Business & Technology Surveillance

Vendor Solar-Plus-Storage Offerings: Anticipating Deployment

By Allison Hamilton

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SUBJECT MATTER EXPERT ON THIS TOPIC

Allison Hamilton

Senior Principal Markets & Rates, Business & Technology Strategies, Aliison.Hamilton@nreca.coop

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ARTICLE SNAPSHOT

WHAT HAS CHANGED IN THE INDUSTRY?

While solar systems have been available from third-party vendors for some time now, integrated residential solar-plusstorage systems are becoming more accessible to homeowners and co-op members in some markets. As the cost of residential solar photovoltaic systems has declined and residential-scale battery storage has become more affordable, vendors are now aggressively marketing solar-plus-storage distributed energy solutions. According to the 2017 Solar Installer Survey¹ produced by EnergySage and the North American Board of Certified Energy Practitioners (NABCEP), nearly 1 in 3 solar shoppers were also interested in a home battery. The same survey revealed that shoppers who received quotes for solar-plus-storage systems followed through on the deal almost 50 percent of the time in some markets. GTM Research expects behind-the-meter (BTM) solar-plus-storage installations to accelerate significantly over the next five years (see Figure 1).



FIGURE 1: U.S. Solar-Plus-Storage Market Outlook, 2018E - 2023E² (Source: GTM research)

¹ "Solar Installer Survey" available at: https://www.energysage.com/data/#2017-survey

² U.S. Energy Storage Monitor, Q2 2018/GTM Research and Energy Storage Association



Navigant Research forecasts that the United States will see approximately 2.4 GW of residential energy batteries installed on the grid between 2018 and 2026 (see Figure 2). This figure includes battery-only and solar-plus-storage systems, although in the U.S. market, the expectation is that a majority of systems will be tied to solar PV. Lithiumion is the technology front-runner due to manufacturing volume, number of suppliers, declining hardware costs, and technology readiness.



FIGURE 2: Annual Installed Residential Energy Storage Power Capacity Additions by Technology, and Installed Revenue, United States: 2017-2026³ (Source: Navigant Research)

WHAT IS THE IMPACT ON COOPERATIVES?

Electric co-ops will be impacted as vendors and installers actively pursue the market opportunity. It is likely that as market penetration grows, the cost of the systems will fall and become increasingly attractive to cooperative consumer-members. As trusted energy advisors and community business leaders, co-ops are in a position to educate their consumer-members. In addition, as energy service integrators, co-ops may want to offer products that may be similar to third-party offerings, while providing more options and value to the entire membership.

WHAT DO COOPERATIVES NEED TO KNOW OR DO ABOUT IT?

Solar PV and solar-plus-storage systems are long-term investments, usually at least 20 years, and members need reliable partners over the life of their system. For cooperatives to be valued partners, it is helpful to understand the competitive landscape and product offerings available in co-op communities, so they can actively coordinate efforts among the members to ensure beneficial deployment. Cooperatives need to not only prepare for member inquiries, but should be aware of the third-party vendor product information to better evaluate these programs and educate their members.

³ Country Forecasts for Distributed Energy Storage, Navigant Research 2Q17



The market for energy solutions is changing very rapidly. This article provides guidance on preparing for solarplus-storage deployments, as well as providing information on the prominent brands in residential solar that now offer solar-plus-storage products. There are also several resources and references that provide a wealth of useful information for cooperative management and for members who are interested in these systems or who have been approached by third-party vendors. Much of the product information is available to the public and all prices included here are cited from publicly available information. With the solar-plus-storage market being dynamic, prices and terms will vary over time and cooperatives are encouraged to seek the most current information before making investment decisions. This article reviews current product offerings and provides insights to help cooperatives educate their members who may be considering long-term energy solutions.

"What About Adding Batteries to Existing Solar Arrays?"

While no empirical data exists about the number of battery retrofits/upgrades, many utilities are seeing their customers with solar panels add batteries to their systems. The batteries can provide limited to complete back-up during an outage depending on the size of the home and the device. If the utility offers TOU rates or demand charges, customers can save on their bill by storing energy from their solar array when prices are high and minimizing purchases from the grid when demand charges are levied.^{*} With the total installed capacity of PV solar capacity in the U.S. expected to reach 14 GW by 2023,^{**} it makes sense that vendors would want to address the battery retrofit market. Using EIA data as a proxy, we estimate there are about 130,000 solar PV systems across co-op territories, though this number may be low. Some co-ops are experimenting with adding batteries by using their own facilities and employee residences in an effort to learn how to control and monitor the batteries and assess the potential value streams.

- $*\ https://www.energysage.com/solar/solar-energy-storage/add-battery-your-solar-energy-system$
- ** https://www.seia.org/us-solar-market-insight



Evolving Market

Solar and storage vendor partnerships allow third-parties to offer full systems at prices potentially within reach of the average consumer in the near future. With the price of solar having rapidly declined over the last several years, combined with the significant evolution of energy storage technology, new products and systems are now within the reach of more energy consumers. Notably, there have been several acquisitions and partnerships among vendors and developers to firmly engage in the solar-plus-storage marketplace. For example, Tesla, the electric vehicle and Powerwall battery manufacturer, purchased SolarCity, one of the leading full-service solar system providers. Vivant Solar, a leading solar installer has partnered with Chargepoint, an electric vehicle charging provider and recently announced plans to offer LG Chem storage systems with solar installations. Sunrun, a roof-top solar provider has partnered with LG Chem to provide a solar-plus-storage solution. These partnerships allow third-parties to offer full solar-plus-storage systems at prices that are or could be within the reach of the average consumer in the near future.

During this time, there have also been state and federal incentives which could spur more investment in residential solar-plus-storage systems. For instance, as part of *California's*





Self Generation Incentive Program (SGIP), homeowners can get a rebate for most or all of their home battery installation⁴ (see Figure 3).

California recently mandated that all new homes be equipped with solar panels starting in 2020.⁵ The new building codes also include incentives for energy storage. The NC Clean Energy Technology Center has identified several other states that offer direct financial incentives for storage, including Arizona (Salt River Project), Maryland (tax credit), Massachusetts (SMART program), Nevada (NV Energy rebate), New York (property tax abatement), and Wisconsin (Energy Innovation Grant Program).⁶ The organization maintains a Database of State Incentives for Renewables & Efficiency (DSIRE) that can be accessed through its web site at: http://www.dsireusa.org

The federal Investment Tax Credit (ITC) for solar installations applies to battery storage under certain circumstances. The IRS recently issued a private letter ruling that batteries that charge 100 percent from solar can qualify for the 30 percent ITC. The battery must be installed within a year of the solar installation to qualify for the credit. While the ruling was a response to a specific taxpayer inquiry, it is an indication of how future rulings or legislation may lean. This ruling is different from utility scale storage projects which require 75 percent of the battery to be charged from a renewable resource to qualify for the ITC.⁷

- 4 https://pickmysolar.com/battery
- There are some alternatives for home/developments that are not suitable (e.g. heavily shaded) such as community solar and energy efficiency programs: https://www.greentechmedia.com/articles/read/everything-you-need-to-know-about-californias-new-solar-roof-mandate#gs.2i2fbB8
- ⁶ E-mail from NC Clean Energy Technology Center
- ⁷ Please note, IRS private letter rulings may not be relied on as precedent by other taxpayers. Bade, Gavin "IRS: Residential Storage Eligible for ITC When Charged by Onsite Solar" available at: https://www.utilitydive.com/ news/irs-residential-storage-eligible-for-itc-when-charged-by-onsite-solar/518377

Retail structures and pricing can also improve the economic value of adding a residential battery.

Cooperatives are encouraged to consider the variety of solar-plus-storage offerings in their areas, including and beyond those reviewed in this article. Retail structures and pricing can also improve the economic value of adding a residential battery. Time-of-Use rates allow consumers to generate power at higher priced times and self-supply during times when the sun is not shining. In states where there is no net metering or reduced net metering, it is more economical to store the unused energy from solar than to export it to the grid at reduced rates. Battery storage can also be used to avoid high demand charges for customers of utilities that offer residential demand charges.

Vendor Evaluations

The most readily available public vendor information is that of larger solar providers with a broad national footprint and recognized brand. These vendors may or may not be in all rural markets, but there are likely similar offerings in many cooperative territories, especially those near metropolitan areas. The vendors — Sunrun, Tesla, and Vivint Solar — are all publicly traded and offer solar-plus-storage solutions, mostly in select markets where solar penetration is high and retail electric rates are above average.

The following descriptions are representative of some of the products supplied by vendors active in one or more cooperative service areas, based on publicly available information. It is mostly limited to product descriptions and average price ranges and is not intended to provide technical reviews or evaluations. The price estimates for each vendor are based on a 5 kW solar panel configuration and an estimate of the installed cost of the battery each vendor has partnered with for the storage component of the system. The estimates are meant to provide a point of reference and do not represent exact price quotes. It should also be noted that there are many vendors actively marketing solar-plus-storage products and we encourage cooperatives to seek and consider offerings by other vendors in their area.

As noted earlier, the market is rapidly evolving, and information valid today is almost certain to be different within a relatively short time frame. Again, we encourage cooperatives to seek the most current information before making investment decisions or advising their members.

SUNRUN

Sunrun provides solar installation and financial services to over 180,000 customers in 22 states, recently surpassing Tesla's lead in market share in U.S residential Solar.⁸ Sunrun has partnered with LG Chem and offers a solarplus-storage product called Brightbox. The product is currently available in Hawaii, California, Arizona, Massachusetts, Florida, and New York. The Brightbox product combines rooftop solar with smart inverter technology and a home battery. Sunrun has partnerships with Comcast and Home Depot, to market its energy solutions. On a recent investor earnings call, Sunrun reported that 10 percent of their solar customers in Massachusetts were also purchasing storage, and that as much as 50 percent of customers were looking at solar-plus-storage in some California markets. Sunrun's investor presentation features the quote "Sunrun is Building Not to Disrupt but to Displace."9

EnergySage estimates the price of the LG Chem RESU 9.3 kWh battery between \$9,500 and \$13,500,¹⁰ including the inverter and the installation costs. Sunrun recently reported installed costs for solar at \$3.34 per Watt.¹¹ The average price for a 5 kW solar system would be \$16,700. The solar-plus-storage system would average \$27,950. **Table 1** shows the average price estimate of the system when the ITC is just applied to the solar (\$22,940) and when it is applied to both the solar and the battery (\$19,565). To be clear, the figure in green represents the estimated cost of the solar-plusstorage *if the ITC is just applied to the solar*, and the battery was added (for instance, if the

⁹ http://investors.sunrun.com/static-files/7edeed7a-52b1-410c-8c24-86d6021f98ea

¹¹ http://investors.sunrun.com/static-files/447c95eb-74cb-4a2a-ba7f-31d3e3261bf7

⁸ GTM Research

¹⁰ "LG Chen RESU battery: the complete review," available at: https://www.energysage.com/solar/solar-energystorage/lg-chem-resu-battery

TABLE 1: Price Estimate for Sunrun Solar-plus-Stora	ige
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	High	Low	Average	
Solar	\$ 16,700	\$ 16,700	\$ 16,700	
Battery	\$ 13,000	\$ 9,500	\$ 11,250	
Total	\$ 29,700	\$ 26,200	\$ 27,950	
ITC/Solar	\$ 24,690	\$ 21,190	\$ 22,940	
ITC/Solar+Storage	\$ 20,790	\$ 18,340	\$ 19,565	
Source: http://investors.sunrun.com/static-files/447c95eb-74cb-4a2a-ba7f-31d3e3261bf7				

storage was added later and did not qualify for the ITC). The amount in yellow represents the average estimated cost of the solar-plusstorage when the ITC is applied to the entire system (battery and solar panels) assuming the battery is charged 100 percent from the solar array and qualifies for the ITC.

TESLA

With Tesla's purchase of SolarCity, the company now offers solar panels and Powerwall batteries to energy consumers. In an effort to rebrand and integrate SolarCity into Tesla, the company has scaled back the SolarCity operations and recently announced a 9 percent workforce reduction and the closure of a dozen installation facilities. Tesla is also terminating its partnership with Home Depot and will focus on selling energy solutions via its retail car dealerships and online channels.¹² While Tesla is stepping back from the SolarCity brand and business strategy (leases

TABLE 2: Price Estimate for Tesla Solar-plus-Storage

	High	Low	Average	
Solar	\$ 16,000	\$ 16,000	\$ 16,000	
Battery	\$ 14,600	\$ 8,600	\$ 11,600	
Total	\$ 30,600	\$ 24,600	\$ 27,600	
ITC/Solar	\$ 25,800	\$ 19,800	\$ 22,800	
ITC/Solar+Storage	\$ 21,420	\$ 17,220	\$ 19,320	
Source: "Tesla Powerwall: the complete review," available at: https://www.energysage.com/solar/solar-energy-storage/ tesla-powerwall-home-battery				

and power purchase agreements (PPAs)), they expect to grow more profitable solar PV and solar-plus-storage systems with a focus on sales and loans.¹³ Tesla recently partnered with Green Mountain Power (GMP) in rural Vermont to lease Powerwalls for \$15.00 per month, as part of the utility's Virtual Power Plant (VPP) program.¹⁴

SolarCity sourced its panels from third parties and Tesla has partnered with Panasonic to produce Tesla panels at its Gigafactory in upstate New York. Finding the price per Watt for Tesla's Panasonic solar panels was not so easy, as it seems they are still using some of the legacy SolarCity vendors as they transition to the new Tesla panels. A recent SolarReviews blog quoted the panels at \$3.20 per watt.¹⁵ The average price for a 5 kW solar system would be \$16,000. The price for one Powerwall 2.0 battery recently went from \$5,500 to \$5,900. EnergySage estimates the total installed cost for the Powerwall 2.0 including installation and supporting equipment to be between \$8,600 and \$14,600.¹⁶ The average cost for a Tesla solar-plus-storage system would be \$16,000. Table 2 shows the average price estimate for a solar-plus-storage system when the ICT is applied to just the solar (\$22,800) and when it is applied to both the solar and the storage (\$19,320).

VIVINT SOLAR

Vivint Solar is an outreach of the Vivint Home Security Systems. Like Tesla, Vivint Solar has transitioned its business model to focus on consumer purchases of solar installations though financing and cash sales. Vivint employs a combination of local dealers and dedicated Vivint employees to market its systems. Most sales result from door-to-door marketing campaigns.

Vivint had originally partnered with Mercedes Benz Home Battery for its solar-plus-storage

- ¹² Groom, Nicholas, Rodriguez, Salvador, Cook, Kristina, "Tesla to Close a Dozen Solar Facilities in 9 States," available at: http://www.msn.com/en-us/money/companies/tesla-to-close-a-dozen-solar-facilities-in-9-states/ ar-AAyZUkl?ocid=ientp
- ¹³ Elmerraji, Jonas, "Here's Why Tesla's Solar Shakeup Makes Sense," available at: https://www.thestreet.com/ investing/tesla-solar-shakeup-makes-sense-14630743?puc=yahoo&cm_ven=YAHOO&yptr=yahoo
- ¹⁴ Cardwell, Diane, "Utility Helps Wean Vermonters From the Electric Grid," available at: https://www.nytimes. com/2017/07/29/business/energy-environment/vermont-green-mountain-power-grid.html
- ¹⁵ https://www.solarreviews.com/blog/are-tesla-solar-panels-the-best-option-in-2018
- ¹⁶ "Tesla Powerwall: the complete review," available at: https://www.energysage.com/solar/solar-energy-storage/ tesla-powerwall-home-battery

TABLE 3: Price Estimate for Vivint Solar-plus-Storage

	High	Low	Average
Solar	\$ 16,050	\$ 16,050	\$ 16,050
Battery	\$ 13,000	\$ 9,500	\$ 11,250
Total	\$ 29,050	\$ 25,550	\$ 27,300
ITC/Solar	\$ 24,235	\$ 20,735	\$ 22,485
ITC/Solar+Storage?	\$ 20,335	\$ 17,885	\$ 19,110

Source: "Tesla Powerwall: the complete review," available at: https://www.energysage.com/solar/solar-energy-storage/ tesla-powerwall-home-battery



FIGURE 4: Average Price Estimate Comparisons (Source: "Tesla Powerwall: the complete review")

solutions. When Mercedes exited the residential battery business, Vivint partnered with LG Chem. The company also has a partnership with Chargepoint, a company that produces Electric Vehicle chargers.

Like SunRun, Vivint uses the LG Chem RESU battery. EnergySage estimates the total installed costs to be about \$9,500 to \$13,000.¹⁷ In its most recent quarterly report, Vivint Solar reported the average price per Watt of \$3.21 for installed solar panels. The installed cost of a 5 kW system would be about \$16,050. Table 3 shows the average price estimate for the system when the ITC is just applied to the solar (\$22,845) and when it is applied to the solar and the storage(\$19,110). The high and low ranges are based on the battery price ranges.

Figure 4 provides a comparison of the three vendors.

Benchmark Industry Pricing Trends for Solar and Energy Storage Components

A recent report from EnergySage found homeowners are paying between \$2.71 and \$3.57 per Watt to install solar with the average price of \$15,700 for a 5 kW system. The system prices will vary by size and state (see Figure 5).¹⁸



FIGURE 5: 2018 Average Solar Price per Watt by State

¹⁷ "Tesla Powerwall: the complete review," available at: https://www.energysage.com/solar/solar-energy-storage/ tesla-powerwall-home-battery

¹⁸ "How Much Do Solar Panels Cost in the U.S. in 2018?," available at: https://news.energysage.com/ how-much-does-the-average-solar-panel-installation-cost-in-the-u-s We also looked at Lazard's Levelized Cost of Energy (LCOE) analysis for residential solar and energy storage (see Figure 6). Prices for both residential solar and storage have continued to decline. According to the Lazard study, the cost LCOE for solar-plus-storage per MWh in 2018 has declined significantly below 2017 costs and even below their initial 2018 estimates. We looked specifically at lithium-ion since that is the preferred technology for home batteries. See Figures 6 and 7.¹⁹



FIGURE 6: Lazard LCOE Solar-plus-Storage 2018



FIGURE 7: Lazard LCOE Solar-plus-Storage 2017

¹⁹ https://www.lazard.com/media/450774/lazards-levelized-cost-of-storage-version-40-vfinal.pdf https://www.lazard.com/media/450338/lazard-levelized-cost-of-storage-version-30.pdf

Other Considerations

Since there does not appear to be a lot of differentiation in the average cost of a solar system across the vendors we reviewed, consumers may want to consider other value streams and attributes such as financing options, warranties, maintenance costs, etc. Below, we provide some guidance and resources that may help co-ops build awareness and effectively educate their member-consumers.

In 2016, the Campaign for Accountability (CfA), a consumer interest group, asked the California Attorney General to investigate more than 125 complaints filed with California Public Utilities Commission (CPUC) by solar residential customers. CfA submitted open records requests to several states and the findings were made public. The summary:

CfA reviewed a summary of 125 *consumer complaints* the CPUC received from 2012 through the present pertaining to the sale or leasing of solar panels and their installation on the roofs of customers' homes and discovered more than 30 different solar companies that had provided poor or inadequate service, **falsely represented the savings** customers would realize from solar power, **lured them** in with low price quotes that later proved to be false, performed **shoddy installation** of the solar panels, and in a significant number of cases made **harassing phone calls**, often to individuals who had placed their numbers on a do not call registry.²⁰

As a result of the findings, the Solar Energy Industries (SEIA) now provides resources on its website to protect potential buyers of residential energy products and services: https://www.seia.org/initiatives/ consumer-protection.

Another useful document that NRECA contributed to is the LSU AgCenter report titled "Solar Power for Your Home: a Consumer's Guide." Here is a link to the report: http:// www.lsuagcenter.com/~/media/system/e/4/8/8/ e48836bdb7da5028f3116b6531b344d7/ pub3366solarpowerforyourhome2.pdf.

Consumers can also go to the **Better Business Bureau** or **Consumer Affairs** websites for information, ratings and company reviews.

Solar Deployment Case Study – WIPCO

This Case Study originally appeared in a Touchstone Energy article, "Solar Energy to Add Value," available at: https://www. cooperative.com/programs-services/touchstone/cooperative-performance/Documents/Secure/2016_western_iowa_ onsite_solar_final.pdf.

Western Iowa Power Cooperative (WIPCO) provides service to approximately 3,500 members in 9 counties in west central Iowa.

When WIPCO began seeing an increase in member interest in onsite solar systems, they were reminded of the challenges they had experienced a decade ago with the advent of small-scale wind systems. Many of WIPCO's members had been convinced by micro-wind vendors to invest in small-scale wind systems, only to find that those same vendors were not responsive or even in business any longer when systems failed just months after installation. Today, WIPCO is seeing solar vendors pitching the largest systems a roof can hold, and WIPCO is concerned that little consideration is being given to the cost effectiveness of the installation. Rather than right-sizing systems to optimize the member's economics, these vendors are selling systems that produce enough energy to entirely offset the member's annual usage, regardless of the sell-back provisions in the cooperative's retail rates.

WIPCO advises members that the greenest energy is that which is never used and in WIPCO's opinion, there is no sense in offsetting wasted energy with solar.

Continued on next page

Solar Deployment Case Study – WIPCO (cont.)

Yet, WIPCO believes that solar vendors are not counseling members on lower cost options to improve the efficiency of their homes before sizing the solar array. WIPCO finds members often do not contact the cooperative until it is time to interconnect the system, at which point their advice comes too late.

When members do contact WIPCO, WIPCO provides members with factual information about solar, which sometimes includes correcting members' misperceptions. WIPCO is cautious to provide facts and avoid appearing as if they are negative about solar energy by using the check-list below to make sure members have the information they need to make an educated decision:

WIPCO Checklist

- 1. Determine where usage is
- 2. Reason for looking into solar
- 3. What % of load are they looking to offset
- 4. What efficiency improvements have been made
- 5. Review programs available through Co-op
- 6. Explain rate structure
- 7. Explain metering policy, what if changes
- 8. Gives estimated payback
- 9. Stress talking to accountant
- 10. Future Plans and usage impact

WIPCO realized they needed to get out ahead of the process to enable members to make educated decisions rather than making a purchase that they may later regret when the economics were not what they expected. WIPCO wanted its members to have a trusted energy advisor that would recommend a cost-effective combination of energy efficiency and solar to maximize their economic benefits. WIPCO believes its members can benefits from a partner that will be there for them over the 25-year life of the system.

WIPCO came to the conclusion that the best way to avert a repeat of the micro-wind debacle was to get into the solar business themselves. With WIPCO already offering HVAC installation, in-home wiring, and energy efficiency services to members, adding solar to their list seemed like a natural fit. So, WIPCO embarked on a community solar program of its own and offered subscriptions to members.

See more about WIPCO's program at: https://www.cooperative.com/interest-areas/ touchstone/performanceexcellence/Docu ments/ Touchstone%20Members%20Only/ 2016 western iowa_onsite_solar_final.pdf

What Can Co-ops Do?

THE COOPERATIVE AS TRUSTED ENERGY ADVISOR

Many solar-plus-storage vendors approach consumers with very appealing offers. As trusted energy advisors and community business leaders, co-ops are in a position to help assist their members' energy solution purchases by providing members with more information about their options. Most of the vendors will not give out specific information on pricing and terms unless you speak with them in person. Co-ops may want to determine which vendors are active in their service area, as the vendor offerings evaluated herein may not be available in every co-op community. A recent NREL report²¹ found that while the largest 1 percent of vendors (solar installers) serve more than 60 percent of the solar market, smaller local companies are growing rapidly and generally have lower prices. Many of these smaller vendors also offer solarplus-storage products.

DO YOUR HOMEWORK

Once co-ops have identified vendors that service their community, they can find information from many sources. There are some excellent resources available to provide reviews, pricing, and guidance on specific vendors

²¹ https://www.nrel.gov/solar/firm-size-pv-pricing.html

whether they are local or national brands. All of these resources also include information on residential batteries.

- SolarReviews
- EnergySage
- Pickmysolar
- Quote.com
- OhmHome

There is also a tool you can download from the NREL website that provides detailed data from simulations. Just enter the parameters and location, and it provides very granular estimates including location specific taxes, incentives, and retail rates. Figure 8 is an example from Springdale, Arkansas.

Co-ops can also talk to members who have experience with the home energy solution purchase process and share it with other members. There are other reference sites that can help. **The Database of State Incentives for Renewables & Efficiency (DSIRE)** web site shows rebates and incentives by state. **The altE store** is focused on do-it-yourself solar customers, and their web site provides a compilation of resources for various types of solar consumers, including solar-plus-storage.

ENGAGE THE VENDORS IN THE COMMUNITY

Vendors have much to gain by partnering with cooperatives and gaining access to their members. In addition, co-ops will want to ensure interconnection guidelines and other protocols are followed. It is important for cooperatives to engage with vendors in their area, to stay aware of developments in DER and to provide guidance on interconnection requirements.



FIGURE 8: NREL Solar-plus-Storage Simulation

One relevant standard is IEEE Standard 1547™, which defines interconnection requirements for distributed energy resources (DER). The significant growth in DER interconnection applications has substantial impact on utilities, the reliability of the grid, safety, and the quality of electric service to other utility customers. IEEE 1547 was recently revised to 1547-2018, in order to mitigate many of these DER impacts as more DER is added. The new standard addresses how DER devices are designed and tested, and how DER is integrated into the power system. For more information on this standard, please see our related content on cooperative.com: https://www. cooperative.com/topics/operations/Pages/ IEEE-Standard-1547---2018.aspx.

An additional resource available to cooperatives to assist with DER interconnections and interactions with vendors is our Distributed Generation (DG) Toolkit. The DG Toolkit has sample interconnection agreements and requirements that co-ops can use as a starting point with their members. These were set up for DER (called DG at the time) which would support either accepting power from a DER (i.e., solar farms, wind, methane) or continuous parallel, such as homes or small businesses which cannot supply all their power needs around the clock. The DG Toolkit was developed when the previous version of IEEE 1547 was in effect and will be updated to reflect the latest version, but can still serve as a useful guide. The *DG Toolkit* is available to NRECA members on **cooperative.com**.

MEMBER ENGAGEMENT IS ESSENTIAL

Co-ops can assist a member's decision to purchase solar-plus-storage energy solutions by driving traffic to co-op web sites and resources that educate the member about available options. Once aware that vendors are offering solar-plus-storage systems to members in the community, co-ops may wish to ensure that methods are in place to communicate with members about their options. Co-ops may want to consider establishing an in-house clearing platform to provide information on interconnection requirements, coordination with the cooperative and opportunities to share the product offerings with the cooperative staff to help evaluate member options. Co-ops can provide information to members indicating that Community Solar and storage options are also available in many communities and note how these options may be more valuable to both the member and the co-op. NRECA recently published a very comprehensive Guide to Residential Solar that would be helpful in structuring a member engagement process.

AUTHOR AND EXPERT FOR QUESTIONS OR COMMENTS

- Allison Hamilton, Senior Principal Markets & Rates, Business & Technology Strategies: Allison.Hamilton@nreca.coop
- To find more resources on business and technology issues for cooperatives, visit our website.

DISTRIBUTED RESOURCE, ADEQUACY, AND MARKETS WORK GROUP

The NRECA Business & Technology Strategies (BTS) department's Resource Adequacy and Markets (RA/M) work group helps electric cooperatives address new or changing regulatory proposals involving markets, standards, development, pricing and other related issues. In particular, the work group helps co-ops analyze resource adequacy and market issues and initiatives and rates and price formation. The work group also updates co-ops on developments in regional transmission organizations, markets and reliability, distribution market structure and resource adequacy and pricing. For more information, please visit **www.cooperative.com**, and for the current work by the Business and Technology Strategies department of NRECA, please see our **Portfolio**.

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