts of up to 20 years for electricity

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<sup>32</sup> See, *Freeing the Grid, Network For New Energy Choices* (2008), which examines each state's net-metering laws and interconnection standard.

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<sup>33</sup> The Solar Energy Industries Association (SEIA) released a tax manual for the federal investment tax credit available on their website targeted at a generalized solar stakeholders audience (free for members; purchase for non-members). The Solar Electric Power Association (SEPA), which released this report, released a tax manual specifically for electric utilities in January 2009.

produced and supplied to the grid by the PV system at higher than retail rates.

Renewable energy credits, also known as RECs, are tradable certificates that represent the unbundled, green or environmental attribute of a kW-hours generated by a renewable energy source. With the kWh unbundled, the actual energy attribute of renewable generation can still be net metered or used to offset customer load. These credits can be purchased by consumers or utilities whether or not they have direct access to any renewable energy source in their generation mix. RECs are valued because they reflect the amount of pollutant emissions that were offset or displaced by the renewable generation as opposed to a conventional power source like coal or gas. One of the reasons that REC's have monetary value is because utilities in states that have passed a renewable portfolio standard can use RECs to meet their RPS obligations. New Jersey's PV market, as was previously mentioned, is based on a REC structure.

**6. Renewable Portfolio Standards**

Renewable (energy) portfolio standards (RPS) are state mandates that require that a certain percentage of the energy sold in the state is supplied by renewable energy generators. Definitions of renewable energy differ from state-to-state but are typically comprised of wind, geothermal, solar, hydro, or any other renewable generation sources. The mandated percentages and time frames also vary, but are usually between 10% - 20% of the electric energy delivered over time periods ranging from 2010 to 2020 for the 30 states that currently have an RPS. Some RPSs are market driven resulting in the lowest cost renewable deployment and some have solar specific or DG set-asides.

Figure 6 lists the fourteen states that have a solar specific RPS. States have taken two main approaches toward solar mandates. The first approach requires that a certain percentage of the state's generation mix must be solar by a

particular year. The second approach applies multipliers for solar electricity credits. For example, the New Mexico law multiplies solar generation by three to determine the amount of kWhs being contributed to the RPS requirement. Colorado, Delaware and Nevada combine the two approaches, by having a requirement and a multiplier incentive. However, states have generally been moving away from credit multipliers alone, in favor of either a solar

**TABLE 1: RPS Solar Requirement Estimates**

State	2010	2025	2025 Solar Generation as a % of State Load
Arizona	110 MW	1,600 MW	2.0%
Colorado	29 MW	160 MW	0.4%
Delaware	0.5 MW	190 MW	1.4%
Maryland	14 MW	1500 MW	2.0%
Nevada	76 MW	180 MW	0.6%
New Hampshire	4 MW	35 MW	0.3%
New Jersey	210 MW	1,600 MW	2.1%
New Mexico	64 MW	420 MW	3.1%
New York	10 MW	15 MW	0.0%
North Carolina	5 MW	280 MW	0.2%
Pennsylvania	25 MW	690 MW	0.5%
District of Columbia	0.5 MW	54 MW	0.4%
<b>Total</b>	<b>550 MW</b>	<b>6,700 MW</b>	<b>-</b>

Estimated cumulative solar required to meet state RPS solar and DG set-asides.

Source (reprinted): Wisser, Ryan and Galen Barbose. "Renewable Portfolio Standards in the United States." Lawrence Berkeley Labs, April 2008.

requirement within a portfolio standard or a combination of both.<sup>34</sup>

In states with a set floor for solar energy production, utilities *must* either install PV generation assets or purchase PV energy from customer sited generators or independent power producers to comply with the law regardless of the prudence of such investments compared to

<sup>34</sup> Wisser, Ryan and Galen Barbose. "Renewable Portfolio Standards in the United States." Lawrence Berkeley Labs, April 2008.

other alternatives. Where states have created multiplier rules for PV generation regulatory commissions will likely be more deferential in applying both the “used and useful” standard as well as the “prudence” standard. The specific statutory requirement or general requirement of renewable energy will make state regulatory commissions more sensitive to arguments that utilities are investing in solar in pursuit of the public benefit as compared to other generation alternatives.

power plant. Though there are differences in the physical distribution of the generation assets, the same basic principles apply. Underlying these principles is the notion that utilities will not invest in PV unless investors and management believe that there is a strong probability of earning a return on the costs of those investments. This includes recovery for the relevant equipment, which might include photovoltaic modules, the inverter, disconnects, mounting brackets, wiring to and from all devices, and required metering, depending on the ownership configuration (Figure 5).

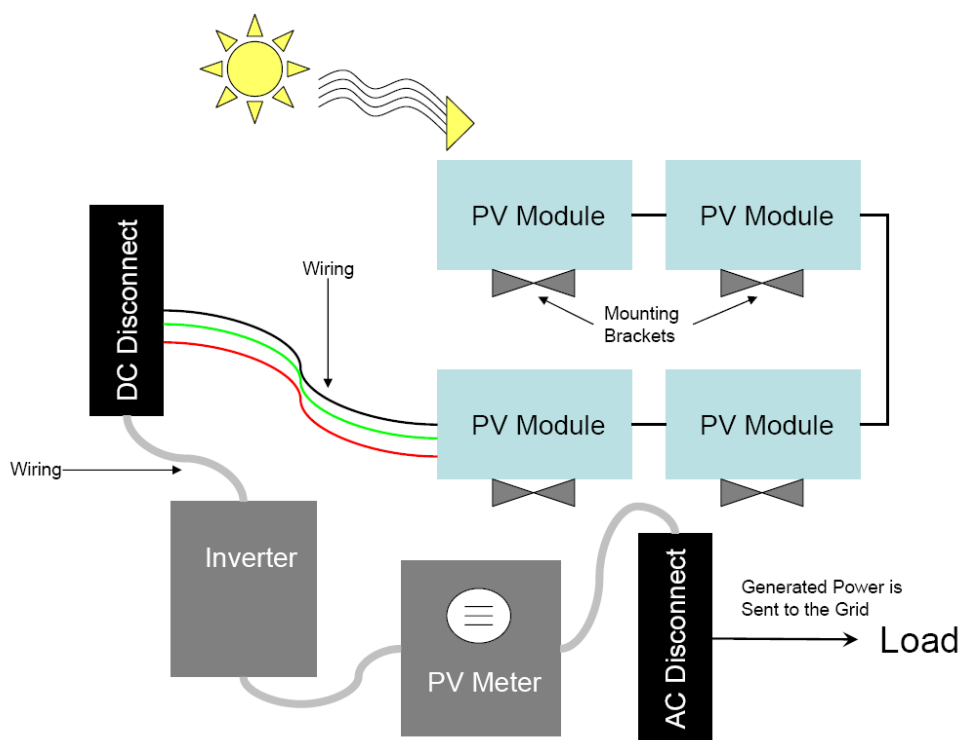


Diagram of the assets upon which utilities may recover costs.

**FIGURE 5: Photovoltaic System Design Schematic**

#### **COST RECOVERY APPLICATIONS TO DISTRIBUTED PHOTOVOLTAIC GENERATION**

Until recently, most utility expenses caused by policy mandates have been included in rates through cost recovery factors. However, in 2008, several utilities filed to rate base solar generation assets.

In most respects, cost recovery based on a fair rate of return on assets will be administered in a *similar* fashion to centralized generation assets such as a coal fired power plant or a nuclear

A central question regarding rate basing for PV systems is whether courts and regulators would find all of the assets in the system “used and useful.” Consider the case of configuration where the utility owns all of the assets used in the system at an end user site. A utility should be able to garner a fair rate of return on all assets that contribute to generation supply. In the scenario of full utility ownership it is the entire PV system, because each system component is an intricate part of the generation

of electricity for regulators to determine “used and useful.”

In order for there to be rate recovery, utility commissions must find utility owned generation to be a “prudent investment.”<sup>35</sup> As discussed earlier, prudence is the legal test that a judicial body applies when ruling whether a utility investment meets (or has met) its service goals and has fairly charged its rate payers. Ultimately, a prudent investment is one in which the utility has not exceeded its mandate to collect revenues from customers. In certain situations a utility may have spent more money on a power generation project or plant than was originally planned.<sup>36</sup> In this situation, a court may find that the investment which the utility decided to pursue was either poorly planned or executed. In either case, courts have consistently ruled that utility commissions may exclude (disallow) the cost of such imprudence from the rates charged to rate payers or customers.

Thus, a vital question is whether state regulatory commissions are likely to view distributed PV as a “prudent investment.”<sup>37</sup> In assessing the prudence of an investment, state commissions, ratepayers and utilities must look to the long

term trends surrounding other comparable investments.

A dynamic analysis that takes into account the interaction of decreasing technology costs for PV combined with increasing fuel and construction costs of more conventional generation sources, distributed generation benefits along with any state goals or requirements for renewable energy, may lead to the conclusion: PV is a wise and prudent long term choice.<sup>38</sup> Extended societal values beyond energy generation such as emissions reduction, water and land use, and economic development could also be pulled into the regulatory evaluation of comparable investments to tip the balance towards PV-DG.

However, several uncertainties present obstacles to wide scale utility investments, from the perspectives of both utility rate base proposals and regulatory allowances. Weather dependent generation intermittency is one risk that is addressed with increasingly smaller time interval forecasting, small amounts of storage, and interface/interaction with distribution load management or facility energy management.<sup>39</sup> Also, the workability of leasing agreements with property owners in order to install a large number of arrays, as well as the durability of the lease over the life of the generation asset.

These are important factors that utilities will likely take into account when considering distributed PV and rate recovery on their investment. The point is that this uncertainty increases the inherent costs of the investment both financially and strategically. However, these factors need to be weighed against the potential benefits of a PV system to determine if it is prudent for the utility to have partial or full ownership.

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<sup>35</sup> See, *Pacific Gas & Elect. Co. v. Railroad Commission*, 302 U.S. 308, 310 (1938) (explaining the Supreme Court’s definition of a “prudent investment”).

<sup>36</sup> The construction of new nuclear power plants in the 1970s is a prime example of *imprudent* investments. In these cases the price of constructing nuclear generation facilities sky-rocketed, far exceeding utility financial expectations. State public service board rulings generally held that utilities were not able to recover their losses from rate payers because the utilities had made *imprudent* investments.

<sup>37</sup> A proposed DG-PV system with a higher present-cost as compared to other alternatives could be a challenge to sell to stakeholders to prove “prudence.” Even a utility that wants to invest in a DG-PV system might find stiff resistance from consumer rights groups, customers who want the lowest possible short term price and potentially from a governing regulatory body. In this way, revenue recovery proceedings by utilities *must* be approached with caution and foresight to anticipate the local/state arguments against a PV investment and to subsequently counteract those arguments. If the public and the regulators are not convinced of the over-arching prudence of the project, it is unlikely to be approved.

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<sup>38</sup> Richard Munson, *Recycling Energy: How Industry Is Leading a Clean-Technology Revolution*, 20 *Electricity Journal* 79, 79 (2007) (noting that the cost of building a centralized coal-fired power plant has increased from \$800 per kW in the late 1990s to as much as \$2,500 per kW, largely because of new pollution control requirements).

<sup>39</sup> Perez, Richard, et al. “Photovoltaic Capacity Valuation Methods.” *Solar Electric Power Association*, May 2008.

# Benefits of Utility Ownership

The benefits of utility ownership fall into two categories, the traditional energy market benefits related to distributed generation and the extended benefits to society. Clearly, the utility ownership model expands the operating options and provides new business opportunities for utilities in a future of wide-spread deployment of distributed PV. The other question that will likely need to be addressed in any public utility commission rate case is, "Will ownership of the PV asset by a utility, or shared between end user and the utility, garner benefits for society at large?" Another related question is, "What is the best way to maximize the benefits for the stakeholder groups involved in a distributed PV system (consumers, utilities and society)?"

The format that these questions take, and the best way to address them, will depend on the specific rate case and location. There are many relevant topics that may be considered when presenting a potential distributed solar project before a public service board. One common objection to utility ownership is that private developers, consumers or any non-utility entity could argue that they might be able to do an equally good job as the utility in providing grid and system benefits using PV systems.

Indeed, in some cases a public service board or a public advocate may question whether the utility is exerting monopoly power or properly separating ratepayer and shareholder funded costs. In order to address such an argument it will be important to document the incentives and the capability of private industry to achieve benefits to society. Both scale and motivation will be important comparisons. Ultimately, the wide scale deployment expected for PV will consist of market development from utility owned, customer owned, and private developers.

The utility owned systems will be justified by an array of utility expertise in generation project development and operations as well as the related benefits to society. Ideally, a case for a specific society benefit needs to be measurable and monetized. However, to get started it will be important to demonstrate that there are definable positive benefits even if they cannot be

precisely quantified. Overall, a regulatory commission is attempting to make sure that the benefits of utility ownership of distributed PV will serve the interests of the parties involved. The following potential benefits are elaborated as examples that could be argued for utility-owned, customer-sited PV:

## UTILITY EXPERTISE AND OPERATIONAL BENEFITS

### 1. Distributed Generation Benefits

Distributed generation has long been attributed the benefits of deferred generation, transmission and distribution capacity investments. PV can be the ultimate DG, when located on urban low impedance distribution feeders with a load curve dominated by air conditioning loads. Additionally, the modularity of PV provides a number of benefits to utility generation, distribution operation and planning engineers and has even shown to have a positive effect on transmission peaks.<sup>40</sup> Obviously PV is a generation asset, but the modularity of PV provides for quick construction times, diminishing the risk and uncertainty in both generation planning and the investment versus revenue collection time frame (a minimum of 10 years for tradition generation). PV modularity provides numerous operating and procedural (O&P) benefits under the utility ownership scenario.

- PV can be located and relocated to best meet distribution load changes. This benefit applies to an urban grid with ever changing business types and urban renewal, as well as to avoid construction disruption in urban areas. Likewise on rural feeders, PV can meet increased loads at the end of feeders where an upgrade or rebuild of aging systems could be very costly.
- With modular inverter design, PV can provide phase balance and rebalance as single phase loads change.
- PV can be oriented to the west for a later afternoon generation profile, which is desirable for distribution areas dominated by residential loads. Some incentives targeted at customer owned systems are de-rated when orientation is not at the optimal energy

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<sup>40</sup> Hammon, Rob and Mike Keese. "Impact of Distributed Solar on SMUD's Peak Load," April 2006.

performance of south and tilted at the latitude. Utility ownership may value the capacity match more than the energy.

- Integration of PV with utility system direct customer load control and load management enhances the load match and availability of both the DSM program and the PV.<sup>41</sup>
- The electronic intelligence of inverters can also provide utilities with reactive power and may contribute to the utility trends towards “smart grids,” which are expected to increase grid availability, reliability, as well as price signals to customers and customers’ end use loads for overall improvement of system utilization.

## 2. Utility Project Management Expertise

The entire US enjoys low electricity costs relative to the grid reliability and availability provided to consumers. And though it has been highly subsidized through the years, all types of utilities, along with the oversight of regulators can be credited with maintaining these low electricity prices. Utilities have nearly century of highly efficient project development and management expertise that can be applied to the utility owned distribution market.

Utilities also own a great deal of property serving as land buffers for existing generation and distribution. The electric distribution system includes substations, right of way, utility poles, power lines, transformers and related control, protection and metering. It is sized to meet the peak demands and voltage regulation requirements along a distribution feeder and for each consumer. This utility experience has proven to decrease balance of system costs. Indeed, Tucson Electric Power developed the Springerville PV project with a system cost nearly 30% less than any other system installed at the time, including a unique inverter design from the utility staff.

With utility ownership and rate basing of PV projects, the whole PV system, grid integration will benefit all market factions even beyond BOS system cost reductions. PV systems, especially when incentivized with an up-front capital incentive, may not provide energy for the full

system life. Beyond installation quality issues,<sup>42</sup> very simple electric/electronic events can bump a PV system off line and in this early consumer market, awareness of simple things like listening for inverter operation may not occur.

To maintain “used and useful” quality of the rate base asset, utilities owned systems will be required to be highly reliable, continuously operation. Utility experience will also expedite the development of simplified interconnection for all PV system markets. The major utility obstacle for interconnection is the utility’s desire to “protect” the grid, and with utility ownership also comes the education to identify the lowest cost (both in hardware and process) to assure grid reliability is not affected by PV systems.

Finally, standard distribution design is for centralized generation and one-way energy flow, often requiring either distribution design changes<sup>43</sup> or expensive protective relaying to accommodate DG. The expanded and accelerated market from utility ownership will develop design changes for new distribution plant as well as the lowest cost standard for existing distribution protection modifications and potentially standards for allowable penetration with no change necessary.

## 3. Enhanced Safety for Utility Lineman

The utility exercising control over the generation assets will make line work and the interconnection process safer for utility employees. When non-utility actors have control or install their own controls on the grid there is a higher possibility that the PV systems feeding into the grid could be turned on unexpectedly. In a centralized generation system, it is simple for line workers to route power away from the line being fixed. However, in a distributed generation system, all energy sources along the line in question need to be switched off. When employees are conducting line work downstream from a distributed generation source they need to be certain that it is not and will begin adding power to the grid unexpectedly.

<sup>41</sup> Perez, Richard et al. “Integration of PV in Demand Response Programs.” National Renewable Energy Lab subcontract #AEK-5-55057-01. See also SEPA report “PV Capacity Methods,” May 2008.

<sup>42</sup> NABCEP ([www.nabcep.org](http://www.nabcep.org)) installer certification, as well as National Electric Code refinements ([www.solarabcs.com](http://www.solarabcs.com)), have vastly professionalized system installation in recent years.

<sup>43</sup> These changes are typically in protective hardware such as fuses and reclosers.

The assumption here is that non-utility ownership increases the possibility of unknown power entry onto the grid during line work. On the other hand the existence of other net metered distributed generation, PV or otherwise, will demand that usual safety practices will have to be maintained irrespective of ownership.

### **SOCIETAL BENEFITS**

Societal benefits are not as easily incorporated in either the utility or regulatory cost/benefit evaluation. Integrated resource planning was an initial phase of including societal benefits via environmental externalities in the cost benefit of the generation/supply balance. As the energy market transitions, even more opportunities exist to consider the whole of society in the evaluation and decision process, and even greater values to the utility ownership of PV.

#### **1. Emissions Reductions**

Currently, from a utility perspective the largest value related to emissions reductions is the future environmental regulation risk. Existing generation plants are not “grandfathered” relative to emissions allowances and have often had to make costly additions of scrubbers and precipitators when the environmental regulation changed, such as air quality standards. As environmental regulations are stepped up to address global warming, the risks of required future investments to address the changes will also increase.

Distributed PV systems have no emissions and therefore no criteria pollutants or carbon emissions during power production. Indeed, with the coming of some form of CO<sub>2</sub> regulatory scheme, which is likely to either tax or cap & trade emissions, fossil fuel power generation costs are very likely to increase dramatically—making non- CO<sub>2</sub> emitting energy sources more cost competitive.

#### **2. Water and Land Use**

Water and land use are also valued by society as a whole, and mitigated by distributed PV-DG. Both nuclear and fossil fuel generation require water for cooling, as well as large areas of land for “buffer zones.” Coastal plants can use salt water and often inland plants reinsert groundwater, but the increasing occurrence of regional shortages will place a high value on water conservative generation technologies. Utility ownership programs are taking advantage of both rooftop real estate as well as the existing plant buffer zones.

#### **3. Economic Development**

Distributed PV generation has also proven to contribute to economic development values, which are increasingly important drivers at the political policy level. The utility perspective to economic value is traditionally the increase in revenues from new business development. It has been shown that local markets enhance the probability of local manufacturing production, hence increased energy sales and revenue to the utility. Less traditional economic development values include the recent utility experience of the trickle down affect of new market niches for the housing and construction industry, which likely employ more local labor than a centralized plant.

A broader societal perspective considers the common economic metrics such as gross regional or state product, earnings, and job-years. Using economic multipliers developed for US regions has shown that the net effect, that is the positive gain by PV-DG less the negative loss by central generation, is positive.<sup>44</sup> More recently, empirical values in the more accelerated markets of Germany and Japan<sup>45</sup> have shown these values far exceed the quasi theoretical<sup>46</sup> results of the multipliers. Developers of customer-owned PV systems may argue against the application of these values to utility-owned systems. However, customer-sited, utility owned systems will have similar benefits, and utility-scale systems will also make somewhat less economic development societal contributions.

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<sup>44</sup> L. Gillette, C. Herig, S. Gouchoe, “Analysis of State Solar Energy Tradeoffs – ASSET (A Databank)”, ASES/ISES, Orlando, FL, August 2005

For modeling tools, see NREL’s Job and Economic Development Impact Models:

<http://www.nrel.gov/analysis/jedi/>

<sup>45</sup> “Trends in Photovoltaic Applications.” International Energy Agency, Photovoltaic Power Systems Programme. Report IEA-PVPS T1-17:2008.

<sup>46</sup> Multipliers are developed using empirical industrial data, and then used to estimate the future economic developments values.

## Conclusion

There must be a common vision between regulators, utilities and the public as to what to expect when moving forward on distributed PV. The purpose of this report is to provide guidance for these groups in understanding what the regulatory part of that vision might look like. It must be stressed that in order for distributed PV to be successful, this regulatory vision will need to provide benefits to all of the stakeholders involved, including a rate of return to the utility, optimum service to the consumer at a low price, and social benefits to the community. Therefore, finding the right regulatory configuration for distributed PV is vital to its future development.

This report has covered the major aspects concerning distributed PV regulation. As covered in section two, we first looked at the basics regarding rate recovery principles. This led to the inquiry on whether utilities might rate base distributed PV assets? Ultimately, our analysis of the regulatory process indicates that there are a number of issues to address, but no major obstacles in the path of utilities when it comes to rate basing distributed PV. In section three the most likely configurations of utility and customer ownership were elaborated. In section four, we discussed what rate basing of distributed PV might look like. Finally, in section five, utility ownership was considered relative to anticipated benefit arguments as well as the challenges that are expected in a case for rate recovery on distributed PV assets.

In an appendix we have also included administrative documents including three different model tariffs, a model filing letter and a model testimony. These documents should not be taken as “final” documents to be used without alteration. They are included as examples to guide utility personnel in an area of regulatory policy that is not widely understood. Of the tariffs, each major ownership configuration is covered, including: customer ownership, joint or shared ownership, and utility ownership.

In the end, there are many different variations of ownership that utilities could pursue in developing and deploying distributed PV systems. We hope that this report has provided some guidance on what sort of relationship would work best in your state or service area. There is no single policy or regulation that can

anticipate all of the issues that may arise in this new and growing area of electricity generation. However, with the right planning and forethought utilities can greatly decrease the risk of future regulatory problems.

# Appendix

## THE MODEL TARIFF

A tariff is essentially the document that controls the rate and method by which utilities charge and provide services to their customers. A model tariff can be a helpful initial document that a utility can use to construct their tariff which matches the specific procedures and needs in their state. With this in mind, we hope that the three tariffs offered are useful in providing a base from which to work from. We have developed three separate model tariffs that describe the services of: (1) the customer ownership model, (2) the joint ownership model, and (3) the utility ownership model.

It is likely that the language presented in one of the tariffs could be inserted into a new or revised model tariff that might touch on a number of other service related issues. In other words, none of these documents are designed to stand alone, but could be presented to a public service board along with other proposed tariff changes

## ADMINISTRATIVE DOCUMENTS

The following documents are essential in preparing and filing a new tariff. Though these documents are not complete, every effort has been taken to use the basic principles or language that will be most useful in a regulatory proceeding. These documents will be helpful as an initial draft from which an individual utility can begin with in filing a new PV tariff in their state.

### 1. Model Filing Letter

A filing letter formally notifies a state public service board or public utility commission of the intent and benefits of the petition that the document accompanies. A filing letter normally enumerates the social benefits and gives a general description of what the utility is intending to alter in its standing tariff. This is normally a less formal document sent by the utility's legal counsel as correspondence.

### 2. Model Petition

A petition addresses the improvements that the utility plans to make and what sources of law allow for the improvements sought. This will vary with each jurisdiction and according to applicable law.

### 3. Model Testimony

Testimony filed with a public service board is an important step in the regulatory approval process. Quality and reliable testimony states the technical, financial and social advantages associated with the improvement sought by the utility. Normally, this sort of testimony is put on record and filed by an engineer or some other technical expert who either directly works for, or is a paid consultant of, the utility.

**(Model Tariff – Customer Ownership)**

State Public Service Board No. XXX  
May 15, XXX

XYZ POWER CORPORATION  
TERMS AND CONDITIONS  
APPLICABLE TO ALL RATES FOR ELECTRIC SERVICE

**CUSTOMER SITED PHOTOVOLTAIC SYSTEM - CUSTOMER  
OWNERSHIP & INTERCONNECTION AGREEMENT**

Applicable to customers who: (1) take service under XYZ Power Corporation (the “Company”), and (2) have received approval from the Company based on their property, building location and design, and the prior installation of photovoltaic arrays and wiring. This tariff shall not supersede any terms and conditions of any other tariff under which the customer takes service from the Company, which other terms and conditions shall continue to apply.

For the purpose of this tariff provision, an eligible property is (1) a parcel of land (2) wholly owned by the Customer that (3) has a potential to interconnect with a nearby power transformer or applicable interconnection point. The interconnection potential is to be solely determined by the Company, which will take into account safety, efficiency and the net benefit to the Customer of interconnection. The Customer has the responsibility to show ownership of the property in question and when asked, to demonstrate that there are no encumbrances on the land that might inhibit the Company’s interconnection of the photovoltaic assets, or inhibit the capacity of such assets to generate electricity.

For the purpose of this tariff provision, an eligible building is (1) an edifice (2) wholly owned by the Customer that (3) has a potential to interconnect with a nearby power transformer or applicable interconnection point. The interconnection potential is to be solely determined by the Company, which will take into account safety, efficiency and the net benefit to the Customer of interconnection. The Customer has the responsibility to show ownership of the building and when asked, to demonstrate that there are no encumbrances on the property that might inhibit the Company's interconnection of the photovoltaic assets, or inhibit the capacity of such assets to generate electricity.

For the purpose of this tariff provision, an encumbrance is any covenant, easement or a separate agreement by the Customer that would inhibit the generation capacity of the photovoltaic assets named in the interconnection agreement. A mortgage, note or other transaction using the property or building in question as security, does not constitute an encumbrance under this tariff.

The Customer shall be compensated by the Company for the amount of kWhs generated by the photovoltaic system that are added to the grid through the Company owned meter. The price paid by the Company under the agreement shall be determined by adding four cents to the average price per kWh for the consumer class to which the Customer belongs in their particular service area. The Company shall pay the Customer in credits to their account or given cash payments.

The Customer shall be required to carry liability insurance in amounts as specified in applicable Rules, Orders or Regulations of the State Public Service Board.

The installed cost of the photovoltaic arrays shall be wholly born by the Customer. The Customer controls and has ownership of the photovoltaic arrays, mounting brackets and all wiring up to the inverter, during the entire term of the agreement.

The installed cost of the photovoltaic interconnection equipment shall be wholly born by the Company. The Company controls and has ownership of the disconnect, meter and inverter directly associated with the photovoltaic system during the entire term of the agreement.

Any Customer seeking to take service in accordance with this tariff shall be required to contact the Company and provide the necessary documentation to establish in good faith, their ownership of photovoltaic assets and ability to comply with a potential interconnection agreement. Agreements will run for a 10 year time period. As part of the agreement, the Customer agrees to ensure the photovoltaic arrays and interconnection equipment is reasonably accessible at all reasonable times, and shall not be removed or otherwise disturbed by the Customer without advance written notice to the Company.

In the event of maintenance of the land or building that requires the disconnection of the photovoltaic arrays, the Customer agrees to notify the utility of the planned maintenance at least fourteen days prior. The Company agrees to make all necessary arrangements to have the system disconnected. The Customer shall notify the Company at least fourteen days in advance when the Company may reconnect the photovoltaic system.

The authority under this tariff of any Customer to seek service will close after the total installed cumulative generating capacity of all photovoltaic systems connected by

the Company equals the pre-set limit of kWhs established by the Company in accordance with the rulings of the State Public Service Board. However: (1) such authority shall re-open should such installed cumulative generating capacity at any time fall below the pre-set limit and (2) the Company may interconnect additional photovoltaic systems under this tariff if found by the Board to be in the public interest.

All Customer-sited photovoltaic systems shall be subject to emergency disconnection of the system. An “emergency” shall be considered to occur when the interconnection of a system represents a condition which is likely to result in imminent significant disruption of service to the Company’s customers or is imminently likely to endanger life or property. If the disconnection exceeds thirty days, the Company shall suspend payments to the Customer under the lease agreement until the time that the photovoltaic system is reconnected to the grid.

A Customer shall be prohibited from disconnecting any photovoltaic system erected on their property or building without prior written approval of the Company, or, in the event of dispute, the State Public Service Board. However, the Company agrees to disconnect and remove any system within fourteen days of notification of a Customer that such disconnection and removal is necessary.

**(Model Tariff – Joint Ownership)**

State Public Service Board No. XXX  
May 15, XXX

XYZ POWER CORPORATION  
TERMS AND CONDITIONS  
APPLICABLE TO ALL RATES FOR ELECTRIC SERVICE

**CUSTOMER SITED PHOTOVOLTAIC SYSTEM - JOINT OWNERSHIP  
& INTERCONNECTION AGREEMENT**

Applicable to customers who: (1) take service under XYZ Power Corporation (the “Company”), and (2) have received approval from the Company based on their property, building location and design, and the prior installation of photovoltaic arrays. This tariff shall not supersede any terms and conditions of any other tariff under which the customer takes service from the Company, which other terms and conditions shall continue to apply.

For the purpose of this tariff provision, an eligible property is (1) a parcel of land (2) wholly owned by the Customer that (3) has a potential to interconnect with a nearby power transformer or applicable interconnection point. The interconnection potential is to be solely determined by the Company, which will take into account safety, efficiency and the net benefit to the Customer of interconnection. The Customer has the responsibility to show ownership of the property in question and when asked, to demonstrate that there are no encumbrances on the land that might inhibit the Company’s interconnection of the photovoltaic arrays, or inhibit the capacity of such arrays to generate electricity.

For the purpose of this tariff provision, an eligible building is (1) an edifice (2) wholly owned by the Customer that (3) has a potential to interconnect with a nearby power transformer or applicable interconnection point. The interconnection potential is to be solely determined by the Company, which will take into account safety, efficiency and the net benefit to the Customer of interconnection. The Customer has the responsibility to show ownership of the building and when asked, to demonstrate that there are no encumbrances on the property that might inhibit the Company's interconnection of the photovoltaic assets, or inhibit the capacity of such assets to generate electricity.

For the purpose of this tariff provision, an encumbrance is any covenant, easement or a separate agreement by the Customer that would inhibit the generation capacity of the photovoltaic arrays named in the interconnection agreement. A mortgage, note or other transaction using the property or building in question as security, does not constitute an encumbrance under this tariff.

The Customer shall be compensated by the Company for the amount of kWhs generated by the photovoltaic system that are added to the grid through the Company owned meter. The price paid by the Company under the agreement shall be determined by adding two cents to the average price per kWh for the consumer class to which the Customer belongs in their particular service area. The Company shall pay the Customer in credits to their account or given cash payments.

The Customer shall be required to carry liability insurance in amounts as specified in applicable Rules, Orders or Regulations of the State Public Service Board.

The installed cost of the photovoltaic arrays shall be wholly born by the Customer. The Customer controls and has ownership of the photovoltaic arrays and mounting brackets during the entire term of the agreement.

The installed cost of the photovoltaic interconnection equipment shall be wholly born by the Company. The Company controls and has ownership of the disconnect, meter, inverter and all wiring directly associated with the photovoltaic system during the entire term of the agreement.

Any Customer seeking to take service in accordance with this tariff shall be required to contact the Company and provide the necessary documentation to establish in good faith, their ownership of photovoltaic arrays and ability to comply with a potential interconnection agreement. Agreements will run for a 10 year time period. As part of the agreement, the Customer agrees to ensure the photovoltaic arrays and interconnection equipment is reasonably accessible at all reasonable times, and shall not be removed or otherwise disturbed by the Customer without advance written notice to the Company.

In the event of maintenance of the land or building that requires the disconnection of the photovoltaic arrays, the Customer agrees to notify the utility of the planned maintenance at least fourteen days prior. The Company agrees to make all necessary arrangements to have the system disconnected. The Customer shall notify the Company at least fourteen days in advance when the Company may reconnect the photovoltaic system.

The authority under this tariff of any Customer to seek service will close after the total installed cumulative generating capacity of all photovoltaic systems connected by the Company equals the pre-set limit of kWhs established by the Company in accordance

with the rulings of the State Public Service Board. However: (1) such authority shall re-open should such installed cumulative generating capacity at any time fall below the pre-set limit and (2) the Company may interconnect additional photovoltaic systems under this tariff if found by the Board to be in the public interest.

All Customer-sited photovoltaic arrays shall be subject to emergency disconnection of the system. An “emergency” shall be considered to occur when the interconnection of a system represents a condition which is likely to result in imminent significant disruption of service to the Company’s customers or is imminently likely to endanger life or property. If the disconnection exceeds thirty days, the Company shall suspend payments to the Customer under the lease agreement until the time that the photovoltaic system is reconnected to the grid.

A Customer shall be prohibited from disconnecting any photovoltaic system or individual arrays erected on their property or building without prior written approval of the Company, or, in the event of dispute, the State Public Service Board. However, the Company agrees to disconnect and remove any system within fourteen days of notification of a Customer that such disconnection and removal is necessary.

**(Model Tariff – Utility Ownership)**

State Public Service Board No. XXX  
May 15, XXX

XYZ POWER CORPORATION  
TERMS AND CONDITIONS  
APPLICABLE TO ALL RATES FOR ELECTRIC SERVICE

**CUSTOMER SITED PHOTOVOLTAIC SYSTEM - UTILITY  
OWNERSHIP & LEASE AGREEMENT**

Applicable to customers who: (1) take service under XYZ Power Corporation (the “Company”), and (2) have received approval from the Company based on their property or building location and design. This tariff shall not supersede any terms and conditions of any other tariff under which the customer takes service from the Company, which other terms and conditions shall continue to apply.

For the purpose of this tariff provision, an eligible property is (1) a parcel of land (2) wholly owned by the Customer (3) with no encumbrances (4) that receives direct sunlight for more than eight hours a day on average per day per annum and (5) has a potential to interconnect with a nearby power transformer or applicable interconnection point. The interconnection potential is to be solely determined by the Company, which will take into account safety, efficiency and the net benefit to the Customer of interconnection. The Customer has the responsibility to show ownership of the property and when asked, to demonstrate that there are no encumbrances on the land that might inhibit the Company’s installation of a photovoltaic system, or the capacity of such a system to generate electricity.

For the purpose of this tariff provision, an eligible building is (1) an edifice (2) wholly owned by the Customer (3) with no encumbrances (4) with a roof or crown that (5) receives direct sunlight for more than eight hours a day on average per day per annum and (6) has a potential to interconnect with a nearby power transformer or applicable interconnection point. The interconnection potential is to be solely determined by the Company, which will take into account safety, efficiency and the net benefit to the Customer of interconnection. The Customer has the responsibility to show ownership of the building and when asked, to demonstrate that there are no encumbrances on the building that might inhibit the Company's installation of a photovoltaic system, or the capacity of such a system to generate electricity.

For the purpose of this tariff provision, an encumbrance is any covenant, easement or a separate agreement by the Customer that would inhibit the generation capacity of a Company installed photovoltaic system. A mortgage, note or other transaction using the property or building in question as security, does not constitute an encumbrance under this tariff.

The Customer shall be compensated by the Company for the leasing of the property or building to install the photovoltaic system. The lease price shall be based on the number of square feet of photovoltaic paneling arrayed on the premises combined. The Company shall pay the Customer in credits to their account or given cash payments.

The Customer shall be required to carry liability insurance in amounts as specified in applicable Rules, Orders or Regulations of the State Public Service Board.

The installed cost of the photovoltaic system shall be wholly born by the Company. The Company will remain in control and ownership of the entire system,

including photovoltaic arrays, mounting brackets, inverter, meter, and all wiring, during the entire leasehold period.

Any Customer seeking to take service in accordance with this tariff shall be required to contact the Company and provide the necessary documentation to establish in good faith, their ownership and ability to comply with a potential lease agreement. Leases will run for a twenty year time period. As part of the agreement, the Customer agrees to ensure the photovoltaic system is reasonably accessible at all reasonable times, and shall not be removed or otherwise disturbed by the Customer without advance written notice and permission from the Company.

In the event of maintenance of the land or building that requires removal of the photovoltaic arrays, brackets or system, the Customer agrees to notify the Company of the planned maintenance at least fourteen days prior. The Company agrees to make all necessary arrangements to have the system disconnected and removed from the property or building. The Customer shall notify the Company at least fourteen days in advance when the Company may reconnect and replace the photovoltaic system. The Customer shall not be paid for the time that the system is taken off-line due to maintenance of the land or building.

At the expiration of the lease agreement, the photovoltaic system and all supporting assets will be removed by the Company at the Company's expense.

The authority under this tariff of any Customer to seek service will close after the total installed cumulative generating capacity of all photovoltaic systems connected by the Company equals the pre-set limit of kWhs established by the Company in accordance with the rulings of the State Public Service Board. However: (1) such authority shall re-

open should such installed cumulative generating capacity at any time fall below the pre-set limit and (2) the Company may install and interconnect additional photovoltaic systems under this tariff if found by the Board to be in the public interest.

All Customer-sited photovoltaic systems owned by the Company shall be subject to emergency disconnection of the system. An “emergency” shall be considered to occur when the interconnection of a system represents a condition which is likely to result in imminent significant disruption of service to the Company’s customers or is imminently likely to endanger life or property. If the disconnection exceeds thirty days, the Company shall suspend payments to the Customer under the lease agreement until the time that the photovoltaic system is reconnected to the grid.

A Customer shall be prohibited from disconnecting any photovoltaic system erected on their property or building without prior written approval of the Company, or, in the event of dispute, the State Public Service Board. However, the Company agrees to disconnect and remove any system within fourteen days of notification of a Customer that such disconnection and removal is necessary.

**(Filing Letter)**

**Corporate Attorneys at Law**

Mr. John Smith, Clerk  
STATE PUBLIC SERVICE BOARD  
111 State Street  
Capital City, ST 05050

Re: Solar Array Tariff Filing of XYZ Power Corporation

Dear Mr. Smith:

With this letter, XYZ Power Corporation (the “Company”) files revised terms and conditions, designed to offer contracts to customers with eligible property or buildings to install photovoltaic systems on said property or buildings through a lease agreement. The filing consists of the terms and conditions, a petition, and pre-filed testimony.

The filing reflects a new service offered to the Company’s customers and therefore does not require any modification of the Company’s General Regulation Plan (the “Plan”). In the event the Board or the Department of Public Service believes otherwise, the Company will file a proposed Plan revision.

The Company requests that the Board approve the revised terms and conditions without suspension or investigation, to be effective July 1, XXXX.

If you have any questions, please feel free to call.

Very Truly Yours,

James Doe, Esq.  
Attorney  
Corporate Attorneys at Law

Enclosures  
cc: State Department of Public Service

**(Petition)**

**State Public Service Board**

Solar Filing of )  
XYZ Power )

Docket No.:\_\_

XYZ Power Corporation  
Petition For New Service

Now comes XYZ Power Corporation (the “Company”) and states as follows:

1. XYZ Power is a state corporation operating as an electric utility in this state, and is subject to the regulatory and rate-setting authority of the State Public Service Board (“Board”).
2. The company desires to offer a new service to customers with eligible property to install photovoltaic systems on said property.
3. Under the new service, a Customer owning eligible property or buildings, who agrees to allow the Company to set up a solar array, mount an array bracket on the Customer’s property or building as well as other necessary assets incident to the installment of a photovoltaic system, and an additional Company-supplied meter to measure the photovoltaic electrical output, would be entitled to receive lease payments from the Company for the use of the property or building. The Company would pay the Customer at a rate commensurate with the amount of square feet of photovoltaic paneling array installed on the property or building.
4. The new service will provide an incentive for Customers to allow Company XYZ to install photovoltaic arrays on their property or buildings that produce the most energy during times of the Company’s peak load. For these reasons, the rates contained in the proposed tariffs are just and reasonable.
5. The new service incorporates an effective date of July 1, XXXX.
6. In accordance with Public Service Board Rules, the Company has included the following documents:
  - a. Official and annotated versions of the proposed tariffs;
  - b. Prefiled Testimony

WHEREFORE, XYZ Corporation respectfully requests that the Board approve this petition and the new service offer as set forth in the accompanying proposed tariff without suspension or hearing.

DATED this 15<sup>th</sup> of May, XXXX

\_\_\_\_\_  
XYZ Corporation Representative

**(Testimony)**

**State Public Service Board**

Solar Array Tariff Filing of XYZ Power Corporation)

Docket No.

**Direct Testimony of  
John Q. Expert  
ON BEHALF OF  
XYZ POWER CORPORATION**

**SUMMARY:** Mr. Expert's testimony describes the development of the proposed solar array tariff filing and concomitant changes to XYZ Power Corporation's terms and conditions.

May 15, XXXX

1 DIRECT TESTIMONY  
2 OF  
3 JOHN Q. EXPERT  
4 ON BEHALF OF  
5 XYZ POWER CORPORATION  
6

7 1. Q. What is your name and business affiliation?  
8

9 A. My name is John Q. Expert and I am an Economic and Regulatory  
10 Analyst for XYZ Power Corporation, (the "Company") 200 Main  
11 Street, in Main City, State.  
12

13 2. Q. Describe your educational background and business experience.  
14

15 A. I graduated from the University of State with a Bachelor of  
16 Science Degree in Mathematics and Statistics in 1974. I have been  
17 employed with XYZ Power Corporation since June of 1974. I  
18 have held numerous analytical and managerial positions with the  
19 Company in Customer Service, Marketing, Finance, and Energy  
20 Resource Planning.  
21

22 3. Q. Have you testified before the State Public Service Board (the  
23 "Board") previously?  
24

25 A. Yes, I have testified before the Board in Dockets No. XXXX, YYYY  
26 and VVVV.  
27

28 4. Q. What is the purpose of your testimony?  
29

30 A. My testimony describes the development of the solar array benefits  
31 that the Company would like to offer its customers.  
32

33 5. Q. What are the terms of the Company's proposed solar array tariff?  
34

35 A. XYZ Power proposes to offer any customer with eligible  
36 property or buildings the opportunity to enter into a contract with the  
37 Company. Under the proposed tariff, a Customer owning a  
38 residence, business or any other building that meets the requisite  
39 specifications and who agrees to allow the Company to set up all of  
40 the necessary equipment, including arrays, brackets, inverter, meter  
41 and wiring, would be entitled to enter into a contract with the  
42 company providing for the leasing of the property or building for the  
43 placement of a photovoltaic system. The Company would pay the  
44 Customer an annual rate for the leasing of the property or building  
45 roof that would be commensurate with the photovoltaic electrical  
46 generating capacity of the space leased. The credits earned from the  
47 leasing agreement can either be used to pay the Customer's electric

1 bill or be paid directly to the Customer as a cash payment.  
2  
3 6. Q. Why was it decided to lease property instead of allowing the  
4 Customer to own the array itself through net-metering.  
5  
6 A. The decision to have full Company ownership stems from the various  
7 value added benefits that such an arrangement brings. Ultimately,  
8 the goal of the new tariff is to increase the use of solar power as  
9 quickly as possible in our service area. After considering the  
10 alternatives available, such as full Customer ownership through net-  
11 metering or joint ownership, we decided that photovoltaic generation  
12 would be deployed faster if the utility were the direct and full owner  
13 of the assets.  
14  
15 7. Q. What were some of the considerations?  
16  
17 A. There were many important factors including ease of interconnection,  
18 faster deployment of photovoltaic systems, reduction in delivery costs  
19 and safety concerns for employees conducting line work.  
20  
21 Q. What are the Company's estimates of revenues and costs attributable  
22 to such service?  
23  
24 A. In accordance with Board Rules, the Company's estimates of  
25 revenues and costs attributable to this new service are attached hereto  
26 as Exhibit 1. As shown on Exhibit 1, Company expects the effects of  
27 this new service to be revenue neutral. This is because payments  
28 made to solar array contracting Customers will reduce the Company's  
29 power supply costs by an equivalent amount. The bottom portion of  
30 Exhibit 1 shows the expected revenue neutrality of the new service.  
31  
32 8. Q. Why has the Company decided to offer this new service?  
33  
34 A. XYZ Power is steadfast in its belief that renewable energy sources  
35 like solar must play an increasing part in State's energy future. All  
36 renewable energy offsets the need for polluting energy sources on the  
37 State's electric system. However, solar "shaves" peak demand during  
38 hot summer days by relying on the sun rather than fossil fuel  
39 generation. This is what makes solar such an attractive renewable. In  
40 addition, the new tariff will accelerate the market for solar energy by  
41 offering an attractive incentive to Customers to allow the utility to  
42 install photovoltaic systems in the community. Therefore, the new  
43 tariff is economical for the Company, the Customer and the  
44 community because it provides benefits to the grid, the environment  
45 and with no increase in costs to the Customer or the Company.  
46  
47 9. Q. Is this new service in the public interest?

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- A. Yes. It is our hope that the tariff change will encourage XYZ Power Customers who have been considering construction of a photovoltaic system to do so with the utility bearing the costs of construction, interconnection and the risks associated with performance. Photovoltaic generation peaks during hot, sunny days, which coincides with the Company's summer peak demand.
10. Q. Will this investment be used for the benefit of the customers of the Company?
- A. Yes. Customers benefit under the proposed tariff because of the manner in which the tariff adds value to the grid. Distributed photovoltaic generation increases reliability, reduces environmental pollution, improves system optimization and reduces in carbon emissions.
11. Q. Has the Company acted prudently in deciding to make this investment?
- A. Yes. The Company has considered the alternatives to investing in photovoltaic generation such as new coal or gas, and has considered whether it would be better to buy needed electricity from the wholesale market. None of these alternatives offers the same long term benefits to the community, the environment and to the Customer, who has the opportunity to reduce their annual electric bill by earning credits through the lease agreement. Investment decisions can only be made with an eye toward possible alternatives that may have lower potential risk of failure to produce electricity at the estimated cost. The Company believes that investment in distributed photovoltaic generation exposes the Customer and the Company to a low level of potential risk compared to other generation alternatives.
12. Q. Can the Company be expected to act prudently in the management of this investment?
- A. Yes. The proposed tariff covers the necessary issues that the Company will encounter when leasing, installing and maintaining each photovoltaic system. One of the benefits of distributed photovoltaic generation is that once the investment has been made there are no fuel costs, few maintenance costs and with utility ownership it is relatively easy to interconnect with the grid.
13. Q. Given your answers to the preceding questions, does this investment meet the Board's traditional criteria for revenue-recovery?

1 A. Yes. Under the traditional notions of revenue recovery, including  
2 the “used and useful” and “prudence” standards, the Company  
3 should be able to garner a return on the assets that make up each  
4 individual system. As long as the Company manages the  
5 distributed photovoltaic system according to the tariff, which we  
6 believe to meet notions of prudence, and maximizes the use of the  
7 assets through constant deployment and maintenance, the  
8 Company will have satisfied the Board’s traditional criteria for rate  
9 recovery.

10  
11 14. Q. Is this investment consistent with, or required by, statutory or  
12 regulatory mandates requiring the Company to acquire a  
13 significant portion of its resources from renewable or  
14 distributed generation?

15  
16 A. Our state’s renewable portfolio requirement compels the Company  
17 to make at two percent of our generation mix based on  
18 photovoltaic by 2018. Currently, we have less than a tenth of the  
19 solar generation we need to meet this obligation. Our estimates  
20 indicate that this new tariff will bring the Company into  
21 compliance with state law before the 2018 deadline by increasing  
22 our solar generating capacity ten fold.

23  
24 15. Q. Does this conclude your testimony?

25  
26 A. Yes, it does.

# SEPA Research Report Summaries

## **Residential Photovoltaic Metering & Interconnection Study (2008)**

Utilizing data from a survey of 63 U.S. utilities, this report establishes a baseline of utility practices related to residential grid-connected solar photovoltaic metering and interconnection practices.

## **PV Capacity Methods (2008)**

This report catalogues the statistical methods used to measure the relationship between peak electricity and solar PV output; compares all the methods in three case studies for three electric utilities; and documents the results from a 2007 workshop on the topic with utilities, industry and other stakeholders.

## **Utility Solar Business Models (2008)**

While renewable market requirements are driving current solar investment, business opportunities are emerging for utilities to become involved in the solar value chain. This report highlights utility solar business models that provide value-added solutions for utilities, customers, and the solar industry.

## **Solar Fact Finding Mission to Germany: Report for Utility Decision Makers (2008)**

Thirty-five US utility decision makers traveled with SEPA to

Germany in June 2008 to examine how they can emulate the success of German utilities in integrating large quantities of solar electricity into a national utility grid without creating transmission bottlenecks, system quality distortions, or scheduling issues. This report summarizes the findings for other US utilities.

## **Top Ten Utility Solar Integration Rankings (2008)**

In early 2008, SEPA conducted a nationwide survey of utilities to find out how much solar electricity was integrated into their service territories through the end of 2007. The resulting report, which will be repeated annually, crowns the most solar integrated utilities in the United States and discusses the number of announced solar projects to date.

## **Electric Utilities and Solar: A Market Review (2008)**

This utility solar market report, which includes the solar integration rankings, discusses future solar market development issues that have arisen in 2007 and 2008, and their implications for utility involvement in solar.

## **Utility Solar Procurement (2009)**

This report identified best practices for traditional utility solar procurement (RFPs/PPAs) and innovative new acquisition

methods that may present cost or efficiency solutions for both utilities and the solar industry.

## **Utility Solar Tax Manual (2009)**

In 2008, Congress extended the federal solar investment tax credit for eight years and removed the utility exemption, allowing regulated investor-owned utilities to utilize the credit. This manual provides detailed explanations of the tax provisions related to the bill, as well as exploring other tax issues such as Clean Renewable Energy Bonds, and unique business tax structures and issues.

## **Decoupling Utility Profits from Sales: Issues for the Photovoltaic Industry (2009)**

The reduced sale of electricity creates an inherent problem for electric utilities in maintaining long-term operating revenue, especially as the solar industry expands. Decoupling is a regulatory policy option that can change the way utilities recover revenues to adjust this disincentive. This decoupling white paper introduces the concept into the solar community, explaining what decoupling is, and defining the different types. It includes a case study showing how solar market development in the future might affect utility rates under decoupling.