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STRATEGIC CONSULTING | Energy

Distributed Solar PV: Challenge and Opportunity

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White Paper

Distributed Solar Photovoltaics: A Challenge and an Opportunity

CRITICAL CONSIDERATIONS IN ADDRESSING THE CHALLENGES AND OPPORTUNITIES OF DISTRIBUTED SOLAR PHOTOVOLTAICS

Distributed solar photovoltaics (PV) and associated net metering policies are fast becoming a business challenge for many regulated electric utilities. However, distributed solar PV is also an opportunity. Unfortunately, utilities have limited understanding both of what those opportunities are and also how to best capture the opportunity.

Distributed solar PV is a disruptive technological challenge to the existing regulated electric industry. The timing, or even the possible occurrence, of a widespread shift of electricity production to distributed solar PV had been an open question for quite a while. However, it has decidedly shifted from an "if" question to a "when" question. A confluence of positive trends for solar PV installations is accelerating and magnifying this challenge. The solar PV industry is developing at such a rapid pace that forecasts and data from even six months ago may be inaccurate today. Quite possibly, the regulated electric industry will have to rethink its entire business model.

While Houlihan Lokey expects to see utility scale solar achieve grid parity, becoming a viable least-cost option for utilities, distributed solar PV already poses significant near-term challenges to many utilities. As the price of solar falls, customers become economically indifferent to purchasing power from utilities or solar PV system providers. This point of indifference is commonly referred to as retail rate parity. The retail rate parity point is approaching faster than many utilities realize, resulting in diminished time to prepare.

To successfully transition to a world with widespread retail rate parity, utilities will have to proactively manage the regulatory and legislative process to ensure that fair ratemaking exists for both solar and non-solar customers. Many existing regulatory and pricing systems do not correctly price the services that utilities provide to solar customers. Moreover, as past regulatory decisions show, no sustainable long-term solutions have been identified to halt the coming "rate spiral."

While these challenges are rapidly becoming top-of-mind issue for utility management everywhere, various studies show significant variations among executives with respect to the timing and magnitude of challenge. Significant disagreement exists over when retail rate parity and the erosion of electricity sales from distributed solar PV will occur. However, retail rate parity is already a reality in a wide range of states and will become a reality in many more in the very near future. The time for action is now.

Due to these rapid changes, the foundation for any successful solar PV strategy will require an alignment across the entire organization built on a fact-based view of **distributed solar PV—as both a challenge and an opportunity they will likely face in the near term.**

This paper intends to initiate that dialog by answering the following questions:

- **Why should I care about solar and retail rate parity today?**
- **Does widespread adoption of distributed solar PV threaten utility financial performance?**
- **How can I address the legislative and regulatory challenges to ensure fair rules and rates for all customers?**
- **What are the opportunities to enter this market and how should they be pursued?**

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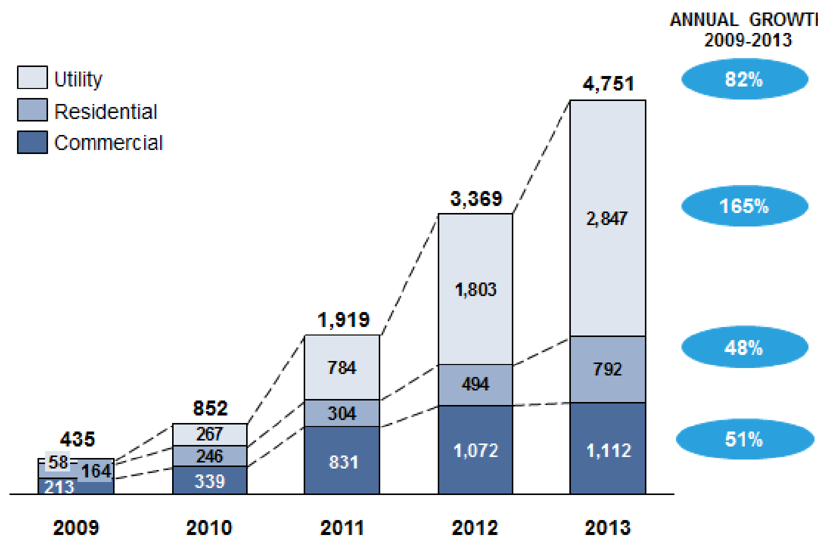
WHY SHOULD I CARE ABOUT SOLAR AND RETAIL RATE PARITY TODAY?

Many executives are well aware of the basic facts of solar—primarily that installations are growing quickly. The United States solar photovoltaics (PV) annual installation volume is rapidly expanding with 70% annual growth since 2009. Of that total, residential system installations have grown at 48% compound annual growth rate. This growth is anticipated to continue as 2013 residential installations surged 60% from 2012 residential installations.

Exhibit 1 – U.S. SYSTEM INSTALLATION (MWp)



Source: SEIA

The residential system installation growth is increasingly driven by economics as more states and jurisdictions achieve retail rate parity—the point at which customers are economically indifferent to purchasing power from utility or using solar PV electricity. Retail rate parity is approaching faster than most think, due to a combination of:

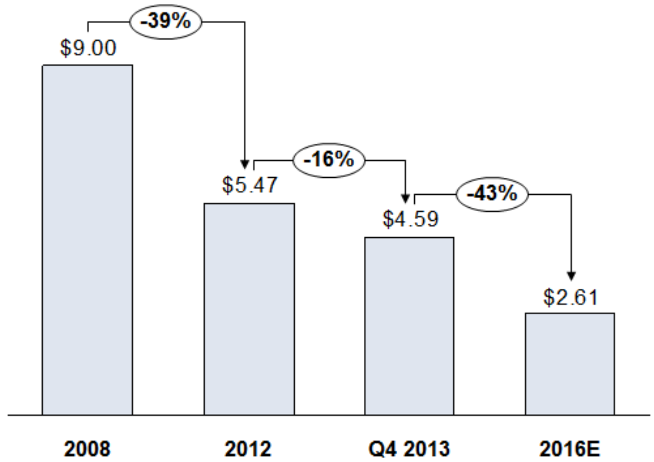
1. System installation cost (including equipment and labor) declines,
2. Innovative third-party business models, and

Declining cost trends are expected to continue

The cost of solar PV has fallen drastically in the last few years. According to the Solar Electric Industry Association (SEIA), prices dropped approximately 12% in the second quarter of 2013 relative to the same period in 2012.[1] System price declines have been driven by reduced module prices and inverter costs, increased module efficiencies, and improved structural components for both fabrication and design. Furthermore, these trends are expected to continue resulting in even lower installation prices. Exhibit 2 shows the prices for 2008, 2012, Q4 2013, and our projections for 2016 for residential scale system installations.

[1] SEIA U.S. Solar Market Insight Q2 2013 Executive Summary

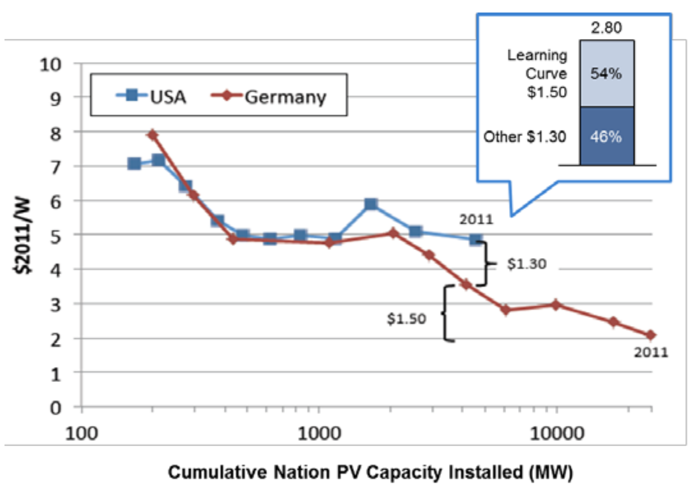
Exhibit 2 – HISTORICAL AND PROJECTED RESIDENTIAL INSTALLATION UNSUBSIDIZED COST DECLINES ($/Wp)



Source: SEIA, Bridge Strategy Group Analysis

One reference point for pricing is to compare U.S. installation prices to prices in more established solar markets. For example, in 2012, the prices for installation of residential scale distributed solar PV in Germany can be half those in the U.S. While the U.S. has some structural differences (e.g., permitting, customer acquisition) resulting in higher prices, a substantial portion of the price difference can be attributed to cumulative experience. The graph in Exhibit 3 suggests that 54% of the difference in 2011 installation costs, excluding modules between Germany and the U.S., is due to learning curve effects.

Exhibit 3 – USA VS. GERMANY PV CAPACITY INSTALLED AND NON-MODULE COSTS



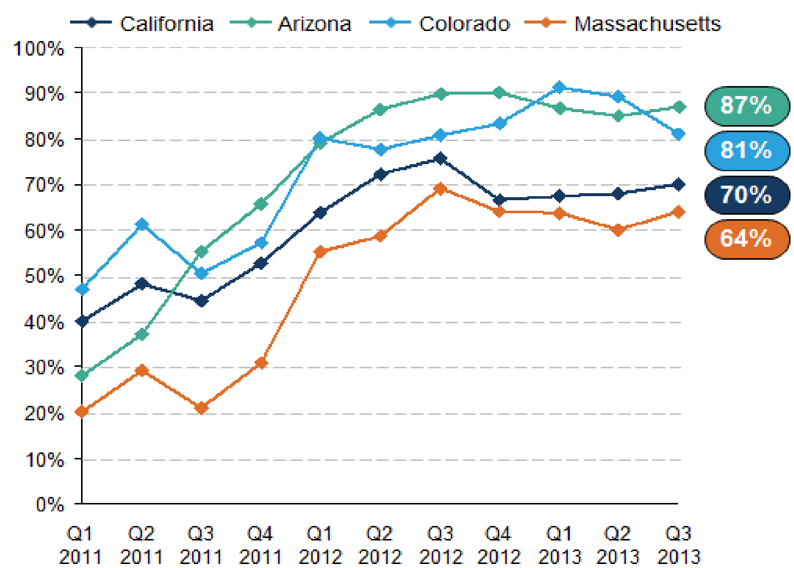
Source: Lawrence Berkeley National Laboratories

If best practices from Germany were to be adopted in the U.S., price drops could be dramatic, resulting in greater penetration and more jurisdictions achieving retail rate parity sooner. Over time, we expect U.S. prices to largely converge to prices in more established markets.

Business models are enabling access to solar with no cash payments

While initial investment costs have been a barrier to mainstream adoption of solar PV, many leading third-party suppliers, such as SolarCity and Sungevity, now provide access to solar PV systems with no upfront cash payment. Customers simply have to sign a lease for a set period of time and pass a credit check. Given that the price of a residential solar PV system can total over $15,000, enabling customers to gain access with no upfront cash outlay substantially expands the market for solar PV. This growth of the lease model has been a key driver of growth, as shown in Exhibit 4.

Exhibit 4 – PERCENTAGE OF INSTALLED RESIDENTIAL SYSTEMS THAT ARE LEASED VS. CASH PURCHASES



Source: SEIA, Bridge Strategy Group Analysis

The success of the lease model is demonstrated by the dramatic increase in the percentage of systems being provided through third parties as opposed to outright purchases by customers.

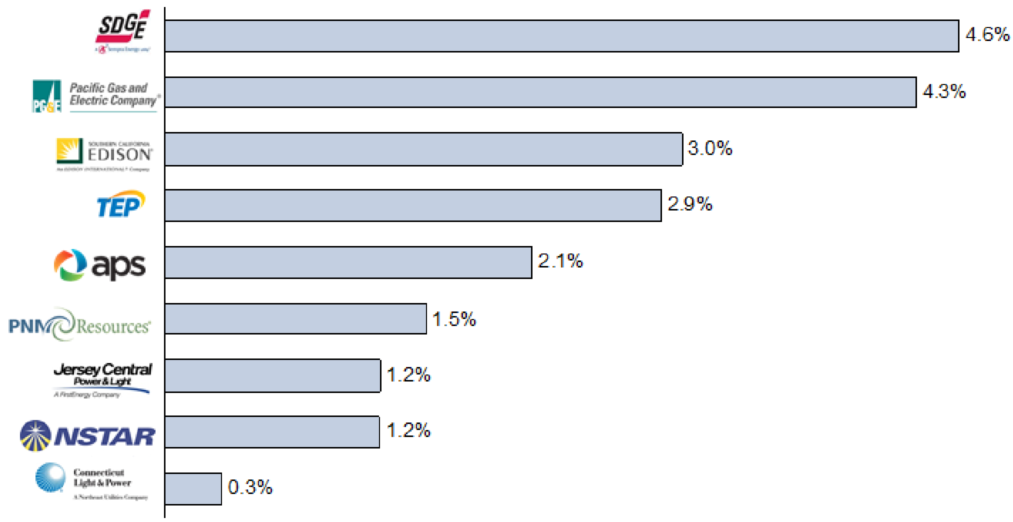
DOES WIDESPREAD ADOPTION OF DISTRIBUTED SOLAR PV THREATEN UTILITY FINANCIAL PERFORMANCE?

Load erosion from distributed solar PV will limit future retail sales growth

These rapid solar PV cost declines coupled together with rising retail electric rates have fueled dramatic increases in adoption by residential and commercial customers. For Investor Owned Utilities (IOUs) and Municipalities in many of the leading solar states, the loss of sales volume is already noticeable. Exhibit 5 shows projected volume of solar production from residential systems as a percentage of the total projected sales volume for 2014. In the absence of solar, this is the percent increase in sales that utilities would gain.

Exhibit 5 – ESTIMATED RESIDENTIAL LOAD EROSION

2014 Residential Solar Production as a Percent of Total Residential Sales Volume (Not exhaustive of top utilities)



Source: NREL PV Watts Version 2, EIA, SEPA, Bridge Strategy Group Analysis, Company websites

Houlihan Lokey projects solar PV installation capacity to continue to grow around 30-50% per year for the next several years. During an industry interview, one utility executive commented that it would most likely go until there are no more rooftops that can take solar PV.

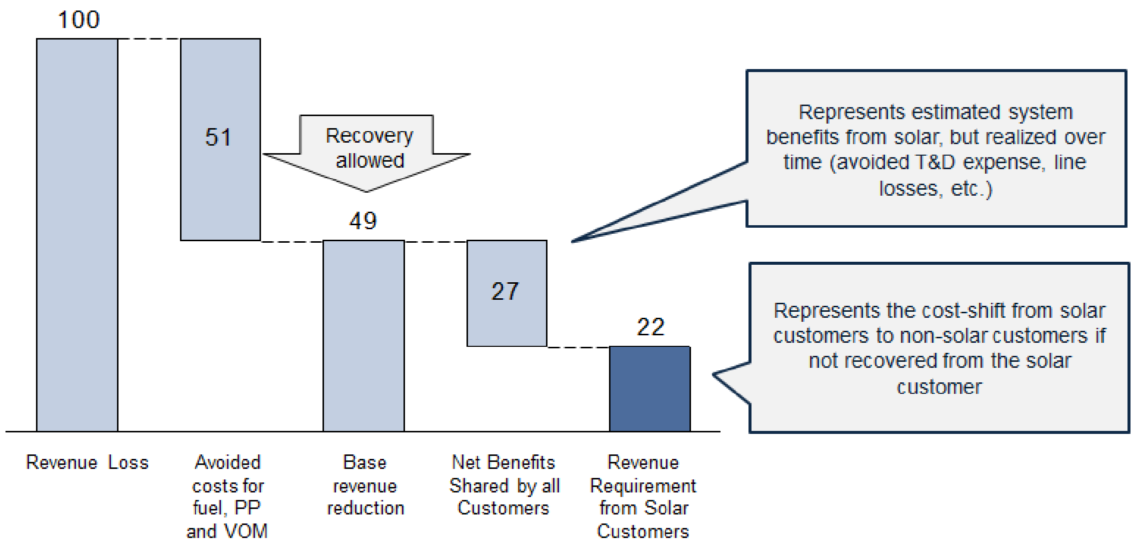
In addition to load loss, solar PV systems challenge utility supply reliability since solar electricity is neither firm nor dispatchable electricity. Therefore, utilities are still required to maintain sufficient infrastructure, including generation, transmission, and distribution systems, for days when the sun is not shining. Most residential bills have a basic monthly facility charge and a volumetric charge which accounts for about 80-90% of the bill and, in a few cases, 100%. Some residential tariffs also have a demand charge, in addition to volumetric charges, that is based on peak monthly kilowatts. Any reduction in kilowatt-hours has a significant impact on the customer's bill and also reduces the amount of revenue collected by the utility. Some reduction in revenue corresponds to an actual cost reduction since the utility would no longer have to purchase fuel or other variable consumables to produce the electricity that customers are now getting from distributed solar PV. This portion of revenue reduction does not impact the utility's rate of return.

So who is paying for this shortfall?

Existing net metering policies often create a contribution shortfall that has to be made up based on the utility's rate base and regulated rate of return. In many cases, this shortfall will be recovered going forward as a result of the next rate case through uniform rate increases. In effect, under the current rules, non-solar customers experience rate increases to cover the shortfall created by solar customers. As noted by Tom Fanning, CEO of

Southern Company: "You, in effect, have a de facto subsidy of rich people putting solar panels on their roof and having lower-income families subsidize…"[2] Exhibit 6 details the revenue shortfall.

Exhibit 6 – FINANCIAL IMPACT OF DISTRIBUTED SOLAR PV SYSTEM



Source: Bridge Strategy Group Analysis

If there is significant load growth, the utility must install additional generating capacity. Distributed PV systems could alleviate some of this requirement. However, this represents a future benefit. In the near term, there is still a revenue shortfall that would be covered by rate increases, impacting both non-solar customers, as well as solar customers, but to a lesser extent.

HOW CAN I ADDRESS LEGISLATIVE AND REGULATORY CHALLENGES TO ENSURE FAIR RULES AND RATES FOR ALL?

Utilities should seek legislative and regulatory solutions in the near term

The most pressing challenge is fixing existing net metering policies that overvalue the electricity produced from distributed solar PV. This results in cross subsidization from non-solar customers to solar customers and financial impacts to regulated utilities. Several billing mechanisms, each with its own pros and cons, have been considered for reallocating the cross subsidization:

- **Demand Charges – a charge linked to demand in terms of peak kW per month,**
- **Standby Charges – a monthly charge linked to solar PV system size as measured by kWp, and**
- **Basic Monthly Charges – a fixed charge applied each month.**

The first step is to determine the financial impact and timing of net metering on the utility. The next step is to determine the true cost of delivering service to net metered customers and quantify the cross subsidization that

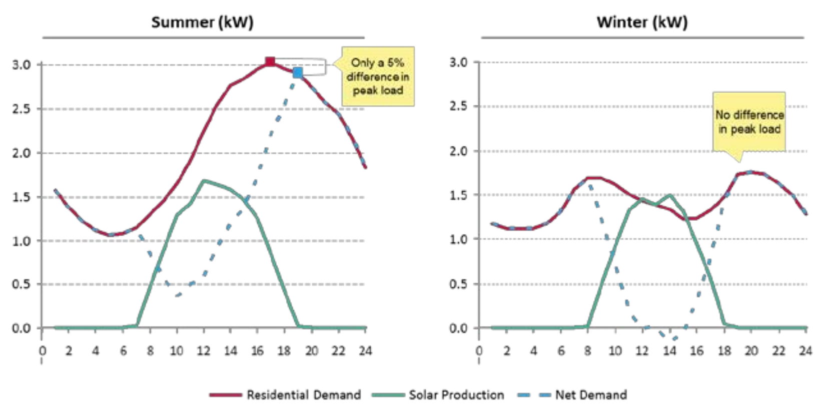
[2] Associated Press Article : http://blog.gulflive.com/mississippi-press-news/2013/05/southern_co_team_weighing_chan.html . Accessed September 21, 2013.

needs to be reallocated. The final and most complicated step is building alliances and relationships across a range of key stakeholders to develop a solution that treats all utility customers fairly and establishes such through legislation or regulation. The best overall result might use a combination of billing mechanisms for solar customers.

Demand charges have been used to develop fair ratemaking already

A demand charge is an attractive option, since average demand is not influenced significantly by solar production due to time of day considerations. Exhibit 7 shows the production profile for solar combined with a sample residential load curve for a summer month and a winter month.

Exhibit 7 – U.S. RESIDENTIAL DEMAND EXAMPLE



Source: Bridge Strategy Group Analysis, NREL PV Watts Version 2 for solar curve, sanitized client demand curve.

Solar PV can provide a benefit on days when the hot summer sun is shining and, thus, driving incremental cooling loads. In this type of situation, electricity demand can often reach its monthly peak, but solar PV systems will also be producing to help reduce that peak demand.

In late 2012, Idaho Power filed for net metering adjustments that would separate charges for volumetric energy from charges for grid access and limit cash payments to net metering customers with solar installations. This represents a shift in thinking and an attempt to more accurately align the billing mechanism with the true costs of delivering electric service. Of course, the filing brought significant outcry from the solar industry. In June 2013, the Idaho Public Utilities Commission denied nearly all of Idaho Power's requests and even eliminated the aggregate capacity limit on net metering installations.[3]

Standby charges are based upon solar PV system size

The standby charge is typically an incremental fee directly proportional to the size of the solar PV system. This charge has the benefit of being easy to compute and simple to explain. Furthermore, unlike a demand charge, it does not require additional equipment in the form of a demand meter.

[3] Idaho Power website, SNL, Boise Weekly 2013, Idaho Public Utilities Commission

In 2011, Dominion Virginia Power was successful in implementing monthly distribution and transmission standby charges of $2.79/kW and $1.40/kW, respectively. However, the charges were only applicable to residential customers with systems larger than 10 kW, which excludes a portion of the residential market. While the concept of a standby charge is reasonable, this implementation does not fully alleviate the challenge posed by net metering.[4]

More recent attempts at establishing standby charges have had mixed results. APS was successfully able to establish a $0.70 per kW per month standby charge. However, this was significantly lower than the requested amount. Other recent attempts in other states, including Utah, have not been successful.

Basic monthly charges are the simplest way to recover incremental costs

In most regulatory filings, utilities request an increase in the basic monthly charge, sometimes referred to as a facilities fee. Most utilities levy this charge to account for basic costs of serving a customer, including billing, payment processing, and in some cases the connection line. These fees vary by utility and jurisdiction and can range from zero (e.g., Pacific Gas & Electric and some other California utilities) up to $22 per month, as seen in the Santee Cooper net billing tariff.

However, these efforts set some of the groundwork for more recent legislation to reform the ratemaking process in California. AB 327, which is expected to be signed into law by Governor Brown, represents a correct step conceptually for net metering as well as other issues to address the differences among the pricing tiers. We would anticipate future issues due to the low cap for fixed charges, which include basic monthly fees, as well as demand charges. However, it does provide a framework to alter the existing net metering approach over a defined time period. Significant aspects yet to be decided by the California Public Utility Commission prevent a final determination of the true impact.

In 2011, San Diego Gas & Electric (SDG&E) filed a proposal to add a network use charge (NUC) that would be applied to both incoming and outgoing power from distributed generation customers. SDG&E also proposed changing the minimum bill portion at $0.17 per day to a basic monthly service fee of $3.00 per month. The NUC was met with opposition and was ruled to be an unfair charge that caused different rate structures for customers within the same consumption tier.[5]

WHAT ARE THE OPPORTUNITIES TO ENTER THIS MARKET AND HOW SHOULD THEY BE PURSUED?

Distributed solar PV should be viewed not only as a challenge to be managed and mitigated, but also an opportunity. Electricity generated from solar PV has a cost structure that is almost completely based on capital cost. These features would make solar PV a valuable addition to a utility's rate base. If utility customers are interested in having distributed solar PV, then utilities are also logical providers of this offering. From a system

[4] DSIRE Solar Portal, Dominion, EEA Inc.
[5] SDG&E website, SNL, Center for Sustainable Energy California

perspective, utilities will have to upgrade the distribution infrastructure to accommodate increasing numbers of distributed solar PV systems. Regulated utilities can participate in this space in several ways:

1. **Rooftop Solar – lease rooftop space to develop distributed solar PV for the distribution grid**
2. **Community solar – leverage existing grid knowledge to find optimal locations for installing solar PV systems and provide subscriptions to interested customers,**
3. **Distribution infrastructure – additional equipment required to ensure reliable power, and**
4. **Other technologies, such as storage.**

Assessing the market opportunity and identifying customer needs are the first steps to participating in this market space. The second key aspect is product development, which includes customer segmentation and analysis. The final aspect is to move forward to implementation, which requires developing sales channels, business delivery model, and ensuring customer service.

Rooftop solar could be attractive to utilities

Rooftop solar could be attractive to utilities as either a service provided to customers or eventually a rate-based generation asset. While existing net metering policies typically overvalue the solar electricity production by ascribing full retail rates, there is value in their proximity to load. Utilities also have an advantage in offering rooftop solar, given their financial strength and long history. Most third-party solar systems require 20-year agreements. Furthermore, the systems can be productive for even longer than 20 years. While many utilities measure their histories far longer than 20 years, very few pure solar companies are more than 20 years old.

Utilities are advantaged in providing the best community solar solutions

Community solar represents an attractive solution since it leverages economies of scale to provide more cost-effective solar. Furthermore, a utility could locate the optimal place for maximizing solar production and minimizing grid congestion with this generation source. With experience in larger-scale procurement, utilities should be able to leverage superior negotiating strength to acquire these systems and provide significant competence to maintain them. Furthermore, utilities already possess the necessary infrastructure for customer service, billing, and other support.

Distribution infrastructure will most likely require upgrades

Additional distributed solar PV will require improvements to the existing grid that utilities will make. These capital expenditures will not be optional and will contribute to the rate base. Many utilities are already testing scenarios to determine the required improvements for portions of the distribution grid with high concentrations of distributed solar PV.

Managing the challenges of widespread distributed solar PV is just the beginning of dealing with a larger challenge of rapid technological disruption in a regulated industry.

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