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Distribution Grid Edge is Expanding Fast. Are You Ready?

A case for Distributed Energy Resource Management Systems (DERMS) for advanced control of the grid

Whitepaper – June 2017

Overview

If you haven't heard the term 'DERMS' yet, expect to soon. It stands for Distributed Energy Resource Management System, a software solution for distribution utilities designed to organize and intelligently manage the growing number of grid-edge resources being added to the electric grid, such as residential solar, energy storage and electric vehicles.

These resources drive grid complexity and adds risk for distribution utilities as they strive to fulfill their obligation to maintain grid stability and reliability. But this risk diminishes if utility operators have visibility and can control the new assets on the distribution grid regardless of who owns or operates the assets. That's where DERMS comes into play.

Risk diminshes if utilities can ‘see’ and control new assets on the distribution grid

If you are a utility already experiencing the distributed energy revolution, demand is upon you to visualize and manage at least some of these devices at the grid edge. For others, the problem may seem far off. But given the velocity of change occurring for utilities, it may be closer at hand than you think. Consider that:

- It took 16 years for the number of solar installations in the U.S. to go from 1,000 to 1,000,000, a milestone achieved in 2016. Now we’re heading for a doubling in just two years to 2,000,000 by 2018.
- Energy storage grew from annual installations of 0.34 GW in 2012/2013 to 6 GW in 2017, and is expected to reach 40 GW by 2022.
- Analysts see electric vehicle sales growing 90-fold, by 2040 reaching 41 million, 35 percent of new car sales.

The grid edge is beginning to populate with these resources, and they will revolutionize the relationship between utilities and their customers. In the future, distribution utilities will have to manage millions of prosumers – customers that both consume and produce energy – a completely different function from the traditional management of poles & wires that distribution utilities have maintained in the past for a one-way flow of electricity.

Prosumers are likely to sell excess power to the grid from their solar and energy storage systems (even their cars), based on the price of electricity for a forecasted period. They also may have energy-consuming appliances that they offer up as grid assets in exchange for credits or payment. This means that the utility may find itself adjusting home air conditioners up and down based on parameters set by the household, or scheduling the outdoor pool pump to run at night to better distribute loads on the grid over a 24-hour period.

Such services and technologies have market value and will require utilities to make investments in existing grid technology, both software and hardware, to fully modernize and enable these capabilities.

In addition, these changes will give rise to new business models and players. Already aggregators are beginning to act as third-party intermediaries, consolidating the distributed loads – particularly batteries housed in fleets of commercial buildings – and presenting them on the grid as one entity. This new relationship between utility and aggregator adds yet another dimension to utility operations and planning.

All of this complexity adds risk for distribution utilities as they strive to fulfill their obligation to maintain grid stability and reliability. But this risk diminishes if they can ‘see’ and control the new assets on the distribution grid regardless of who owns or operates the assets. That’s where DERMS comes into play.

What is DERMS and Why is it Needed?

Utilities face three main challenges in managing resources on today’s increasingly complex distribution system.

First, they must meet heightened expectations from both regulators and their own corporate leadership to achieve high reliability metrics, and do so by investing efficiently and prudently. Second, they must install digitization technologies to handle exponentially increasing amounts of network data. And finally, utilities must optimally manage distributed energy resources to meet safety, operations and economic goals.

DERMS is a control platform that allows utilities to visualize, manage and in some cases economically optimize energy resources on the grid that may not be owned by the utility, like household rooftop solar. These resources, both loads and generation sources, are likely to be on a customer’s premises or other parts of the ‘grid edge.’

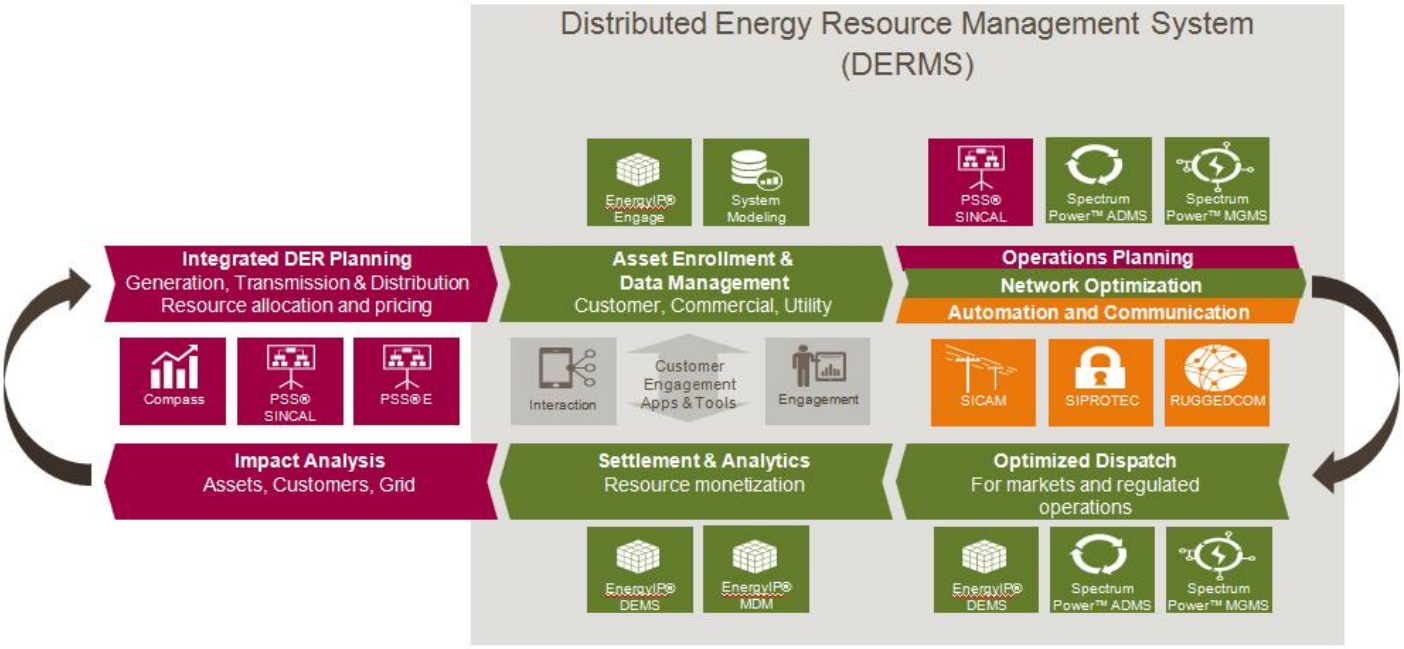

Figure 1. Siemens Integrated DER Portfolio

Highly intelligent and versatile, DERMS serves three main functions. First, it helps the utility operate its distribution grid by balancing network constraints based on both forecasted and actual levels of DER. Second, DERMS acts as a customer relationship and management tool, as utilities interact with customers, not just as buyers of electricity, but as partners in supplying grid resources. Third, DERMS optimizes available resources to ensure economic gain for both prosumers and the utility.

The advantages offered by DERMs include:

1. Ensures network safety and reliability

Certain distributed energy resources (DERs), wind and solar in particular, function intermittently. A sudden cloud cover, or halt in wind, causes them to stop producing power. This creates a high level of fluctuating, two-way power flow, leading to operational uncertainty. As distributed generation is added in greater numbers, and not necessarily in a geographically uniform fashion, the operational concerns intensify.

DERMS helps the utility plan ahead to bring supply and demand in balance so as to not exceed the constraints of the network and cause an outage.

DERMS integrates with forecasting services to predict renewable generation and automatically make operational recommendations for resource ramping or load shedding.

2. Enables integration and adoption of distributed energy

Consumers have made clear in poll after poll that they favor distributed energy. And in certain parts of the country, regulators are mandating that utilities bring more distributed energy onto the grid, particularly renewables. DERMS enables utilities to easily enroll customer assets into DER programs, manages the massive amount of asset information received by the utility, and integrates the information into other utility systems. DER management is a completely new function for distribution utilities and DERMS software provides the capabilities to realize the DER benefits and engagement levels that prosumers are beginning to expect.

3. Leverages economic benefits of distributed energy

New revenue streams are opening up to distributed energy resources, such as through participation in ancillary services markets. Utilities are better able to leverage these revenue streams when they have a clear understanding of all energy sources available to them, where they are, and how and when they produce power. DERMS offers such clarity. DERMS provides optimized dispatch of DER for both market participation as well as regulated operations, economic settlement for billing, and advanced analytics for the utility to ensure business returns.

What Functions Does DERMS Provide?

Speaks to individuals or aggregators

DERMS can manage the many individual distributed energy resources on a utility's distribution grid or it can 'speak' to an aggregator who is managing those devices, perhaps thousands of household solar rooftops or a group of commercial buildings with onsite batteries. Brought together in an aggregation, these resources act as a single virtual power plant on the grid. DERMS allows the utility to interact with them as such.

Integrates with other utility systems to enhance grid reliability

DERMS will be integrated with a variety of other utility software systems as DER information becomes more critical throughout the utility. Systems, such as planning software, Meter Data Management, and Advanced Distribution Management, will all share data back-and-forth seamlessly in real-time to fully enable DERMS' capabilities for both the network and economic optimization.

Visualizes with granularity in real-time

It's not enough to know how the resources act as a group. The utility also needs to model each type of equipment in real-time, down to each solar installation or battery, for example. It can then determine the impact of the resource on the utility's distributed network.

This process is even more granular than it sounds. Each piece of equipment may come with certain constraints. Perhaps a substation's capacity limitations mean only half the neighborhood can install rooftop solar. Or maybe the constraint is business-related – say the customer will only allow 2-degree load shifting of an air conditioning unit.

DERMS can be configured to model these system constraints – whether they be physical network limitations, consumer driven, or economic conditions. The utility can then optimize its network with refined precision to meet its power needs at any time of day, based on the predicted availability of distributed energy resources. It even will register the arrival of new distributed energy resources as they are installed, including details about the equipment used, such as the sophistication of the inverter.

Optimizes for economics

DERMS also helps the utility tap into the growing market opportunities available to distributed energy resources. Today, these might involve load shedding or selling capacity or ancillary services into wholesale power markets. Tomorrow, this may mean transacting on a distributed energy exchange platform, as envisioned in New York.

With DERMS, the utility can determine which opportunities offer best value for the customer and for the grid. Instead of each consumer (or aggregator) bidding into the market, the utility may do so on their behalf.

When transacting in wholesale markets, DERMS can calculate the value of aggregations or reach down all the way to the household level to determine market availability and worth. And DERMS can respond to control signals set from a variety of platforms – from energy management systems to Independent System Operators or Regional Transmission Organizations.

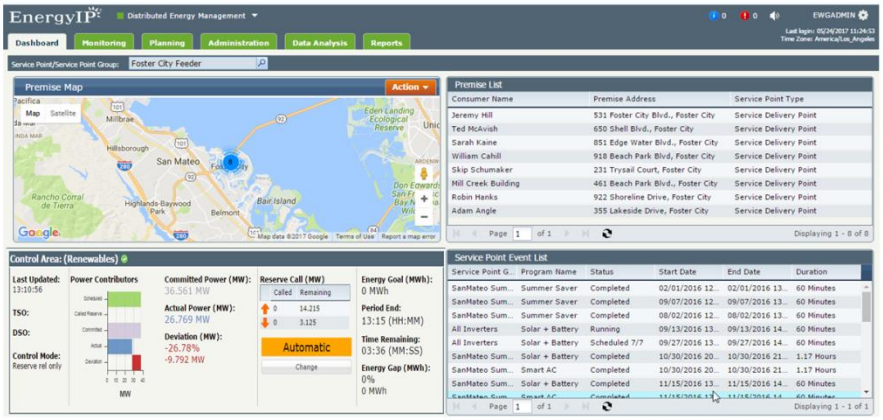

Figure 2. Siemens DERMS Dashboard

Utility Challenges Ahead on the Changing Grid

It's clear that the distributed energy revolution is changing the way utilities operate. This is creating new working relationships among departments within a utility, and between utilities and outside entities.

Consider, for example, what utility planning, operations, and customer relations responsibilities include when distributed networks come into play.

Planning departments will need to better integrate generation, transmission, and distribution planning activities to ensure the utility allocates resources and investment in the right areas at the right time. An internal function once conducted on a yearly-plus basis, such planning now takes on a real-time dimension as DER growth explodes on our grids. Further, as utilities simulate network constraints and make investment roadmaps according to predicted load growth and asset age, they must consider – and clearly understand – how DER impacts not only the distribution grid but also the prosumer.

Meanwhile, operations staff, which has traditionally managed the one-way flow of energy from power plant to consumer, finds itself now managing a two-way power flow – from power plant to consumer and from prosumer back to the grid. So it's no longer enough to control and visualize up to the generation source.

Like planning, the operations staff needs visibility and control down to the household, too – data that is available within the DERMS software.

Utility customer relations departments also find their work changing, as more and more customers add solar and storage. Suddenly the department is no longer just about signing up new accounts or managing billing. Instead, workers find themselves reviewing, approving, and onboarding a prosumer's solar panels, ensuring that the system meets interconnection requirements and managing economic settlements.

At the same time, the clear line between the three – planning, operations and customer relations – is diminishing as all find distributed energy management in their work missions. As a result, job roles and descriptions will change to foster closer, real-time collaboration.

Meanwhile, utilities see their outside relationships changing, too. Aggregators, a new entity, are gaining ground. Utilities need to learn how aggregators work – and how utilities can work with them – in terms of information flow and business transactions.

How can utilities and aggregators create value together?

The answer may differ from region-to-region, given that state regulatory rules vary. The variation in rules also influence how utilities will connect to distributed devices, cybersecurity requirements and other, technical and regulatory functions. A lack of uniform standards and policies nationwide only makes the transition to a distributed grid more difficult.

As the grid edge reshapes, Siemens brings its depth and breadth of expertise in taking on these tough, new challenges and making them work to strengthen utility operations and relationships. Siemens leads in utility control products and in management of grid edge devices. Our DERMS product integrates the two capabilities with a degree of experience, sophistication, and flexibility not found elsewhere in the industry.

Right now, you may be thinking that DERMS sounds like a possibility for your utility in the future, perhaps when your territory has the density of solar rooftops found in California. But get ready. When it comes to change at the grid edge, the future is not far off, and California's about to have competition.

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