PowerOn Advantage

Advanced Distribution Management System (ADMS)

Delivering increased reliability, productivity and efficiency through a single ADMS platform

PowerOn™ Advantage is a single, yet modular ADMS combining GE’s best in class Distribution Management System (DMS) and Outage Management System (OMS) capabilities. GE’s ADMS has been designed from the customer’s perspective to bring stakeholders together on a single platform to interact with the network, perform work and share information in real-time. PowerOn Advantage enables utilities to keep the lights on, to respond to outages and to maximize return on network investment in the dynamic and ever changing distribution environment.

The growth of embedded generation such as solar and wind, the volume of electric vehicles and the management of an active distribution network all present fundamental challenges to existing utility control systems. At the same time, new measurement and control technologies are being introduced as more equipment and sensors, as well as mobile devices, are utilized across the network, increasing the volume of data to be managed and visualized. All of this must be integrated across the utility’s enterprise, while ensuring operational security—a convergence of both Operational Technology (OT) and Information Technology (IT). Utilities are going through an operational transformation driven by an increasingly complex grid with higher performance targets as customers and regulators raise the bar of expectations. PowerOn Advantage is the digital cockpit at the heart of this transformation.

Built on more than 30 years of industry experience and collaboration with our utility partners, PowerOn Advantage has been specifically designed to support utility professionals through a unique and easy-to-use user interface. GE’s ADMS presents a paradigm shift in user-interaction, where data finds the user via a pre-defined dashboard with user-configurable widgets. Through guided work pages and streamlined and robust workflows, GE’s intuitive ADMS provides the advanced situational awareness utilities require to face the challenges of a modern distribution grid.

Key Benefits

- **Integrated and Streamlined Operations**
  - One network model providing a single view of all work across distribution network operations in real-time
  - Integrated and optimized operational workflows, streamlined across GIS, ADMS, AMI and mobile
  - End-to-end network model management processes and streamlined workflows

- **Intuitive User Experience**
  - Pre-defined dashboard with user-configurable widgets providing greater situational awareness
  - User experience focused around specific archetypes and key operational workflows
  - Streamlined, intuitive and guided work pages optimized for operating during blue sky days or under extreme storm conditions

- **Simplified System and Modular Design**
  - Quick-start packages offered to accelerate deployments which maximize improvements across reliability, productivity and efficiency KPIs
  - Purpose-designed and built as an off-the-shelf ADMS product, deployable pre-configured on networks spanning from EHV to LV
  - Modular software architecture on a core real-time platform for flexible implementations as either an OMS, a DMS or a fully functioning ADMS

**Key Benefits**

- **UP TO 33%** Reduction in SAIDI for increased reliability
- **UP TO 3%** Reduction in voltage for greater network efficiency
- **UP TO 30%** Reduction in crew/operator interaction for greater productivity
- **UP TO 20%** Increase in renewables generation from active network management
PowerOn Advantage ADMS Overview

With a drive towards clean energy and addressing energy security concerns, the way we generate, distribute and consume energy is changing at an ever increasing rate. Add to this the need for enterprise system integration while enforcing cyber security policies, it is clear that a new approach to Operational Technology (OT) is required, supporting a closer collaboration and convergence with IT.

Existing standalone OMS and DMS systems are limited in their effectiveness. Data inaccuracies and divergence issues around multiple models reduce a utility’s confidence to push network assets to higher utilization and creates delays in response times between systems, negatively impacting reliability and productivity KPIs. The on-going duplication of IT costs related to supporting, maintaining and upgrading two systems presents additional challenges.

GE’s PowerOn Advantage is a single, modular ADMS that delivers reliability, productivity and efficiency all via one platform, one network model and a simplified operational workflow, using real-time network information that spans EHV to LV.

GE’s ADMS encompasses advanced monitoring and control of the distribution network, fault and outage management and network performance optimization on a single system. PowerOn Advantage manages every step of the operation, from understanding the state of the network and planning work, to mobilizing resources, to optimally restoring parts of the network after an outage. Service bus integration, based on CIM standards, provides the flexible connection required to enable the OT/IT convergence desired globally by major utilities. GE delivers a cutting edge technology on a proven platform optimized for grid modernization.

Optimized for Grid Modernization

Centralized Monitoring & Control
A real-time cockpit enabling utilities to collaboratively manage work across their active distribution networks and provide enhanced service.

Distributed Energy
Control and optimization of distributed energy resources, maximizing renewable generation.

LV Network Visibility
Extending situational awareness and control to increasingly dynamic LV networks.
Integrated and Streamlined Operations

When an outage occurs, sensors on the grid communicate information from substations, circuits, meters or customer calls. This equates to a flood of data. Data that needs to be analyzed and acted upon.

With all of the information displayed in a single dashboard, the operator is able to clearly see the state of the network and all work being performed across the distribution grid. This enables safe practices and supports the operator’s ability to make informed decisions at the appropriate time.

With PowerOn Advantage, system restoration can be automated, via a Fault Detection, Isolation & Restoration (FDIR) engine. Using intelligent automation algorithms, FDIR can automatically execute switching to isolate the problem section of the circuit, restoring the maximum number of customers as quickly as possible.

After the automated restoration, the intelligence of PowerOn Advantage assists the operator to find the available crews and sends them to the identified section of line, while maintaining communication between the teams in the office and the field.

Using a robust set of workflows, the control center keeps data and decisions moving to avoid delays, and directs the task to the right person.

The restoration to the remaining customers must be done with precise coordination to ensure the safety of crews and the public. With PowerOn Advantage, operators clearly see the tasks required and the system status. They are then able to communicate with field crews efficiently, allowing them to confidently and quickly proceed with the restoration.

PowerOn Advantage has the flexibility to play many roles in a restoration. System restoration can be automated, restoration steps can be recommended or PowerOn Advantage can simply manage the workflow and let the operator make the decisions.
Intuitive User Experience

Data Finds the User

**Previous industry approach**

Historically, utilities have struggled to gather network information from multiple, separate applications. These applications use multiple filters and table configurations to access relevant information, resulting in inefficient work flows across multiple screens. Operators need extensive knowledge, experience and training to navigate the system, and the system itself has limited effectiveness in maintaining situational awareness, especially under stress conditions such as large storms.

**New paradigm**

PowerOn Advantage is changing the industry’s approach to data access. PowerOn Advantage offers an integrated dashboard with pre-defined work pages, creating a seamless next generation user experience. Through guided, streamlined and robust work flows, the intuitive PowerOn Advantage delivers advanced situational awareness in an environment with ever increasing volumes of data to be managed, controlled and visualized to meet grid modernization objectives.

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**Key dashboard components**

The pre-defined and integrated dashboard within PowerOn Advantage presents relevant and necessary network information to system operators in one easy to use interface where data finds the user. The dashboard provides an optimal view of all critical information requiring the attention of the operator, robust for both blue sky days as well as extreme storm conditions.
Simplified System and Modular Design

Modular design and functional components

PowerOn Advantage has been designed with modularity in mind. This design gives customers the flexibility to choose to deploy as a single DMS, a single OMS or as a fully functioning ADMS. GE understands how customers work and can deliver a proven software solution to meet utilities’ needs in distribution operations with a platform that is ready to grow and expand with our customers, today, tomorrow and into the future.

Modular system offerings

GE offers PowerOn Advantage in a variety of tailored and modular based packages designed to accelerate delivery. Our pre-configured solution and services meet the utility’s key business objectives quickly. Whether it’s increasing reliability, improving productivity or delivering greater network efficiency, GE can provide the right package to optimize your utility’s grid modernization efforts, while increasing overall customer satisfaction.

Functional components of PowerOn Advantage

Base Components

- Automation
- Calculation Engine
- Event Management
- Group Telecontrol
- Master Log
- Network Display
- Temporary Devices
- Time Series Data Store
- TLQ Management
- Topology Processing
- Training Simulation
- Trending

Modular Offerings

Productivity

- Auto Gen Schematics
- Commissioning Manager
- Crew Management
- Mobile Dispatch & Switching
- Switching Advisor & Management

Reliability

- Call Taker
- Fault Level Studies
- Fault Location
- FDIR
- Load Shed and Restoration
- Outage Analysis & Prediction
- Protection Verification
- Restoration Management
- Storm Manager

Efficiency

- DER Management
- Distribution Power Analysis
- Distribution State Estimation
- Dynamic Thermal Limits
- Feeder Reconfiguration
- Integrated Volt-Var Control
- Load Forecasting
- Load Transfer Capacity
- Low Voltage Management

Enterprise Interoperability

- Customer Manager
- DRMS
- EMS
- Enterprise Historian
- ICCP
- Outage Reporting
- Planning Analysis
- Smallworld Electric Office
- Smart Meter
- Reporting

Enterprise Interfaces

- Asset Management
- Building Management
- CIS
- ERP
- GIS
- Call Center
- OMS Systems
- Mobile Systems
- SCADA
- Workforce Management
GIS/ADMS Interoperability
Reducing total cost of ownership through IT/OT convergence

The significant increase in the volume of data within a utility’s network means that traditional methods of manually maintaining separate operations and GIS networks is no longer a beneficial approach.

PowerOn Advantage’s GIS/ADMS interoperability allows utilities to create an initial operational network model build and continue to incrementally update and maintain this integrated model over time, from EHV down to LV. This delivers improved data accuracy, enabling increased asset utilization. Interoperability also delivers the ability to model, monitor and manage LV networks—providing efficient LV modeling ready for renewables. In addition to an integrated approach, GE also offer a synchronized method as an alternative, a first step towards integration with less change management upfront, and allowing utilities to gain confidence in their GIS data quality and readiness for use as source of operational model.

The integrated GIS approach is pre-configured and optimized with GE’s Smallworld Electric Office via a CIM-based adaptor to provide simplified workflows, data management and integrated network models across operations and planning, all with a single point of data maintenance at a reduced cost. With Electric Office GE has developed pre-configured workflows, out of the box, for initial loads and incremental updates. These workflows allow utilities to realize and unleash the power of previous GIS investments to build and maintain vast distribution networks—critical when modelling global digital networks. With Electric Office, GE has examined workflows end-to-end and optimized them across projects, from initial designs through to construction through to energizing and operations.

GE is the only vendor to be rated by Gartner as a ‘Leader’ in GIS and ADMS, a key differentiation in the market where the integration between GIS and ADMS is becoming increasingly important—customers can come to GE for a market leading, end-to-end solution.

Model integration solutions

<table>
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<tr>
<th>Model Integration Methods</th>
<th>Solution Capability</th>
<th>Customer Benefits</th>
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<tbody>
<tr>
<td><strong>Integrated</strong></td>
<td>GIS to ADMS</td>
<td>Reduced number of sources for building and maintaining networks</td>
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<td></td>
<td>Bulk load</td>
<td>Opportunity to automate workflow</td>
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<td>Incremental update</td>
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<td>Geographic &amp; schematic views</td>
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<td></td>
<td>Schematization</td>
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<td>Business Process simplification</td>
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<td>Semi-auto workflow</td>
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<tr>
<td><strong>Synchronized</strong></td>
<td>GIS with ADMS</td>
<td>Synchronize attributes across multiple data sources</td>
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<tr>
<td></td>
<td>Bulk load</td>
<td>Less change management to implement</td>
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<tr>
<td></td>
<td>Geographic &amp; schematic views</td>
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<td></td>
<td>Identify &amp; update deltas</td>
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<td></td>
<td>Synchronize attributes</td>
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<td></td>
<td>Tool-based workflow</td>
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<tr>
<td><strong>Visualized</strong></td>
<td>Background Maps in ADMS</td>
<td>Improve situational awareness by viewing data on a map</td>
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<td>Google, WMTS</td>
<td>Increase intelligence with analytics across operations, planning and asset management</td>
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<td>Layers &amp; Feature Sets</td>
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<td>Traffic, Weather &amp; Vehicle</td>
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<td>Geospatial Analysis</td>
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<td>Switch counts</td>
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<td>Problematic networks</td>
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Putting Mobile First
A migration in thinking: From data collection tool to collaborative control

Utilities are under continuous pressure from customers, regulators and shareholders to improve overall safety, service and cost performance despite significant challenges of increasing frequency of severe storm events, aging networks and increasing network complexity.

Remodeling utility operations around mobilizing advanced distribution management offers the potential to transform electrical utilities and unlock significant benefits. Rather than just digitizing existing paper processes, utilities are now looking to re-design their business processes around mobile technologies—to change their thinking to a Mobile First perspective.

PowerOn Advantage’s integrated ADMS mobile functions for dispatching and switching brings data directly into the field; the rich mobile client provides a direct link to schematics, maps and GPS navigation. Crews are empowered to be significantly more productive, reducing crew-to-operator interactions by up to 30%, as well as driving reductions in SAIDI.

GE’s approach is quickly scalable and device and operating system agnostic, allowing data to be accessible anytime and anywhere, resulting in a connected utility, from crew to operator to consumer.

Key benefits of mobile first
- Mobile-enabled crews are significantly more productive
- Reduce SAIDI by up to 33%
- Reduces crew/operator interactions by up to 30%
- Relieves bottlenecks during shift change-overs and high-stress conditions

Key features of mobile first
- Order dispatch
- Mobile switching instructions
- Mobile operation confirmations
- Safety documents
- Paperless dynamic maps
- Navigation

Information workflow using a mobile device

**STEP 1**
The crew member is notified of a new job (INC2-15-6) on their mobile phone while out in the field.

**STEP 2**
The crew member accepts the new job on their phone, this information is replayed to and updated at the control center.

**STEP 3**
Directions to the job location are dispatched to the crew member’s phone.

**STEP 4**
Job status is updated from Accepted to On the Way and an ETA is calculated.
LV Network Management Solutions
Extending situational awareness and control

Historically the LV network has largely been opaque, but increasingly utilities require that it be visible to model, manage and optimize. We are seeing a transformation in how utilities operate and manage their LV networks as they become much more dynamic with an increasing volume of renewables, EV and storage being connected.

LV management solutions maximize business benefits by identifying network hotspots, implementing a network model with an improved depth of information and enabling active network management.

GE’s LV Network Management solutions give visibility on the LV network beyond what is available via customer meters, and can be extended to provide RTU-like data for measuring amps, volts, phase angle, harmonic content and directional power, as well as control such as LV SCADA and LV automation.

PowerOn Advantage’s LV Network Management solutions allow utilities to gain a holistic view of the network at all voltage levels as well as visibility of distributed energy resources. Utilities are then able to optimize the design and planning of their network and control interventions as well as gain improved data required for regulatory compliance and aiding in investment decisions while continuing to provide security of supply.

LV network management solutions

<table>
<thead>
<tr>
<th>Customer Challenges</th>
<th>Solution Offered by LV Network Management</th>
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<tbody>
<tr>
<td>Distributed Generation (DG) Intensity - Microgrid and</td>
<td>Integrated adaptive network management system enables forecasting of generator output,</td>
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<tr>
<td>Intermittency</td>
<td>modelling of low voltage network and seamless management, through all operational phases, to</td>
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<td>monitor DG output and facilitate necessary control interventions to optimize any curtailment &amp;</td>
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<td>still maximize renewable export to the grid.</td>
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<tr>
<td>Demand Intensity (EV/Heat Pump) - Microgrid and</td>
<td>LV monitoring ascertains current network performance and reports impacts of asynchronous</td>
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<td>Intermittency</td>
<td>technologies on quality of supply.</td>
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<tr>
<td>Quality of Supply - Regulatory reporting</td>
<td>The fully-connected network model identifies network availability and opportunities for</td>
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<td>maintenance based on historic utilization and anticipated future loading profiles. Supporting data is</td>
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<td>sourced from the GIS, Distribution Power Flow app, ample available technical data and the</td>
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<td></td>
<td>application of field-enabled mobile devices.</td>
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<tr>
<td>City Center Networks &amp; Street Work Access - Hospitals,</td>
<td>LV monitoring ascertains current network performance and reports impacts of asynchronous</td>
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<td>buried services and penalties for access and over-running</td>
<td>technologies on quality of supply.</td>
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<td>work</td>
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<td>application of field-enabled mobile devices.</td>
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<tr>
<td>Low Energy Faults &amp; Fault Detection - Risk of damage to</td>
<td>Proven procedures adopted on the higher networks are likely to form the basis of the emerging</td>
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<tr>
<td>primary equipment and loss of supply to customers,</td>
<td>requirements for managing actively managed LV networks. Process improvements can be enhanced by the use</td>
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<tr>
<td>replace faulty apparatus, or re-configure network</td>
<td>of mobile and safety-enabled field crews.</td>
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<td>prior to loss of supply</td>
<td>Distribution Power Flow and state estimation allow network operators to identify where power flow from</td>
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<td>the distribution transfer exceeds the customer and non-metered network devices. Where there is a clear</td>
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<td>mismatch in amps an alarm &amp;/or dynamic widget can be triggered that allows the network operator to</td>
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<td>conduct further investigations. This functionality can be applied in both meshed and non-meshed networks.</td>
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<tr>
<td>Cyber Security/Privacy - Secure access to required data,</td>
<td>A multi-layered approach to security, using appropriate security expert partners, ensures that</td>
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<td>even if not “company built” device</td>
<td>control room systems remain uncompromised, but can still facilitate an open data exchange through security</td>
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<td>designed in development approach with secure deployment &amp; maintenance best practices, providing</td>
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<td>reassurance to customers that their information will be handled securely.</td>
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Adaptive Network Management
Solving the rise of distributed generation

The distribution grid is becoming more complex as an ever increasing number of renewables are connected. The growing volume of distributed generation (wind and solar) and energy storage within the grid results in a more dynamic and active network, where power flows in two directions with some consumers now acting as producers. With this trend, situational awareness and visibility is increasingly critical and consequently the ability to manage active networks emerges as a significant challenge for utilities.

PowerOn Advantage’s Adaptive Network Management (ANM) application enables utilities to manage generation and loads safely within system parameters without relying on significant capital investments. ANM is also scalable - from a single pilot deployment to across a full distribution network.

The optimization challenge is addressed via ANM’s complete, accurate and up-to-date view of the network, dynamically updated to manage distributed energy resources (wind, solar) ANM responds to network changes, faults and planned work and can adapt to maximize the power delivery potential via renewables.

CAPEX avoidance is captured through ANM’s adaptive approach to curtailment enabling generators to connect more while averting the need for utilities to reinforce their network. ANM also ensures commercial fairness between generators and by working to minimize curtailment of embedded generation, assisting utilities in reaching their sustainability and low carbon targets.
Adaptive Automation
Solve an Outage in Minutes

How a utility’s current reliability metrics perform compared to regulatory targets is an extremely important measure for all utilities around the world. Reducing the impact and duration of both planned switching and unplanned fault restoration is critical to achieving reliability improvement goals.

GE’s Adaptive Power Restoration System (APRS), is an integrated FDIR module that reduces the duration of outages and the number of regulatory report customer interruptions, working to improve SAIDI and SAIFI metrics for utilities. This adaptive process can restore customers’ supply in less than a minute. Being adaptive, the algorithmic approach can run under abnormal network conditions, where scripted schemes and grid edge point solutions would fail.

PowerOn Advantage’s highly sophisticated FDIR solution offers a proven restoration capability and a clear focus on safety through a fail-safe methodology. Utilizing an optional power flow engine for optimized restoration, APRS intelligence isolates faults to the smallest possible section using fault location, then restores upstream power and looks for the best load transfer options for restoring downstream customers. PowerOn Advantage can split the downstream section and seek multiple transfers to restore customers; then the switching advisor module can then generate the manual switching steps for the crews to follow to fix remaining faulted circuit. The result is the maximum number of customers restored in the shortest possible time, and a reduction of manual steps by up to 35%.
Security
Managing Risk in the Grid

Network security is all about managing risk by:
• Minimizing the threat surface
• Monitoring the system for signs of abnormal behavior that could indicate an attack
• Gathering information about the system’s security parameters to ensure no unplanned changes occur
• Rapidly recovering if an event occurs

Our Security Solution takes best practices from the leading standards authorities and integrates them into our comprehensive, layered approach to security that provides a solid defense-in-depth strategy. Adopting our Security Solution makes compliance to regulations, such as NERC CIP, much easier to achieve.

Our Security Solution portfolio brings together security features from the core GE utility operations systems applications, secure network architecture, secure deployment practices during the system build and configuration process and ongoing security services that help to maintain the system’s integrity throughout its lifecycle.

This is all underpinned by secure business processes ensuring that GE employees working with customer systems are fully aware of applicable operational and regulatory standards, as well as trained in security best practices pertinent to their role.
Software Solutions Portfolio Overview

GE’s portfolio of software operation systems designed for utilities around the globe provide a suite of software, ranging from asset management and control to advance analytics and hosted and consulting services, all to improve operator situational awareness, reduce operating costs and enhance electric reliability.

Geospatial Systems
Design and planning services, field automation and workforce management

Utility Operation Systems
Real-time control systems for the management of transmission and distribution networks

Solutions as a Service
Hosted services to shift integration, financial and deployment risks

Advanced Analytics
A flexible, real-time, scalable platform that enables utilities to put big data into action

For more information about PowerOn Advantage ADMS visit GEGridSolutions.com/ADMS