How the distribution management system (DMS) is becoming a core function of the Smart Grid

Reducing risks and costs by optimizing distribution network operations

Abstract

As utilities identify their components and evaluate the effects of transforming their existing delivery assets into a Smart Grid, a strong emphasis is being given to systems, products and services that provide value in automating and managing the electric distribution delivery grid.

Within the Smart Grid context, utilities are focusing on four main themes in distribution:

- Reliability – improving on current reliability levels; reducing customer energy outage duration
- Efficiency – streamlining and automating existing work processes; improving operator, dispatcher and field crew productivity
- Safety – managing field crew work and public safety
- Interoperability – utilizing open architecture.

This Siemens’ point of view (POV) white paper discusses how distribution management systems (DMS) have a direct and measurable impact on each of these areas. Energy delivery grid design criteria are dramatically changing, from supporting static delivery infrastructures, to highly automated dynamic infrastructures. These dynamic infrastructures cannot be sufficiently managed without significant distribution control center systems and applications to monitor, assess and control delivery conditions.

Point of View (POV) Executive White Paper Series

These executive white papers provide valuable insight into the innovative application of technology to solve business problems that are confronting utilities, municipalities and other Smart Grid related organizations. The papers should serve as a helpful resource to aid chief financial officers (CFOs) and chief executive officers (CEOs) in discussions with institutional chief information officers (CIOs) in the exploration of new methods and processes for reducing costs.

Point of View (POV) Executive White Paper Series

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Executive summary

We are in the midst of a paradigm shift in electrical infrastructure design and operation. The opportunity is unlike any since the energy delivery grid was originally constructed. The distribution management system (DMS) is a fundamental component to enable this transition.

DMS – an integral part of the Smart Grid

DMS sits firmly in the middle of Smart Grid transition requirements, and provides the basis from which to model operation and direct field activities in a safe and efficient manner. It also serves as an operations platform, automating tasks and filtering information for the operator. For a utility, it is the strategic system that will enable management of a Smart Grid and will leverage its benefits.

Implementing a DMS solution requires the integration of many different elements – field equipment, communications, control centers and supporting systems within the utility enterprise. This establishes a total solution for the utility to achieve its business objectives in the reliable delivery of power to its consumers.

In most cases, different vendors supply different pieces of a total solution, with the utility serving as an integrator or employing an integrator to manage the implementation.

DMS as part of a comprehensive strategy

With the acceptance of the need for Smart Grid roadmaps and transition plans, utilities are increasingly selecting vendors that can provide larger contiguous portions of a DMS solution to reduce their risk and ensure successful implementations.

Ultimately, utilities are looking for total solution providers that will take responsibility for the complete solution implementation. Their desire is that these vendors also have a meaningful product component within the solution to ensure access to focused subject matter expertise, product and market segment commitment. This is a response to opportunist integrators who have won initial implementation projects, but failed to provide specialized expertise and have not retained market segment focus.

Distribution management system challenges and trends

The DMS is an integrated systems solution supporting the day-to-day management of the distribution network, related construction and maintenance efforts, and proactively guides operators when the system is needed most – during storms and related restoration activities.

As the utility workforce ages and utilities come under greater pressure to more fully utilize existing equipment, DMS is rapidly becoming an essential element in maintaining and improving delivery reliability while reducing complexity and automating related work processes. The recent acceleration in distribution
automation, substation automation and automated metering initiatives in the industry has created additional impetus to establish DMS as a solid foundation to leverage these aspects of the emerging Smart Grid.

These systems are usually either not integrated or have very light interfaces – requiring distribution operators to deal with multiple systems, applications and user interfaces.

**Background**
A DMS can help improve control room operations and key performance indicators. As the utilization of electrical energy has increased, its optimal usage and reliability has become important. Real-time network view and dynamic decisions have become instrumental for optimizing resources and managing demands, thus creating the need for a DMS that can handle increasingly complex work flows.

**DMS overview – taking OMS to the next level**
A DMS is a collection of applications that can monitor and control the entire distribution network efficiently and reliably. It acts as a decision support system to assist the control room and field operating personnel with the monitoring and control of the electric distribution system. Improving the reliability and quality of service in terms of reducing outages, minimizing outage time, maintaining acceptable frequency and voltage levels are the key deliverables of a DMS.

Most distribution utilities have been comprehensively using IT solutions through their outage management systems (OMS). A DMS takes an OMS to the next level by automating complete sequences and providing an end-to-end, integrated view of the entire distribution system. It accesses real-time data and provides all information on a single console at the control center in an integrated manner.

**Significantly improved operator efficiency**
A DMS provides an efficient visual interactive work environment that integrates all information sources within a common real-time workspace. It reduces the number of systems on the operator’s desk, predicts operating issues, provides greater clarity in emergency situations and improves operator response time. DMS also supports management of the system with less experienced users and promotes improved staff retention.

**Standards-based Integration**
Due to the addition of a new consumer, a new transmission line or replacement of equipment, the distribution system changes daily. If the different functional modules are operating in a non-standard environment, the engineering effort becomes unmanageable.

A standards-based integration eases integration with other functional modules and also improves operational performance. It ensures that a utility can be in a vendor-neutral environment for future expansions, which in turn means that the utility can easily add new functional modules on top of existing functionality.
Case study – Oncor

Customers have come to consider electricity as an almost inalienable right. They expect to have it and to have it all the time. In households and businesses alike, power outages quickly escalate from inconvenient to unacceptable.

An interactive, digitized, intelligent electric grid is becoming reality at Oncor, the largest distribution and transmission company in Texas. Oncor’s Smart Grid connects power providers and customers to improve both reliability in a deregulated market and service across the Oncor system. Oncor is taking its already high-level distribution management and customer service skills to a new level by deploying the industry’s first fully-integrated distribution operations environment for the power grid.

Siemens worked with Oncor and other stakeholders to provide an off-the-shelf, fully integrated DMS solution consisting of a consolidated user interface running on a common operating platform that allows for system maintenance and keeps upgrade costs under control. Operational challenges were limiting Oncor’s capabilities. Operators had to toggle between keyboards, windows and applications to access necessary data, consolidate disparate information manually and decide what actions to take. Although the various applications were functional and valuable, the environment was complicated, and the process needed improvement to cope with existing and anticipated operations requirements.

It became clear to Oncor that to gain the efficiencies they required, the operators’ tasks would need to be automated end-to-end by consolidating the user interfaces of the many applications necessary into a single operator environment. Adding the DMS framework to the infrastructure simplifies the operator’s job by improving analysis and decision-making capabilities, allowing Oncor to better prevent outages and other network interruptions, respond more quickly and efficiently when they occur and reduce the average outage minutes.

DMS impacts on assets and reliability

DMS for any utility is a mission-critical tool. It is the tool that operators use for command control of valued assets, optimize the life or output of those assets and to maintain the highest degree of reliability for their customers.

A DMS solution creates the context to tightly integrate tools and systems addressing different aspects of the distribution operator’s and/or dispatcher’s work tasks, including but not restricted to:

- **Outage management system (OMS)** – provides the ability to view the current connectivity of the distribution feeders and safely manage day-to-day and emergency restoration work.
- **Mobile work force management (MWFM)** – provides the ability for work crews to communicate electronically with the OMS directly from the field, reducing delays in performing tasks and improving safety.
- **Distribution network analysis (DNA)** – provides equipment loading and complex voltage calculations to help the operators understand the voltage and loading of the distribution feeders and individual equipment at any point in time. In particular, it can locate faults and provide optimum switching guidance for operators in the field. It also provides a variety of operations-optimization tools to offload the operations staff and improve efficiency.
- **Distribution supervisory control and data acquisition (D-SCADA)** – as communication and distribution automation technology is being deployed, a scalable and flexible SCADA provides real-time telemetry information to keep the operating model as close as possible to the real conditions in the field, as well as remote fast switching to improve reliability and reduce operational costs (fuel, labor, etc.).
To achieve maximum efficiency and take full advantage of the features of the different components, these systems are tightly integrated to automate the user’s workflow.

**Spectrum Power™ DMS**

Today’s distribution grid operation is mainly characterized by manual procedures relying on the experience of an aging work force. Using Siemens’ Spectrum Power DMS enables a smart, self-healing grid by providing the following improvements:

- Reduction of outage occurrences and durations by applying advanced fault location and network reconfiguration algorithms
- Minimization of losses through improved monitoring
- Optimization of assets by management of demand and distributed generation
- Reduction of maintenance costs by online condition monitoring.

The smart management of electric distribution grids is one of the key success factors to reach ambitious Smart Grid goals.

**With Spectrum Power**

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<td>- No monitoring, control and automation</td>
<td>- Automation of distribution substations</td>
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<td>- No communication</td>
<td>- Communication in distribution networks</td>
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<td>- No auxiliary power supply and motor-operated mechanism</td>
<td>- Decentralized, intelligent application</td>
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<td>- No active integration in control center (manual updates)</td>
<td>- Self-healing capabilities</td>
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<td>- Online condition monitoring</td>
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The growing impact of DMS

DMS is the key to integrating emerging and mature Smart Grid technologies and applications focused on automation, consumer enablement, distributed energy resources and controllable demand, while effectively balancing optimal network operations with environmental and open-market objectives.

Real-time correlation of equipment loading, voltage, environment and timing conditions allows for increased utilization while improving reliability and continuously ensuring the safety of workers and users.

Accurate engineering knowledge enables operators to push equipment when it is needed the most without causing damage or risking an outage. Ultimately, better equipment utilization translates into deferred capital expenditures.

Additional DMS benefits

DMS presents numerous benefits for business and consumers, including:

- Actionable information
- More efficient ability to meet regulatory requirements
- More efficient customer service
- Open systems platform
- Safety
- Scalability
- Simplified training
- Simplified workstations.

Siemens’ Spectrum Power DMS provides customers with an effective control center solution – containing the elements and tools needed to integrate all their operational needs by defining an environment with common layers of a user interface and data modeling – and rules and services to interface with external or enterprise applications.

Smart Grid solutions from Siemens in the fields of IT, data communication, energy automation and rail electrification pave the way for efficient grids, intelligent power distribution, intelligent consumption as well as electromobility and smart buildings.
The Siemens Smart Grid Division

The Siemens Smart Grid Division supplies products and solutions for intelligent and flexible electrical network infrastructures. To meet growing energy needs, the networks of today and tomorrow must integrate all forms of power generation and ensure bi-directional energy and communication flows. Intelligent networks help make it possible to generate and use power efficiently and on demand. They contribute to the electrification of railroads and also supply industrial enterprises, infrastructure elements and entire cities with electricity. For more information, visit www.usa.siemens.com/smartgrid. For more information about Siemens’ Spectrum Power DMS on our mobile website, please scan the QR code below:

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