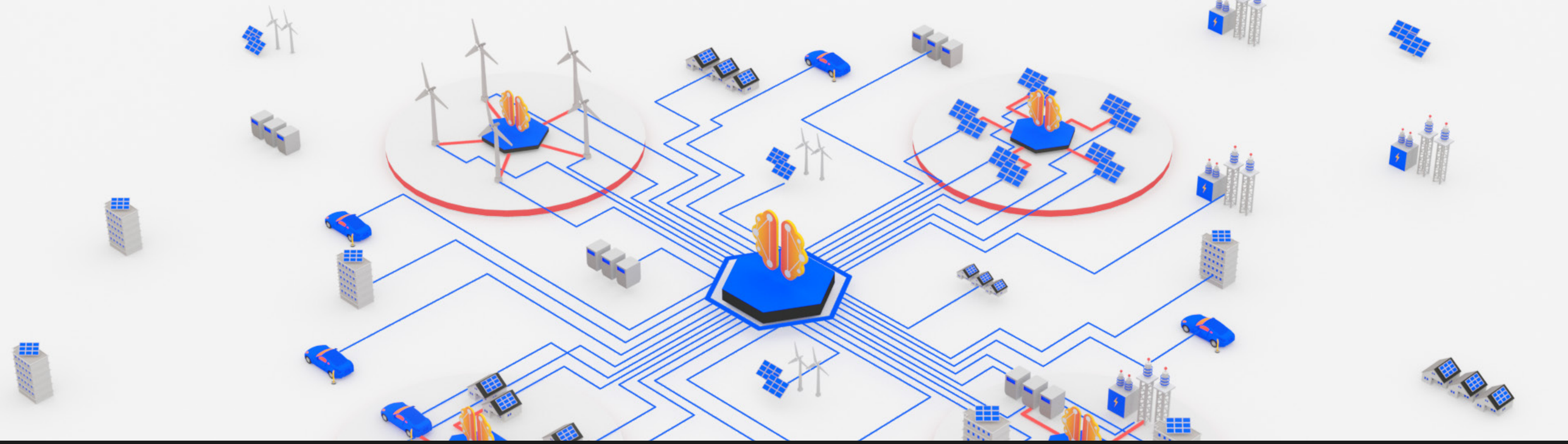

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DERMS: Yes or No for Your Utility?

Evaluating Microgrid Controllers as the Next Step to a Resilient, Renewable Grid

YOKOGAWA

Introduction

This white paper—the third in a three-part series— outlines how and when a distributed energy resource management system (DERMS) can help utilities navigate challenges and create a road map to a fully renewable, multidirectional, resilient grid. Part one looks at challenges utilities face managing DERs on their systems, and part two explains how microgrid controllers can help.

As the grid gets cleaner and serves a complex web of intermittent supply and demand requests, utilities must maintain resiliency, provide affordable rates, and enable a proliferation of customer distributed energy resources (DERs). To successfully meet these challenges, utilities need more insight into the grid edge and must secure some control over customer-owned DERs to predict, plan and manage grid operations and resources.

While it may take some time to solve operational challenges, technologies are available today to get a grip on the grid. Utilities can avoid a patchwork approach and proceed holistically to develop a resilient, renewable grid. The correct first step for each utility depends on its approach to controlling assets, the conditions on its system, and its relationship with its customers.

A DERMS is the right next step for utilities that want a broad distributed layer of visibility into and control over customer-owned DERs. The visibility and system-wide control a DERMS provides enables optimal planning and smooth operation with the maximum level of DERs on the grid.

The first white paper in this series, Six Challenges Every Utility Must Assess to Form a Roadmap to a Resilient, Renewable Grid, reviews the common grid challenges utilities face amid rapid system transformation. To draft the right road map and know when and where to implement a DERMS, it's important to discern if each challenge is critical, emerging, or a longer-term concern.

How to Determine the Next Step to Solve Today's Grid Challenges

Grid operators and planners shouldn't (and can't afford to) wait to solve reliability issues and network and hosting capacity constraints. There are multiple paths forward to solve emerging grid challenges today. Which path a utility takes depends on its answers to three questions:

1. **What is your utility's philosophy toward managing customer-owned assets located behind the meter?**
   DERMS are effective when used for system-wide planning and optimization enabled by data collection from and control of customer-owned assets. If controlling behind-the-meter assets isn't a priority, a DERMS may not be the best solution.

2. **What is the depth of your utility's relationship with its residential, industrial, and commercial customers?**
   A utility with a strong presence "inside customer homes" via programs like demand response can use a DERMS to leverage behind-the-meter assets for the holistic benefit of the entire grid.

3. **What are the current conditions on the utility's grid?**
   A utility operating a grid facing a widespread increase of DERs and EVs should take a different approach than a utility challenged more by localized grid strain, such as a new housing development with of high solar and EV penetration.

A utility presents a strong use case for implementing a DERMS now if it seeks insights into customer-owned assets and control of them along with a desire to enable additional customer DERs on their grid. In an ideal scenario, the utility has already developed deep relationships with customers behind the meter, and it prioritizes system-wide planning and optimization to accommodate a complex web of intermittent supply and demand requests. Time is of the essence for this utility because it's much more cost effective to implement a distributed layer of control and build system architecture around it before the anticipated DERs are online.

The Case for a DERMS as the Next Step Toward Renewables and Resilience

A narrow definition of a DERMS sees it only as a way to operate a virtual power plant—that is, to call for more energy supply or reduce demand at points across the grid when needed. Under this definition, the controller doesn't consider whether grid infrastructure can handle the load changes requested. It also misses the true, primary use for a DERMS, which is to act as a distributed layer of control that allows utilities to operate a grid with high DER penetration.

Artificial intelligence-based decision-making allows PXiSE's DERMS to use historical data combined with forecasts to plan ahead, pivot when needed based on emerging new data, and automatically optimize grid operations. It coordinates the tsunami of requests to maximize production and minimize curtailments from intermittent systems. Its DERMS applications include centralized, fleet, and edge or field uses that provide utility grid operators the ability to see and act rather than wait and react.

Under that all-encompassing definition, a DERMS can be the next step in a strategy to address common grid challenges. Because many of the common challenges are interrelated, each benefit offered by a DERMS can help solve several issues at once.

How DERMS Address Grid Challenges

Responsive control for a new paradigm

The sun rises and sets on solar PV systems. Winds ebb and flow at utility-scale wind farms. EVs plug-in and unplug with the rhythms of daily life. All these growing sources of intermittent supply and demand are changing the shape of load profiles across utility grid systems. The old demand curve is out. The duck curve is in. A DERMS is the coordination layer of a grid-control solution that is designed to respond to what customers need while factoring in DER production estimates and constraints. The result is efficient and effective planning for customer- and utility-owned assets so they send and receive energy when and where it's needed.

Digital accuracy and speed

Without the right data collection and predictive analytics, DERs leave grid operators at the mercy of unexpected moment-to-moment changes. Grid operators relying on conventional SCADA systems face multi-second lag times and rely on human responses to address challenges. It's an analog approach to tackling a digital world. A DERMS provides system-wide visibility, enabling artificial intelligence-based planning and network-optimized local decisions within the context of the bigger picture across the entire grid. These automated decisions efficiently schedule assets and grid operations by applying machine-learning to data from the grid that is delivered 200 times faster than the sampling range of conventional SCADA systems.

Maximum DERs

Grids with outdated controls become less reliable as rising numbers of renewable energy assets and other DERs lead to intermittency-related issues. Oftentimes, grid operators will resort to unsustainable patchwork solutions to work around the challenge as it intensifies. A DERMS expands local hosting capacity and scale to control the maximum amount of DERs, microgrids, and fleets of storage and renewable assets in one system. This also helps utilities reach carbon emission reduction goals and offer more equitable grid connection to customers.

Cyber security

With high-profile cases of hackers shuttering critical energy infrastructure, network security is top of mind for utilities. However, bringing more DERs onto the grid only increases the risk. DERMSs coordinate DERs in front of and behind the meter, alongside traditional grid components, on a single network with an integrated software platform that controls the dynamic two-way flow of energy. This maintains network-wide security by enabling appropriate security protocols for both physical and cyber threats, providing secure communication with DERs via enabled gateways, meeting compliance needs with role-based authentication and multifactor authorization, and reducing silos by integrating with existing utility data and operational systems.

Gain regulatory support

Utilities must justify expenses to win regulatory support for their grid road map. DERMS automate individual and aggregate DERs, forecast environmental impacts on operational conditions to maximize use of assets, and improve power quality by smoothing power output with ramp control during periods of intermittency. All this helps utilities realize cost savings by optimizing system efficiency and improving overall grid reliability.

DERMS in Action

An ideal scenario for DERMS as a distributed layer of control occurs when there is high adoption of distributed solar across a service territory, an area is aggressively pursuing EV adoption, the utility has strong customer engagement programs as well as the desire and capability to manage customer resources, and the utility wants to limit power shutoffs or DER energy curtailment.

Horizon Power was facing a similar scenario in Western Australia, where it wanted to enable a high amount of customer DERs and engage customers through new programs that would give the utility a level of control over customer resources. In the remote coastal community of Onslow, a wealth of solar and battery storage had come online to complement the region's traditional power source supplied by fossil-fuel generators. In addition to reaching its maximum hosting capacity for customer solar PV, the microgrid was also experiencing challenges posed by the intermittency of solar PV, which can wreak havoc on the network and its equipment, especially on a system that's not connected to a larger grid network.

In 2020, Horizon Power installed a DERMS solution to balance and coordinate all of the community's DERs. The DERMS tripled the hosting capacity for customer DERs and will also enable scaling back of the fossil-fuel generators. Horizon Power plans to expand the solution throughout its service territory over time. Like other rural utilities around the world, Horizon Power faces an enormous challenge in providing reliable electricity to some of the most remote communities scattered across a wide area, which makes local power generation key.

Next Steps

Whether a territory's grid is on the precipice of rapid DER integration or faces a slower build toward high penetration of those resources, there are steps utilities should take now to determine their future with DERMS.

1 **Complete an assessment of customer-owned resources and customer engagement:**
The current and projected volume of DERs across a utility's grid is a key determining factor of whether implementing a DERMS is the right next step to manage the challenges of a complex grid. A utility should also assess its existing customer programs as well as its potential to control customer-owned resources. DERMS are ideal for utilities with the desire and capability to manage customers' DERs and incorporate that control into grid operation and planning.

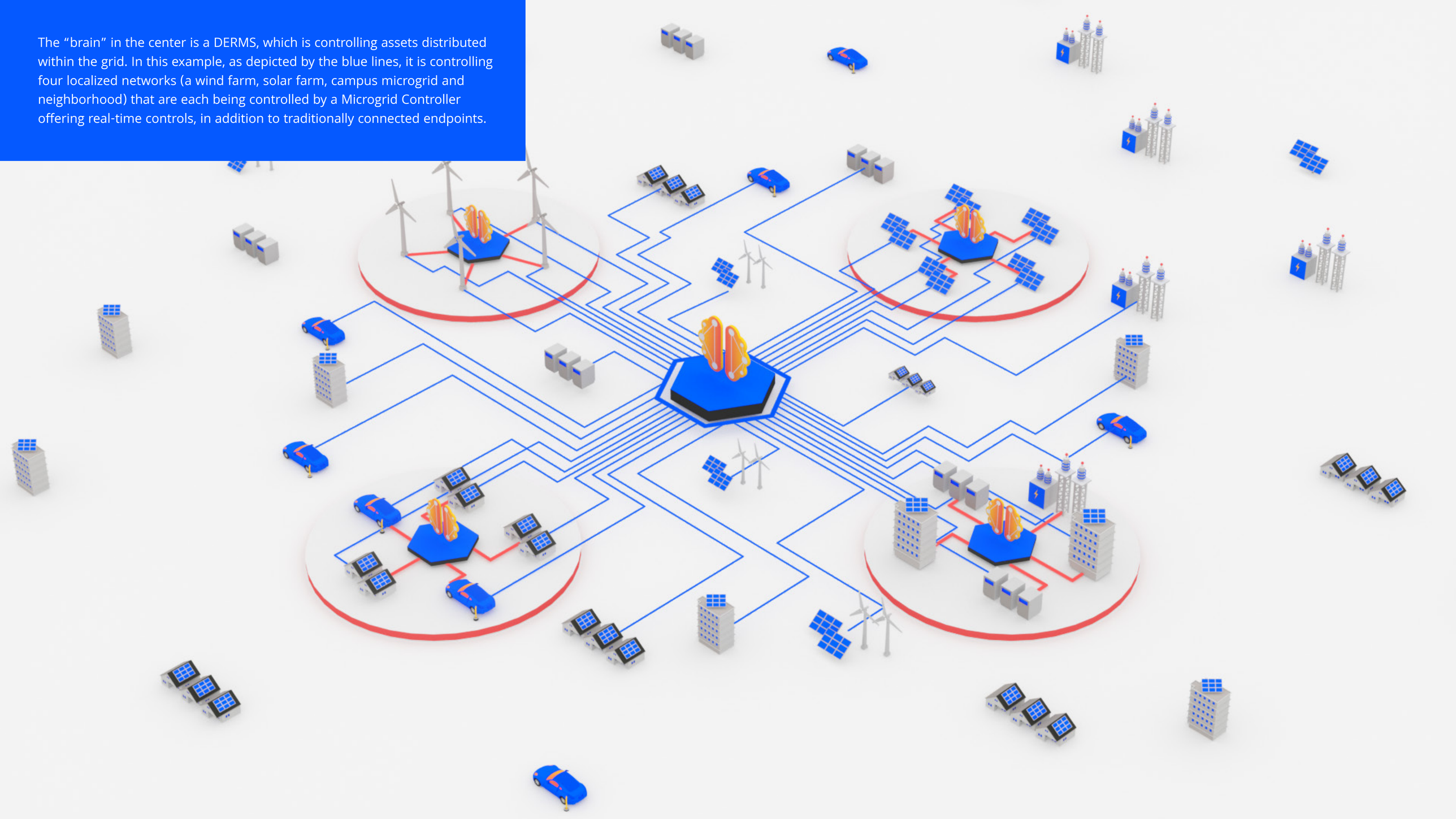
2 **Determine if DERMS is the right next step:**
Utilities with the desire and capability to control customer DERs and seek to address DER growth at the system level should consider deploying a DERMS solution. Utilities and regulators can be hesitant to transition centralized control of the broader grid to a DERMS, so pilot projects are a useful approach to start. As seen in the Horizon Power example in Australia, a DERMS can provide immediate benefits for regional and remote communities.

3 **Engage key stakeholders in deeper conversations:**
DERMS are new to the utility industry; there's a need for discussion and education. Regulatory structures, such as rate cases, aren't structured to easily accommodate these deeper conversations. It will be helpful to create or participate in forums that create awareness of the issues. Doing so allows utilities, regulators, solar and storage providers, tech companies, and others to participate in the iteration of the 21st century grid.

4 **Bring silos together to create a road map to a resilient, renewable grid:**
At the utility level, planners, operators, and strategy groups must break down their silos and work together. Utilities were built for top-down planning in a world where central generation was delivered to homes and businesses. Today, a bottom-up approach is needed to manage a decentralized, intermittent, multidirectional grid matrix. Collaborative testing, evaluation and planning will help utilities shift from a reactive mindset to a strategic one. With all three groups working together to create a grid road map, utilities will obtain a more holistic, accurate view of how to approach DER integration.

Regardless of whether a DERMS solution or a microgrid controller offering real-time control is the right next step, combining the two later on a utility's grid road map will ultimately enable the final destination: centralized control of a complex web of microgrids and DERs for optimal planning and real-time operation that holistically solves challenges for the new grid.

The “brain” in the center is a DERMS, which is controlling assets distributed within the grid. In this example, as depicted by the blue lines, it is controlling four localized networks (a wind farm, solar farm, campus microgrid and neighborhood) that are each being controlled by a Microgrid Controller offering real-time controls, in addition to traditionally connected endpoints.



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PXiSE Energy Solutions offers configurable and scalable solutions for the evolving grid, including the PXiSE Microgrid Controller and PXiSE DERMS. Contact PXiSE to discuss how these solutions can be the basis of your road map to a resilient, renewable grid.

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