Solar PV Development in the U.S.: Growth, Hurdles and Opportunities

By Jeffrey Domanski

The solar PV industry provides great opportunity for creating jobs, saving energy and putting money back into local economies. However, it faces many hurdles to growth, including limited understanding of its economic and environmental benefits, project costs and the absence of best practice standards. This article discusses these impediments and progress to address them.

Solar PV basics

2015 was a banner year for solar photovoltaic, or PV, deployment in the U.S. Installed capacity increased five-fold from 2010, to over 7 gigawatts, or GW.[1] Ten times that capacity (70 GW) is expected to be added by 2020, by which time the solar industry will contribute approximately $30 billion to the U.S. economy annually.[2]

Currently, nearly all solar projects are linked to the electricity grid, and are thereby dependent on the operation of the grid system. When a grid power outage occurs, systems within the outage area do not function. Interest in "off-grid" systems that could operate independently of a regional power grid through the use of a battery storage system is strong. The introduction in 2015 of the Tesla "Powerwall" home battery module is a clear indication of the direction of efforts; indeed, there has been significant investment in battery technology research and development.

An average residential or small commercial system is about 8-10 kilowatts, or kW, and comprised of approximately 30 connected solar PV panels. Not long ago, a 30 kW solar PV system was considered large.[3] In recent years, it is common for municipal and commercial projects to be measured in megawatts rather than kilowatts, including projects on closed municipal landfills.

Solar cost trends

The national average price of a solar PV project dropped from $12 per watt in 1998 to less than $4 per watt by 2013, which includes a 50 percent cost reduction since 2010.[4] These reductions were driven in large part by drops in the cost of panels and other hardware.[5] The U.S. Department of Energy's SunShot Initiative, launched in 2011, seeks to make solar PV cost-competitive with other forms of electricity by 2020 by focusing on research, manufacturing and market solutions. The SunShot Initiative also seeks to support non-equipment, or "soft," cost reductions, including access to capital, supply-chain costs and grid connection, which now account for up to 64 percent of the cost of a residential solar installation.[6] A primary goal of this program is to help solar energy grow from less than 2 percent of the U.S. electricity supply to roughly 14 percent by 2030 and 27 percent by 2050.[7]

Investment Tax Credit extension

Federal and state incentives have been instrumental in supporting the growth of solar. A significant boon to the industry occurred in December 2015, when Congress passed a 4-year extension of the federal Investment Tax Credit, or ITC, for solar PV installations as part of an omnibus appropriations bill. The ITC covers up to 30 percent of system cost through a tax credit to the system owner. The ITC will remain at 30 percent for solar energy installations through 2019, and then drop in the subsequent two years, but will remain at 10 percent for commercial projects beginning in 2022. According to IBTS Solar Programs Manager Rudy Saporite, "This is a critically important policy development, as it provides the long-term certainty needed to continue growing the industry in a sustainable way by investing in quality solar installations that generate attractive returns for years to come, as well as fostering improved technology, establishing industry best practices, and driving down costs."

Net Metering

State-level "net metering" policies have been critical to facilitating solar growth. When a PV system's production exceeds the needs of the customer's building, the excess electricity is sent back to the electric grid. In many states, a credit is granted to

the owner/leaser of the solar PV system, which is used to reduce the customer's total electric bill. The policy supporting this credit approach is commonly referred to as "net metering."

There has been notable resistance to net metering policies at the state-level. Critics of the policy contend that net metering over compensates system owners for excess power sold back to the grid and unfairly shifts the burden of paying for grid services to other, non-solar utility customers. Some states are beginning to alter or eliminate net metering programs. In December 2015, the Nevada Public Utilities Commission voted unanimously to approve a new solar net metering rate for NV Energy, reducing the credit for net-metered customers from $0.11/kWh to $0.026 by 2020. This change has essentially stopped solar development in Nevada. SolarCity alone has cut 550 jobs since this decision.[8]

The California Public Utilities Commission recently enacted a net energy metering, or NEM, successor tariff, also known as NEM 2.0. It builds upon the policy that, for the past decade, has assured net-metered customers they will earn retail-rate payments for surplus solar energy, which has helped position the state as a leader in rooftop solar.

States and Utilities

A number of states are focusing on the role of utility companies. Mississippi has a net metering policy that is more favorable to the utilities, as excess electricity from customer-sited solar projects is valued at the average wholesale rate rather than the higher retail rate. Both Minnesota and Texas have net metering policies, but investor-owned utilities in those states have the option to establish a value of solar tariff for compensating net-metered customers for generation. These tariffs require annual review and approval by the state public utility commission.

In New York, a significant, stakeholder-focused process is transforming the power-generation market. The "Reforming the Energy Vision," or REV, proceedings were initiated by Gov. Andrew Cuomo in 2014. Cuomo charged the Public Service Commission with changing the way electricity is distributed and supplied, with a focus on encouraging distributed energy resources, or DERs, including solar PV, and transitioning away from grant-based incentives toward greater use of financial and other market-based strategies. Other U.S. states and countries are watching the REV process closely.

Growth in Finance-based Strategies

A number of finance-based strategies are providing a spectrum of options for solar PV customers and fostering increased investor-community confidence in solar as an asset class. For both residential and small commercial customers, many of these tools offer no upfront-cost options, attractive interest rates and "cash-positive" structures, wherein monthly savings exceed payments thereby yielding benefit to customers from Day 1.

For customers who can afford an upfront cash outlay and/or can take advantage of federal and state tax incentives, a straightforward purchase is usually the optimal option. For customers not able to meet purchase requirements, solar PV leases and power purchase agreements, or PPAs, are widely available. Both leases and PPAs are third-party ownership models for a solar PV system. Rather than the homeowner or business owner paying for the panels and reaping the rewards of the electricity they produce, a third party owns the panels and either sells the electricity produced to the customer at a discounted rate (PPA) or requires a fixed monthly payment for a guaranteed output (lease). Either way, the third party absorbs all upfront costs while the customer receives free solar panels and typically purchases electricity at a lower rate than the local utility for the lease/PPA period (e.g., 20 years).

In California, the residential market for solar PV leasing agreements and PPAs increased from 9 percent in 2009 to 75 percent in 2012. This financing structure played a significant role in the rapid deployment of solar PV in the state. While the share of third-party ownership has since decreased due to the reduction in the cost of solar, it remains the dominant ownership model.[9] Other states experiencing rapid growth due to these models are Arizona, Colorado, Massachusetts, New Jersey, New York and Pennsylvania—all states with attractive customer incentives and relatively high electricity rates.

There are a number of finance options to support direct purchase. Banks and other lending organizations partner with an incentive provider (e.g., state authority) to provide subsidized energy project loans, which often provide financing at half of the market interest rate. In an On-Bill Financing model, a utility company allows customers to repay the cost of energy projects through their utility bill. The Property Assessed Clean Energy, or PACE, model allows commercial customers—and residential customers in some states—to

finance energy projects through their property tax bill. Both On-Bill Financing and PACE projects are transferable with sale of a property and, therefore, reduce concern over personal liability and reluctance to invest. These are also considered relatively safe investments because payments on property tax and utility bills rarely default.

Investor-Community Strategies

A number of finance-based programs and instruments in place and on the horizon are focused on engaging investors in solar and other energy projects to foster growth of solar developer companies and leverage private investment.

State-level Green Banks are at the center of many of these efforts. In general, a Green Bank is a public or quasi-public institution that uses public funds to attract private-sector investment for clean energy projects through programs and financial support mechanisms. Connecticut, Hawaii and New York are leaders in this approach.

Securitization of energy project lending as an asset class was initiated in Pennsylvania as a program known as WHEEL, WareHouse for Energy Efficiency Loans, and is an innovative approach that seeks to facilitate energy project loans by the traditional finance community by pooling loan and supporting secondary investment markets.

Securitization provides a pathway to large-scale capital markets and significantly lower interest rates. This brings down the cost of solar PV to consumers, giving solar companies access to virtually limitless funds as long as these assets continue to perform. In general, to engage large-scale private investment, rating agencies must have assurances the equipment and services are rated on an equal basis through a national standard in order to evaluate the investments. To securitize solar PV leases, assets must be accurately rated by a third party against widely adopted standards.

In late 2012, the National Renewable Energy Laboratory, or NREL, initiated the Solar Access to Public Capital, or SAPC, working group, backed by funding from the U.S. Department of Energy, or DOE, to build investment community confidence in solar project instruments. This required organization of the solar, legal, banking, capital markets, engineering and other relevant stakeholder communities in order to open lower-cost debt investment for solar asset deployment. More than 400 organizations, including five rating agencies—Standard & Poor's, Moody's, KBRA, Fitch and DBRS—participated in the SAPC process to standardize contracts, develop best practices, and discern the way rating agencies perceive solar project portfolios as an investment asset class. This effort led to development of residential (2015) and commercial (2016) PV system installation best practice guides, as well as a best practice guide for operations and maintenance.[10] These guides were developed to encourage high-quality system development and operation to improve lifetime project performance.

In late 2013, SolarCity, the largest vertically integrated residential solar installer in the country, successfully sold a portfolio of solar leases into the secondary market as a unique asset class. This new solar security represents an unprecedented opportunity to lower the cost of capital and bring solar into reach for millions of homeowners.

Promoting industry best practice

Through the Solar Quality Initiative, an extension of the SAPC process, solar industry leaders continue to partner to ensure this booming industry is built on a solid foundation of quality installation and assurance, by addressing risk borne by investors, including maintenance costs, failures, and performance, and developing minimum requirements to instill investor confidence in an environment of rapid growth.

As the solar industry continues its transformation to being a provider of energy services from being a vendor of labor and hardware, the need for quality assurance, or QA, and standardized measurement has moved from a program requirement to a necessity for responsible growth and financial confidence. QA is needed to facilitate the efficient flow of capital by private investors into the market by providing confidence in the underlying economics of distributed solar energy and in the quality of the physical asset. As markets for renewable energy mature, the need is emerging for a true investment-grade quality assurance, or IGQA, system that can provide a variety of stakeholders with the data necessary to manage risk with confidence.

IGQA goes beyond traditional in-house or programmatic QA programs by providing stakeholders with the suite of data necessary for securitization and management of risk. In addition to traditional field inspections to assure work was installed to industry best practices, specifications, and building code, IGQA would tracks and reports on a broad set of metrics that includes energy production.

Conclusion

While solar PV currently represents a relatively small share of total energy production, this share is anticipated to grow substantially in coming years. As with any booming industry, growing pains are inevitable. However, the progress in policy development, the focus on industry best practices, and the associated advances in solar finance strategies and asset securitization described in this article indicate the industry is accelerating into maturity.

Notes

[1] 1 gigawatt (gW) = 1,000 megawatts (mW) = 1,000,000 kilowatts (kW) = 1,000,000,000 watts (W).

[2] SEIA, "Impacts of Solar Investment Tax Credit Extension," Research & Resources, Solar Energy Industries Association, *http://www.seia.org/research-resources/impacts-solar-investment-tax-credit-extension*

[3] U.S. Department of Energy, *Guide to Implementing Solar PV for Local Governments*, IBTS and the Solar Outreach Partnership

[4] Solar Energy Industry Association, "Tracking the Sun VI: The Installed Cost of Photovoltaics in the US from 1998–2013," *Solar Market Insight Report 2014 Q1-Q4*

[5] Feldman et al., "Photovoltaic System Pricing Trends: Historical, Recent, and Near-Term Projections, 2014 Edition" *NREL*, *http://www.nrel.gov/docs/fy14osti/62558.pdf*

[6] "Friedman et al., "Benchmarking Non-Hardware Balance-of-System (Soft) Costs for U.S. Photovoltaic Systems, Using a Bottom-Up Approach and Installer Survey—Second Edition," National Renewable Energy Laboratory, *http://www.nrel.gov/docs/fy14osti/60412.pdf*

[7] U.S. Department of Energy, "Energy Infrastructure Update, Federal Energy Regulatory Commission," *SunShot Vision Study*, *http://www1.eere.energy.gov/solar/sunshot/vision_study.html*

[8] Shallenberger, Krysti. "Nevada PUC Denies Request to Stay Solar Net Metering Reforms." *www.utilitydive.com*

[9] Schafer, Alissa Jean, "Solar financing paves the way for market growth," CleanEnergy.org, *Southern Alliance for Clean Energy*, *http://blog.cleanenergy.org/2015/08/07/solar-financing-paves-the-way-for-market-growth/*

[10] Solar Quality Initiative, "Solar industry best practice guides," *Commercial/Industrial*, *http://www.solarquality.org/commercial—industrial.html*

About the Author

Jeffrey Domanski is senior manager, energy and sustainability, at the Institute for Building Technology & Safety, or IBTS, a 501(c)(3) nonprofit established to provide services to help governments implement cost-effective services and address challenges. IBTS is also a leading solar PV quality assurance provider working to improve best practices to enhance reliability, safety and investor confidence.