

HOW TO USE UTILITY DATA TO PREPARE FOR EMERGING VPP OPPORTUNITIES



The rapid adoption of electric vehicles (EVs) and electrified home appliances – like heat pumps and water heaters – is expected to create a surge in total electric demand and peak demand in markets across the United States.

Electric load growth and new demand peaks present opportunities and challenges for utilities, cooperatives, and generators. These organizations need new, cost-effective resources to meet the growing demand, maintain grid reliability, and capture the value of an increasing power market.

The historical answer to serve growing power demand has been more generation, more transmission and distribution, and as much energy efficiency as possible. But as digital, connected smart technologies have advanced in recent years, flexible demand management has emerged as a new resource in the utility toolbox. Virtual power plants (VPPs) represent one of the most promising frontiers in this new flexible energy landscape to meet the needs of the electric grid of the future.

This white paper, presented in partnership with NextEra Analytics, explores the following:

- What constitutes a VPP
- Key steps to form a VPP
- How to manage and analyze data to effectively operate and optimize a VPP
- How one VPP pilot is proving the concept in Texas

LOOKING FOR ANSWERS TO ELECTRIFICATION AND CLEAN GRID CHALLENGES

For utilities, co-ops, and independent power producers (IPPs), taking action to meet new electric demand is nothing new. The conventional way of meeting load growth, particularly increased peak demand, is to build new generation, often paired with new transmission. New infrastructure can be an expensive investment, but utility customers — and regulators — aren't keen to see rates surge as the average consumer's electric use increases. These competing pressures and the increasing cost of capital are challenging utilities to find low-cost alternatives.

A concurrent challenge comes with the growth of intermittent renewable energy in most parts of the United States. Electrification is driving demand, but EVs and heat pumps aren't necessarily drawing power when renewable resources like solar are generating.

Matching newly electrified sources of demand with renewable sources of supply isn't always easy. Most utilities are working to meet aggressive state or corporate decarbonization mandates, which means they must find ways to serve their loads with clean energy rather than traditional natural gas-fired peaking plants and coal-fired baseload plants.

NextEra 360™ energy management provides a comprehensive, integrated hardware and software solution to do portfolio-level optimization. We are currently working with numerous front-of-the-meter and behind-the-meter customers to provide grid services for increased revenue stacking and energy savings. Our solutions currently span from single-site with multiple resource aggregation — also referred to as colocated and hybrid plant optimization — to the orchestration of multiple devices that are geographically dispersed, which has driven our VPP optimization offerings.



VPPS EMERGE AS SOLUTION AT THE NEXUS OF ELECTRIFICATION AND CLEAN ENERGY

VPPs can be a demand-side management solution to offset the need for a supply-side resource adequacy solution, such as investments in expensive, new peaking generation.

According to the Brattle Group, U.S. utilities spent over \$120 billion on 100 GW of new generation capacity in the last decade for resource adequacy. However, moving forward, the Brattle Group found that utilities could [save up to \\$35 billion](#) by 2033 compared to the cost of resource adequacy alternatives by deploying an additional 60 GW of VPPs.

VPPs can serve more than resource adequacy. They can create new revenue opportunities for non-traditional power technologies to sell into the electricity markets, which are offering attractive economics for meeting capacity, peak load, and emergency condition needs.

In its [“Pathways to Commercial Liftoff: Virtual Power Plants”](#) report, the U.S. Department of Energy (DOE) said deploying 80 to 160 GW of VPPs by 2030 would expand the U.S. grid’s capacity to support rapid electrification, reduce grid spending on peaker plants, and reduce overall grid costs. The DOE estimated that the level of VPP deployment would cut U.S. grid spending by \$10 billion per year. These gains will both directly and indirectly benefit end-use customers, making VPPs attractive to a wide variety of stakeholders.

WHAT IS A VPP?

The potential of VPPs is compelling, but the technology is new enough that most utilities and industry experts are still grappling with the basics. Namely, what, in practice, constitutes a VPP?

There’s no agreed-upon answer, which is why the DOE provides a wide range of 30 to 60 GW when estimating how much VPP capacity exists in the U.S. today. There is, at least, an agreed-upon theoretical definition. According to the Rocky Mountain Institute, a VPP is a [grid-integrated aggregation](#) of distributed energy resources (DERs) that are highly automated and capable of rapidly responding to signals from grid operators or other asset controllers. Utilities or independent system operators (ISOs) might use the term in broader or more narrow ways, so it’s always important to check for the relevant definition when working within a specific program.

VPPs evolved from utilities’ decades of experience in demand response (DR). DR has steadily become less manual and more automated as smart technologies become increasingly advanced and ubiquitous.

Among the DERs that can be aggregated into VPPs are DR and distributed generation resources, such as rooftop solar systems, battery energy storage systems (BESSs), EVs, EV chargers, smart thermostats, water heaters, and many other connected devices. Many DER types that can be aggregated are often owned by utility customers, not the utility, which has important implications for those who want to provide VPP solutions. One such implication is that an aggregation of DER owners needs to be incentivized for the use of their assets.

Fortunately, DR programs authorizing utilities to pay participants and new rules allowing aggregated DER generation to be sold into spot wholesale electricity markets have created mechanisms to make owner incentives cost-effective.

TO GET IN POSITION FOR A VPP-ENABLED FUTURE, START BY GETTING SMARTER WITH DATA

Data is king. It is the foundation of any VPP.

Data is needed to understand, at a minimum, how much generation or energy savings an aggregated group of DERs could deliver. It's essential to understand how the total resource changes based on the time of day and the impact of requirements laid out in contracts with DER owners, such as a maximum number of uses, energy availability, minimum state-of-charge, etc. Data is also needed to understand how certain VPP operational decisions impact DER enrollment declines or growth.

Due to the rollout of advanced metering infrastructure (AMI) over the last 20 years, most utilities across the nation are already collecting the data they need. Now, the key is to get smarter about using the data that utilities have.

A utility must first ensure they are storing relevant data, such as customer home loads, output of solar PV, state of charge of batteries, and grid data across distribution feeders and transmission nodes. Ensuring there is a robust dataset will allow both insight and testing.

From this data, utilities can develop advanced analytics and forecasting to understand potential future VPP capabilities. A robust mix of historical, real-time, and predictive data analytics can all yield insights that empower utilities to form and optimize VPPs. Depending upon the time horizon for which the utility is making decisions, the VPP can be leveraged for investment deferral or hedge management, saving their utility customers up to millions of dollars spent on wholesale power production and consumption.

With a variety of software solutions available, the key is finding one that helps store the data and begins predictive analysis. Software solutions can help establish a baseline for DR programs and capacity forecasts for market-integrated programs. Some solutions can also point to areas of the grid where the response might be higher, necessitating equipment upgrades.



For utilities interested in market-integrated programs, it is important to consider the frequency with which data can be updated, as some programs have strict requirements for telemetry. A software partner with experience with utility-scale assets can provide further insights into onboarding assets and market integration. Utilities and aggregators can also benefit from working with companies with real-time operations experience since some programs require 24/7 support.

Utilities have been hearing the call to better leverage their data for years. VPPs are one more compelling reason to act now to invest in comprehensive software solutions that position data to produce real value.

SIX ACTIONS TO LAUNCH A VPP AND SCALE THE PROGRAM

Smart management of AMI data via software solutions is a critical, no-regrets step any utility should take on its VPP journey. It's a no-regrets action in that, even if a utility never actually deploys a VPP, it will gain countless benefits from the insights delivered through data management software — everything from improved forecasting to better DR to expanded grid automation capabilities. IPPs and other DER aggregators participating in capacity markets, DR programs, and wholesale energy markets can achieve similar value with data management software.

There are several additional critical steps utilities and others can take to move along the pathway from dipping a toe in the VPP waters to deploying a full-scale VPP portfolio.

1. Learn from the data. AMI data helps utilities learn about their portfolio, customers, and flexible demand assets on their grids. Ask important questions, such as, “When do we need to start responding on high-demand days to avoid wholesale price exposure?” or “How can we call on customer-owned DERs to respond to demand without them feeling negative consequences?” The answers are in the data. Utilities can use the data insights to understand demand flexibility restraints.

2. Start small with flexible demand management. Many utilities today are just beginning to develop flexible demand programs. Most utilities that aren't at the vanguard should work on launching or strengthening DR programs and building out basic flexible demand management capabilities, such as adjusting thermostats during high-demand events or shifting the times when EV chargers and water heaters use energy. These capabilities are all building blocks toward deploying a VPP.

3. Get agreements in place with customers. Businesses interested in controlling customer-owned DERs located behind the meter as VPP assets need strong contracts in place that provide flexibility to deliver promised generation or energy savings while also adequately incentivizing DER owners to participate.

4. Educate regulators and policymakers on the need for supportive rules. In many cases, regulated investor-owned utilities, municipal utilities, and co-ops might not yet be able to deploy a VPP because they require authority in the form of a new rule from regulators. Through the Bipartisan Infrastructure Law,

Inflation Reduction Act, and Federal Energy Regulatory Commission (FERC) Order 2022, the federal government has become an active proponent of DER aggregation and VPP deployment. Utilities and co-ops should build on that momentum by advocating for state policymakers and regulators to help their state unlock federal funds for VPPs and the benefits VPPs deliver to taxpayers.

5. Ensure an effective certification process for aggregators. FERC Order 2022 directs ISOs to accommodate the participation of DER aggregations in markets. However, DER aggregations introduce new kinds of uncertainty related to the availability and amount of the resource. Utilities, IPPs, other third-party aggregators, and ISOs must work closely together on certification processes that ensure aggregations best serve the market.

6. Share best practices and learnings. At this early stage, no one has the operation and optimization of VPPs exactly right. There will be bumps in the road as VPP operators learn what they can reliably deliver and regulators and ISOs learn to accommodate the differences of flexible demand resources compared to traditional generation. As electricity market stakeholders travel down this road together, VPPs will mature faster, and the market will grow quicker if participants share key learnings from early VPP pilots.

CASE IN POINT: GEXA ENERGY

Gexa Energy launched its demand response program in 2020 with the help of NextEra 360™ comprehensive energy management software.



How it works: Gexa enrolls residential and commercial customers who want to benefit from their distributed energy resources — such as their smart thermostats, EV chargers, solar inverters, and battery storage — into its demand response program. Once customers enroll, Gexa leverages the NextEra 360 solution to aggregate the resources from the customers, manage them, schedule the supply of energy into the market, and integrate it into ERCOT to offset high settlement point prices in times of peak demand. The result of this is a generator, or VPP, powered by existing resources in the community that can contribute to the grid in times of peak demand.

Data and details: As of Q4 2023, Gexa has over 10 thousand devices connected through its demand response program. Gexa has run hundreds of events since the start of the program. In the summer of 2023, Gexa ran over 50 demand response events across multiple devices and deferred over 500 MWh of peak load through the platform.

While Gexa is able to manage specific customer resources during high-demand events, its customers maintain full visibility and control of their energy assets — meaning that they have the option to override demand response events and manage their assets themselves, if they'd like. Gexa operates this program under customer-set parameters and preferences to best align with their behaviors to maximize the value of their existing assets.

Key takeaways: Managing demand response through VPPs can be a mutually beneficial opportunity for customers and utility suppliers. By utilizing the NextEra 360 solution in its demand response program, Gexa was able to reduce supply costs for customers and create more customer engagement while reducing carbon emissions and providing systematic efficiency.

CONCLUSION

Electrification is an opportunity for utilities, co-ops, and IPPs, but it is not without challenges. Ensuring resource adequacy the traditional way with more generation and transmission is costly. A tighter supply-demand environment is difficult for market stakeholders to navigate and can lead to significant price exposure during high-demand events.

Flexible demand management has emerged as an often-low-cost solution, thanks to the explosion of smart technology inside thermostats, home appliances, distributed solar systems, EVs, and BESSs. As an automated and potentially large-scale resource, VPPs represent the next great frontier of flexible demand management. They have the potential to save

billions in the form of offset or deferred spending, as well as create new revenue streams by bringing a new resource into the wholesale electricity markets.

The road from DR basics to VPP deployment isn't easy, though, and even the most advanced utilities have a long way to go before launching VPP programs at scale.

However, the value and vision are clear. Utilities can start their journey today by improving how they use their existing data.

NextEra Analytics can help utilities and other organizations collect the right analytics and then help put them to use for improved decision-making. With its experience serving regulated utility and merchant IPP operations within the NextEra corporate family, NextEra Analytics understands its partners' core concerns and requirements, from the need to conform to strict market rules or regulatory guidelines to the imperative to steward ratepayer funds. The NextEra Analytics team developed NextEra 360 comprehensive energy management software to reduce energy costs and carbon emissions, manage risks, optimize asset performance, and improve return on investments.

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