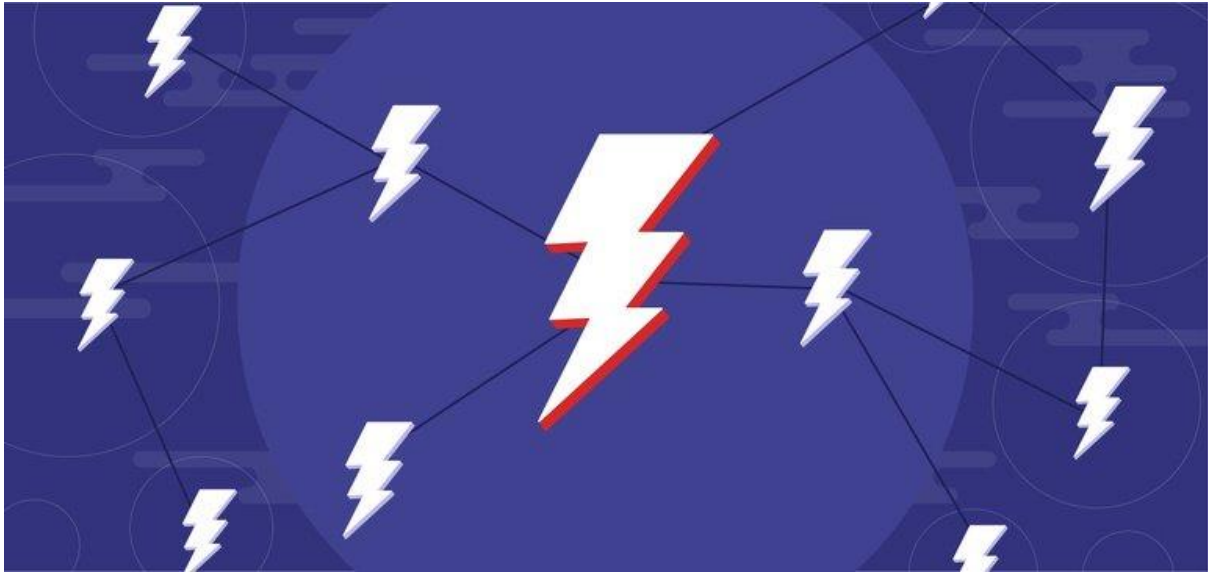


DEEP DIVE

Propelling the transition: The battle for control of virtual power plants is just beginning

As virtual power plants develop, there is a growing debate about the degree to which the future of distributed energy management will be controlled by large utilities or third-party aggregators.



Brian Tucker/Utility Dive

AUTHOR

Matthew Bandyk @MatthewBandyk

PUBLISHED

Aug. 18, 2020

The largest power plants in the the U.S. - massive feats of engineering like the over 5,000 foot-long, 6,800-MW capacity Grand Coulee Dam — are proving to be no match in scale to the combined power of the rooftops and basements of homes and businesses across the country.

Distributed energy, including rooftop solar, on-site batteries to store electricity and more, are on track to grow to nearly 400 GW in the U.S. by 2025, according to [projections](#) from Wood Mackenzie, significantly greater than the amount of coal or nuclear power capacity in the U.S. today.

The existence of that much power leads to an inevitable question: who controls it? Utilities see distributed energy as both a threat to their business models and an opportunity to harness this relatively new and massive source of energy to make money. The rise of distributed energy has led to a conflict between a utility-centered business model and a service model based around third parties. "The fundamental question is who can manage and schedule distributed energy resources (DERs) and how?" said Omar Saadeh, business strategy manager at Accenture. "It's a question being asked in a number of states."

The concept of a network of DERs operating across homes or businesses and being collectively dispatched — sometimes described as a "virtual power plant" — has gone from theory to practice in a short amount of time. Roughly five years ago, the idea of a central authority using distributed energy resource management systems (DERMS) to remotely control an aggregate of rooftop solar, battery systems, water heaters and other resources was just starting to be demonstrated in a few pilot projects.

Now, virtual power plants are bidding into wholesale electricity markets in California, New England and other areas, pilot projects are proliferating, and more utilities are, if not yet pursuing the full virtual power plant model, at least investing into or considering the DERMS technology that enables the aggregation of DERs to perform services for the grid.

DERMS expansion and debate

"It'd be hard to find a North American utility that isn't considering some kind of DERMS," Saadeh said.

But as virtual power plants have started to get more real, discussions around how to implement the concept and the software behind it have become more heated. There is a growing debate about the degree to which the future of distributed energy management will be in the hands of large utilities, or in the hands of third-party aggregators.

For example, PPL Corp., owner of one of the largest regulated utilities in Pennsylvania, is in the midst of a pending case with state regulators for approval of an expansion of its ability to manage distributed resources that has generated fierce back and forth between the utility and stakeholder groups. PPL's proposal "will likely stifle the nascent DER market in Pennsylvania" by placing "stringent" rules on rooftop solar customers and other distributed energy users, the Natural Resources Defense Council stated in a brief filed in the case. NRDC has allied with Sunrun, which has a growing distributed resource aggregation service business, in opposition to PPL.

"Most DERs are not being dispatched. They are operating for the needs of the customers where they are installed."

Janet Besser

Managing Director, Smart Electric Power Alliance

PPL's response was just as fiery. Sunrun's involvement "is nothing more than a blatant and anti-competitive attempt to delay and stifle PPL Electric's efforts to proactively manage DERs and provide safe and reliable service to its customers," the utility said in a brief.

As rooftop solar, battery storage and other behind-the-meter sources spread across the country, more of these debates may occur as more utilities see the need to pursue DERMS. Stem, Sunrun and other companies are actively managing several virtual power plant projects serving competitive wholesale electricity markets. But in the regulated utility world, "we haven't progressed as quickly as some of us had anticipated, especially with utility-driven programs," according to Anissa Dehamna, associate director at the consulting firm Guidehouse. "We haven't seen many utilities procure virtual power plants," she said.

But recently, regulated investor-owned utilities that primarily make money through capital investments, like PPL, are starting to take notice. Virtual power plants have so far tended to take root in competitive wholesale electricity markets where there are a multitude of revenue streams.

However, the increasingly favorable economics for solar and storage may make the differences between independent system operator (ISO) and regional transmission organization (RTO) regions and vertically-integrated regions less relevant when it comes to virtual power plants. "We are at such

a price point on pure solar... [that] you don't need markets to guide that," said Bud Vos, President and CEO of Enbala Power Networks, a company that designs DERMS and virtual power plant software. "Utility customers are going to get more sophisticated," he said, because the opportunities to optimize the grid with DERs will become more and more creative.

Early aggregation projects were similar in concept to demand response - they were about reducing electricity load at certain times. What's next, according to Vos, is a much more dynamic and granular approach.

Communication vs. control

The precise definition of DERMS depends on exactly who you ask, but it essentially comes down to communication. By default, DERs are islands unto themselves. "Most DERs are not being dispatched," said Janet Besser, managing director for the Smart Electric Power Alliance. "They are operating for the needs of the customers where they are installed."

DERMS allow an entity to connect these disparate resources so they can operate for the needs of the grid. The potential value of harnessing distributed energy with DERMS has gone up as more solar, storage and other flexible resources have come online.

Only about 10% of substations on the grid are connected to a DERMS platform, according to an estimate from Michael Kelly, a senior research analyst at Guidehouse, focusing on energy information technology. But that 10% is up from "the low single digits" only three to five years ago, when DERMS were mostly used in pilot projects, Kelly said. In addition, Guidehouse forecasts that global revenue for DER management technologies will grow from a little over \$800 million today to nearly \$6 billion by 2029.

"There isn't one person controlling all the routers on the Internet..." [some utilities are]" rooted in a centralized command and control paradigm that is outdated."

Ric O'Connell
Executive Director, GridLab

But managing distributed energy resources does not necessarily mean controlling them. In the U.S., typically only utility-scale DERs are subject to aggregation with DERMS because the issue of utilities or other third parties being able to dispatch privately-owned energy involves regulatory hurdles. The rooftop solar panels that dot homes and businesses across the country, as well as other residential and commercial DERs, do not work together as virtual power plants because their private owners control how they are dispatched. The regulations at play have been a "big barrier" to the growth of DERMS, according to Kelly.

But "regulatory changes are likely on the horizon," he said. The California Public Utilities Commission issued "Rule 21" in 2017, setting new requirements for any generation facility connecting to the distribution system, including mandating the use of "smart inverters" that can communicate with the broader grid. Although issued in 2017, Rule 21 is only now coming into effect, and is likely to be a model for other states, Kelly said.

That could set up a showdown over the question of who is in control over the platforms for virtual power plants, and exactly how much control they will have. One vision is that DERMS work best if they are decentralized and in the hands of a competitive market of companies that aggregate the neighborhoods of residential DERs, or hundreds of DERs at commercial buildings throughout an area, and then contract with utilities to provide virtual power plant services, bid into wholesale markets, or both.

Two paradigms

Ric O'Connell, executive director of GridLab, a consulting firm that specializes in policies "to ensure a rapid transition to a reliable, cost effective and low carbon future," compares the decentralized paradigm to other communications networks. "There isn't one person controlling all the routers on the Internet," O'Connell said. When it comes to DERMS, some utilities are "rooted in a centralized command and control paradigm that is outdated."

GridLab filed a brief with the Pennsylvania PUC agreeing with NRDC's criticisms of PPL's pending DERMS case. PPL has requested that any customers trying to interconnect DERs with the utility be required to, first, install PPL-approved "smart" inverters that can communicate with the utility's grid management systems and, second, install devices that allow PPL to "monitor and proactively manage" the resources.

PPL installed DERMS as part of its Keystone Solar Future Project, a \$9 million pilot partially funded by a U.S. Department of Energy grant. The project involves managing hundreds of private solar arrays through DERMS to explore "the opportunities and challenges presented by increased DER installations, so that PPL Electric can smoothly integrate DERs into its distribution system while maintaining system reliability," according to PPL's petition before the PUC. The Smart Electric Power Alliance named PPL the "2019 Investor-Owned Utility of the Year" due to its pursuit of these strategies and technologies.



An example of a Stem battery storage system installed at a commercial building
Permission granted by Stem

But DERs are growing so fast on its grid that it needs to plan for much more than just a pilot project, according to the utility. The influx of DERs is leading to issues like voltage problems and "load masking," meaning that the utility does not know the full demand on its system at a point in time because some of the demand is being met by rooftop solar and other DERs, according to the petition. The new smart inverters and other devices PPL wants to require can mitigate these issues, the utility said.

"For example, when there is a disturbance on the system, PPL Electric will be able to accurately determine the actual electric demand on a circuit without the contribution from DERs and act accordingly. This allows the Company's system operators to safely perform system restoration without violating any equipment ratings or constraints such as current or voltage limits," the petition said.

Regardless of whether the utility or a third party is managing DER dispatch, the most economically efficient approach is for the authority in charge of a VPP to be determined competitively, according to Dehamna with Guidehouse. "Typically, we see better economic outcomes with greater competition - a structure where DER owners had a choice of which VPP to subscribe to - be it the native distribution utility's VPP or a third party," she said. Competition "should yield the best result for the ratepayer."

"If there are competitors willing to [manage DERs], that can raise capital that doesn't have to come from ratepayers; regulators should ask why would they want ratepayers to cover this?"

Anne Hoskins
Chief Policy Officer, Sunrun

Utilities push for DER control

Critics of PPL's petition claim that the utility is exaggerating the issues it raised to grab a piece of the distributed energy pie by turning customer-owned equipment into company-controlled assets, while ratepayers cover the costs of the expensive software that comes with the utility's DER oversight. In its brief, NRDC argued that, for example, smart inverters can, on their own without direct control, respond to voltage frequency fluctuations. But turning control of DERs over to the utility could stifle the growth of distributed energy, the brief said.

For example, PPL could decide to curtail energy production from the DERs, the group argued. "Practically, this means that third-party DER providers will be unable to finance systems," according to NRDC. "DER owners will be exposed to significant risk of lost production, meaning their investments in their DER system may not provide the expected return."

"What PPL put forward is unfortunate," said Anne Hoskins, chief policy officer at Sunrun. PPL's stance is an "outlier," Hoskins said, compared to the relationship between third-party aggregators and utilities in California, New England and New York, where third-party companies have signed bilateral contracts with utilities whereby the company is in the driver's seat for DER management and the utility is a customer instead of a competitor.

For example, Liberty Utilities in New Hampshire is in the process of installing Tesla Powerwall batteries at the homes of 150 customers as part of a pilot project.

PROJECT SPOTLIGHT

New Hampshire Powerwall VPP

NAME

Liberty Utilities Battery Storage Pilot Program

PURPOSE

The New Hampshire distribution utility is offering residential customers who participate in the program a Tesla Powerwall 2. Tesla will use its "magic software algorithm" to leverage the batteries and cut the utility's peak demand, according to a Liberty Utilities spokesman.

STATUS

The Powerwall batteries are currently being installed at participating customer homes.

IMPACT

The utility does not own any generation itself, and hopes the batteries will lead to reductions in the transmission charges it pays, which are based on the highest peak demand day.

But utilities that are not divested of generation assets and work under a traditional, rate base utility model face very different incentives. Hoskins pointed to PSE&G in New Jersey, which, like PPL, has proposed taking a degree of direct control over DERs. A possible trend is that as DERs proliferate into the service territories of vertically-integrated utilities, those utilities will run into more conflicts with third parties like Sunrun.

Hoskins said Sunrun will continue to argue that regulators should allow third parties, not just utilities, to manage virtual power plants in regulated utility service territories on the basis that doing so will create competitive forces that can cut costs for the software used to aggregate DERs. "If there are competitors willing to [manage DERs], that can raise capital that doesn't have to come from ratepayers, regulators should ask why would they want ratepayers to cover this?"

PROJECT SPOTLIGHT

California virtual power plant is the first to operate in the U.S.

NAME

Southern California VPP, managed by Stem.

PURPOSE

In 2014, Stem won a contract to provide utility Southern California Edison with 85 MW of capacity from distributed storage. Stem now manages a network of batteries installed in dozens of buildings across the west Los Angeles Basin.

STATUS

The project began operation in 2016 and was the first fully commercial aggregated distributed storage project in the US, according to a Stem spokesperson. Stem recently more than doubled the size of the VPP with the addition of installed batteries acquired from a former competitor, the spokesperson said.

IMPACT

In addition to providing resource adequacy, Stem also bids the project's energy output into the wholesale market. "Even if we didn't have a contract, we could just bid [the batteries] into the ancillary services market," according to Stem Vice President of Policy and Regulatory Affairs Ted Ko.

Aggregators also claim they can do things with DERMS that utilities simply cannot, and that this disparity is only growing as the technology matures. DERMS use machine learning to be able to forecast the optimal times to dispatch DERs given weather, electricity prices and other factors. Now, they are incorporating more sophisticated artificial intelligence that makes these systems so complicated that they are "not something you would sell to a utility — that's not their expertise," Stem's Ted Ko said.

PPL is telling Pennsylvania regulators that it needs to build out its DERMS capability to gather data on the distributed energy growing in its service territory and forecast how these resources will cause energy to fluctuate. The Pennsylvania PUC's case considering PPL's petition — as well as the objections from Sunrun and others — will resume with an evidentiary hearing in September.

Follow Matthew Bandyk on [Twitter](#)

https://www.utilitydive.com/news/propelling-the-transition-the-battle-for-control-of-virtual-power-plants-i/581875/?utm_source=Sailthru&utm_medium=email&utm_campaign=Issue:%202020-08-18%20Utility%20Dive%20Storage%20%5Bissue:29148%5D&utm_term=Utility%20Dive:%20Storage