

# ALSTOM GRID SMART DISTRIBUTION

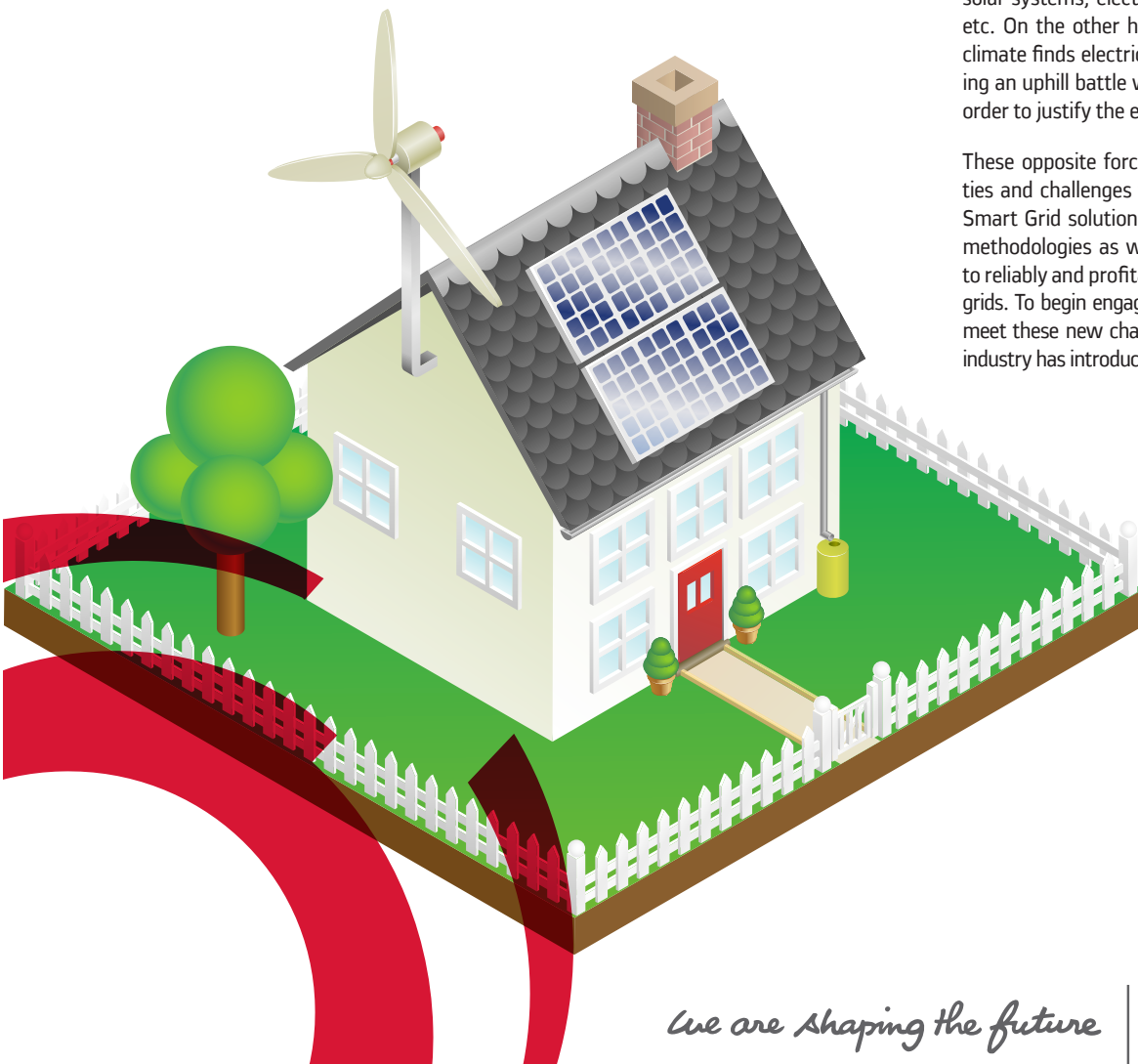
SOLUTIONS FOR SMART UTILITIES

As electric distribution utilities face intense pressure to find new and innovative ways to reduce their costs, Smart Distribution offers promising solutions for enhancing grid performance and increasing customer satisfaction, while creating a more sustainable environment.

## Smart Distribution

As the Electric Distribution industry enters the Smart Grid era, it is deploying a variety of new technologies (including distributed energy resources) and communications infrastructure to enhance the performance of the distribution grid, improve customer satisfaction and reduce the carbon footprint. On the one hand, these new Smart Grid investments look as though they will pay off as customers begin to enthusiastically adopt photovoltaic solar systems, electric vehicles, demand response, etc. On the other hand, the challenging economic climate finds electric distribution utilities still fighting an uphill battle with state regulatory entities in order to justify the expense of their investments.

These opposite forces will pose unique opportunities and challenges to electric distribution utilities. Smart Grid solutions call for enhanced operational methodologies as well as better economic models to reliably and profitably manage future distribution grids. To begin engaging in solutions that proactively meet these new challenges, the Electric Distribution industry has introduced the term **Smart Distribution**.



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## What is Smart Distribution?

- **Smart Distribution supports distributed energy resource deployment:** It will give electric distribution utilities the ability to incorporate generation (including intermittent renewables), storage devices, demand response and electric vehicle charging at all voltage levels throughout the distribution grid.
- **Smart Distribution enables self-healing and autonomous restoration:** The ability to restore healthy sections of the network after a fault without intervention by distribution operators will help energy utilities avoid considerable losses when an incident occurs.
- **Smart Distribution allows for bi-directional flow of energy and information:** This benefit will give electric distribution utilities the ability to not only actively manage the flow of energy from distributed energy resources, but also effectively use the bi-directional flow of information to optimize distribution grid operations.
- **Smart Distribution enhances security of supply and power quality:** Energy utilities will be able to manage the distribution grid in a way that maintains continual supply to customers under abnormal conditions while ensuring that the quality and level of power delivered meets customers' needs.
- **Smart Distribution minimizes investment and operations costs:** Providing a high level of overall efficiency in the distribution grid will be possible through innovation, advanced energy management and support for third-party service arrangements – as well as the ability to delay additional investment in the distribution grid and centralized generation – for peak load management.
- **Smart Distribution protects against technical and commercial losses:** By utilizing efficient devices and control technologies, losses can be minimized at all points in the distribution grid and carbon-monoxide emissions reduced.
- **Smart Distribution reduces maintenance and intervention:** This gives electric distribution utilities the potential to actually exploit additional “intelligence” incorporated in all levels of the distribution grid by reducing the maintenance and manual intervention required to keep the distribution grid operating efficiently.
- **Smart Distribution resists physical and cyber attacks:** It will boost electric distribution utilities' ability to withstand attacks to the physical distribution grid and its control systems, either directly or via the Internet.

## The Case for Smart Distribution

Electric distribution utilities are continuously seeking opportunities to reduce operational costs while supplying electricity reliably and securely. One field-proven solution known as Conservation Voltage Regulation (CVR) improves utilization of the existing distribution network for serving peak-load growth, thus deferring further capital expenditures for distribution grid upgrades or generation-capacity additions. Voltage-dependent loads can be actively managed through conservation voltage reduction programs, which can also improve billings by as much as 3-5%. CVR, when combined with demand-response programs and time-of-use tariffs, can further reduce peak load, leading to large savings in new-generation capacity.

Another key area of potential savings is in the detection and isolation of faults by deploying Smart Metering for customer service restoration. Instead of waiting for customers to call in during power outages, Smart Metering provides an alternative way for electric distribution utilities to detect unplanned customer outages. This – coupled with fault information from field devices – provides electric distribution utilities with necessary information to more quickly and accurately locate faults and automatically restore healthy portions of the distribution grid. For the sections that do require manual intervention, the above metering and grid information will help guide the crew to the fault's approximate location instead of having them manually locate the fault. Not only does this aid in reducing fuel costs and carbon monoxide emissions from crew trucks, Smart Metering also cuts customer outage times by up to 30%, thus improving reliability indices (such as SAIDI, CAIDI) and improving customer satisfaction and furthering relations with industry regulators.





## The Alstom Grid Advantage

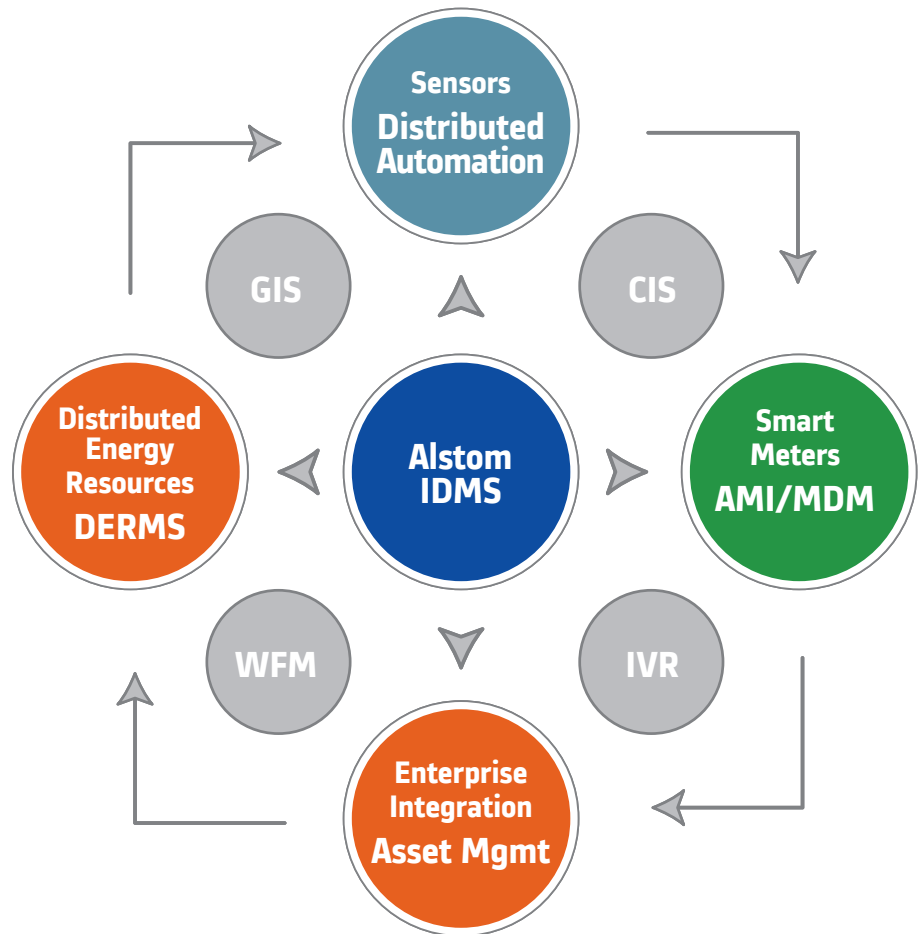
To accomplish these cost savings, electric distribution utilities have been investing in making the distribution grid smarter, with new software platforms and hardware technology, while at the same time re-engineering core business practices.

Alstom Grid's Integrated Distribution Management System (IDMS) solution, called **e-terra** distribution, accomplishes the overall objectives of Smart Distribution by providing a platform with centralized information-gathering and analysis – the heart of electric distribution grid operations. By offering an off-the-shelf, integrated solution with SCADA, DMS and OMS functionality, the Alstom Grid IDMS platform reduces integration complexity, cost of deployment and total cost of ownership. The platform allows closer coordination and tighter integration with core enterprise software systems for enhanced grid optimization and customer management. The enhanced integration also improves crew safety through increased awareness of equipment energization across all business functions and processes.

The Alstom Grid IDMS platform can play a central role in providing enhanced situational awareness of both the electric distribution grid and the Smart Metering infrastructure. The ability to simultaneously analyze both traditional distribution-grid and Smart-Metering information significantly simplifies the outage prediction and restoration process. Emerging deployments of Demand Response, distributed resources such as wind, solar and energy storage devices and the future use of millions of electric vehicles will only be possible through the analytical and control capabilities provided in Alstom's IDMS DERMS (Distributed Energy Resource Management System).

Moreover, the platform includes automatic feeder reconfiguration and switch-order management functions that prompt switching plans to isolate faults, optimally restore healthy sections of the network and reconfigure the network to relieve overloads, voltage violations and feeder imbalances. This reduces switching complexity and potential human errors while enhancing field crew safety.

At the core of the Alstom Grid IDMS platform is state-of-the-art network analysis and optimization functions for complete 3-phase unbalanced systems, providing refined state estimation and loss minimization.



The Integrated Volt/VAR Control (IVVC) function minimizes the transport of reactive power and accomplishes the objectives of Conservation Voltage Reduction (CVR). IVVC is also capable of running in a fully automated mode, incorporating Smart Meter data to expand upon the field observability and control provided by distribution SCADA. IVVC proactively queries for near real-time voltage measurements from a small set of Smart Meters on each feeder to check that existing voltages are not too close to operational limits before issuing new controls. Additionally, AMI data is used by subscribing to low-voltage brown-out alarms that are reported as exception messages. These inform the IVVC function when meter locations are approaching a low-voltage limit and provides a warning to the IVVC that no further voltage reduction should be performed for a given area.

The Alstom Grid IDMS platform includes a Training Simulator for dispatchers and operators to master new business processes for Smart Distribution and also provides a basis for the development and validation of Smart Distribution operational strategies.

As both a pioneer and leader in Smart Distribution solutions, Alstom Grid supports and actively participates in multiple standards development process and industry workgroups, including NERC CIP, WS-Security, DNP3 Secure Authentication and IEC 62351. The Alstom Grid IDMS platform uses IEC Common Information Model (CIM) 61968 based messaging to provide flexibility in interfacing with other enterprise IT systems, simplifying integration and maintenance.



## Conclusion

Electric distribution utilities continue to face financial challenges and must find new and innovative ways to reduce their costs structure, including minimizing short-term grid-related investments. Moreover, regulatory, infrastructure and competitive pressures will demand ever-increasing levels of distribution grid performance and reliability. However, the advent of Smart Grid solutions, through the introduction of new technologies, has created a new wave of opportunities and challenges for electric distribution utilities. This proven alternative better utilizes existing distribution grid assets by operating them more efficiently and effectively through enhanced grid optimization.

In terms of dollars, a \$100+ million investment in generation to meet 3 to 5% of peak load could be more effectively accomplished through conservation voltage reduction programs. And in terms of customer service, satisfaction will be better achieved through enhanced self-healing programs, ensuring customers stay connected to the distribution grid, while improving overall profitability.

In the words of Thomas Edison, “There’s a way to do it better - find it.” Likewise, the success of electric distribution programs requires a new, integrated platform with knowledge of the real-time status of both the distribution grid and the Smart Metering infrastructure. The Alstom Grid IDMS platform has been developed with exactly this in mind. It provides electric distribution utilities with a proven solution, using state-of-the-art applications to enable true Smart Distribution capabilities that can boost distribution grid performance and customer satisfaction while reducing its carbon footprint and creating a more sustainable environment.