

Innovation

DERMS: Software and Communications for Grid Integration

Researchers Envision App Managing Millions of Distributed Energy Resources

By Matthew Hirsch

Who Knows What DERMS Is?

In a recent presentation about future grid innovations, EPRI Technical Executive Brian Seal gave the utility representatives in the audience a pop quiz. “I asked who had heard of DERMS,” said Seal, whose research addresses communication systems for distributed renewables. “Almost all the hands went up.” DERMS, or Distributed Energy Resources Management Systems, are new types of software and communication systems that manage distributed energy resources (DER) such as solar photovoltaic and battery storage systems. Such systems are envisioned to connect to thousands or someday millions of smart inverters, managing them in organized groups and simplifying their integration with distribution management systems and the rest of the utility enterprise.



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Who Has DERMS on Their Systems?

“Then I asked who had DERMS, and no hands went up,” Seal said. “Utilities are aware that this need is coming soon and want to figure out how to fit it into their information and communications technology frameworks.”

“Connection of distributed energy resources to the distribution system is creating technical challenges, and increasingly utilities are using distribution management systems, or DMS, to improve reliability, optimize efficiency, and maintain power quality,” explained Seal. “These systems typically perform their duties by using a small number of relatively simple control devices. In their present form, they cannot manage large and growing numbers of grid-tied smart inverters with numerous complex functions, such as Volt-VAR control. DERMS supports distribution management by organizing the monitoring and management of these devices.”

What Will DERMS Do?

Industry stakeholders envision four primary roles for DERMS:

- **Aggregate.** Take the services of many individual distributed resources and aggregate them in a manageable number.
- **Simplify.** Handle the details of distributed resources' settings and present simple, grid-related services.
- **Optimize.** Harness various distributed resources groups at minimal cost and maximum power quality.
- **Translate.** Diverse languages of various resources are presented and used cohesively.

Standards for DER Integration at Every Level

In recent years, Seal's team at EPRI worked with Sandia National Laboratories and the U.S. Department of Energy's (DOE) SunShot program to accelerate the development of international standards for communication interfaces from DERMS to individual inverters. As the DERMS' role is better understood, EPRI, DOE, and the National Renewable Energy Laboratory (NREL) are developing communication methods for groups of inverters, ensuring coordination with established interoperability standards. These standards can be used to integrate DERMS with other grid applications.

"We recognize that grouping DER and managing these groups must be possible at many levels: in a building management system, within a microgrid, at the feeder or circuit level, by the distribution utility, and by the system operator," said Seal. "This principle was previously applied in developing demand response standards and is now a key aspect of our DER integration strategy."

With respect to distributed resources, the urgency for DERMS depends on their number, characteristics, and location, along with distribution system design. In some regions, such as parts of Hawaii, smart inverters and DER management systems are needed now. Without them, maintaining grid stability and protecting grid assets become increasingly difficult.

Developing and Testing a Reference DERMS

NREL and EPRI recently tested newly developed DER group-management functions and messages at a workshop with software technology companies. To support testing, EPRI developed a reference DERMS software that can communicate upstream with enterprise applications and connect with and manage many smart inverters downstream. This enables the testing of algorithms to optimize dissemination of messages to various DER groups.

For the NREL workshop, EPRI built a tool for testing early-stage products, and vendors used it to demonstrate interoperability among DMS, DERMS, and utility distribution control systems. The successful demonstration helped build interaction among vendors, which continue to remotely access EPRI's test tool through an online server.

Bryan Palmintier, a senior research engineer in energy systems integration at NREL, said that eventually DERMS could be integrated into an *advanced distribution management system*—a mega-platform of all distribution management functions. "That's where I see the future and the excitement in this space," Palmintier said.

Key EPRI Technical Experts

Brian Seal