As a provider of CO$_2$-free energy solutions, the ALSTOM group is strongly committed to the development of tools and technical applications that improve energy efficiency and preserve our planet’s resources.

As the world’s leading supplier of network management solutions, ALSTOM Grid has developed a set of innovative solutions based on state-of-the-art technology, including the "Smart Grid suite for Distribution."

ALSTOM Grid, with its operational energy experts, and IT specialists — together with its global technology partnerships — satisfy distribution customer demand throughout the energy value chain, offering tomorrow’s solutions for a smarter distribution — today.

**Business challenges**

The world is undergoing an energy revolution accelerated by injection of huge amount of investments and grants worldwide and power utilities are faced with new challenges:

- Pressure for energy efficiency and demand response management
- Reducing the global carbon footprint by renewable integration
- Evolving regulatory frameworks with tighter Service Level Agreements
- Lowering cost of operation and increasing customer satisfaction leveraging grid infrastructure investments

In response to above challenges, utility industry is undergoing two key major transformational changes:

1. Active engagement from customers lead to a very different generation-load behavior resulting into bi-directional power flow between grid and the end customer.

2. Distributed renewable resources connected at various transmission and distribution voltage levels in the grid demand special attention for the reliable grid operation.

**Customer Profiles**

- Utility Distribution Company (UDC)
- Independent System Operator (ISO)
- Load Aggregators
- Load Serving Entity (LDE)
- Curtailment Service Provider (CSP)
- Transmission & Distribution Service Provider (TDSP)
- Distributed Resource Provider (DSP)
Today’s products ...

For more than 30 years, ALSTOM Grid has been investing in R&D to pioneer the technology for building real-time power system applications focusing on high volume data processing. Scalability and performance have always been the utmost design requirement for our application development. Our approach has resulted in a technology platform suited for addressing the challenge of massive data processing and integration with value added applications for smarter distribution.

ALSTOM Grid’s expertise has helped utilities with large distribution models succeed in meeting their operational targets. Our technology architecture principles include Unified CIM-compliant modeling platforms, SOA-based architecture, Fast User Interface with advanced visualization and situation awareness technologies, standard IEC 61850 interfaces, and domain specific algorithms.

An intelligent product range in operation

Today, ALSTOM Grid has a number of proven platforms available to support the new design and application requirements of intelligent grids for smarter distribution.

Together these form our Smart Grid Suite for Distribution:

- **e-terra<sub>source</sub>** is our CIM-based solution for answering demanding power system modeling and planning requirements. This product consolidates dispersed data models into a single standardized and consistent data source to build interoperable architectures. The product is designed to manage modeling of volumes of Distributed Resources, Meter Data & AMI processes in real-time applications for smarter distribution. The product architecture supports incremental updates and on-line modeling updates with automatic updates of servers and clients.

- **e-terra<sub>distribution</sub>** is the technological platform with product suite that provides the advanced distribution system applications for integrated DMS-OMS (Distribution Management System and Outage Management System) and DR-DG (Demand Response – Distributed Generation) solution. This platform with its product suite provides integrated solution for distribution utility from control room and back office to customer end point with capability of handling multi-million electrical points/loads.

  The product provides full function DMS and OMS applications with unified user interface. It is particularly adapted to the integration of individual low voltage consumers in their geographical and electrical context in advanced metering infrastructure resulting into comprehensive demand response solution. In addition, the product supports the operator training simulator fully capable of simulation and studies of distribution grid operation together with customer engagement impacts arising due to evolving demand response and distributed generation in smarter distribution operation.

- **e-terra<sub>disgen</sub>** is our distributed generation solution for managing grid operations to deal with evolving high penetration of distributed generation resources. This product supports operational planning and operation functions for forecasting, estimation, dispatch, monitoring and control including predictive modeling support for near real-time ability to predict and accommodate changes. The application manages intermittent nature of DG outputs together with careful switching operational plans ensuring safety considerations.

- **e-terra<sub>settlement</sub>** is our Settlement/Billing and Decision Analysis solution for smarter distribution. This product is a fully configurable application that manages portfolio of settlement rules corresponding to service level agreements. The product supports near real-time estimation of monetary value of load or distributed resource curtailment based on configurable rules and performs after the fact settlement/billing for demand response functions in smarter distribution.
ALSTOM Grid’s Smart Grid suite for Distribution is a specific set of new applications which, in addition to our existing core platforms, address global energy challenges. ALSTOM Grid’s solutions make intelligent networks a reality right now.

**Integrated distributed operation management**

Utility Distribution Companies (UDCs) have been investing billions of dollars in AMI and other distribution infrastructures and assets. The challenge is how to realize comprehensive benefits from these investments:

- How to maximize end-customer satisfaction with AMI enablement
- How to maximize operational efficiency for distribution operation beyond smart metering
- How to minimize penalty payments and improve distribution grid reliability and safety

Integrated Distributed Operation Management addresses these challenges through innovative technology proven with the capability of managing some of the world’s largest distribution network model as follows:

- Fast status projection powered by intelligent prediction engine
- Analysis of end-customer connectivity through support of AMI integrated real-time interface
- Intelligent (Selective) Interrogation of Smart Meters to assess the outage profile resulting in reduction in SAIDI and CAIDI.
- Optimal switching with AMI integration to facilitate distribution grid reliability and active power reduction
- Optimal Voltage VAR Control for loss reduction, peak load reduction, and distribution capacity maximization
- Distribution grid operation management consolidated in single control center application integrated with AMI, GIS, CIS and IVR

**Distribution data intelligence management**

This application domain brings value-added application with data intelligence to UDCs, TDSPs, LSEs, and CSPs who are challenged with data complexity and dimensionality due to smart distribution devices.

- How to derive benefits from voluminous smart distribution measurement data
- How to manage distribution grid data with high penetration distributed resources

These challenges are addressed by:

- Single application suite for all measurement data management powered by configurable aggregation and calculation analytics
- Near real-time estimation of monetary value of load or distributed resource curtailment based on configurable market settlement for advanced DR schemes
- GIS-based “Distribution Viewer” down to individual customer level through support of AMI enabled real-time situational awareness display
- Intelligent interrogation of smart devices and data analysis

**Distributed generation management**

The industry is challenged by fast evolving exponential growth of distributed and renewable generation at various voltage levels on the grid. This application suite provides uniquely designed solution for ISOs, TSOs, UDCs, LSEs and LAs. This application domain addresses:

- How to manage, monitor and control thousands of distributed generation units with varying enablement and rejection control schemes
- How to perform portfolio management functions for operational planning including forecasting, estimation and simulation with security analysis
- How to operate and control DGs integrated with grid operation functions including FISR, together with Connect/Disconnect, and advanced VVC functions

**Demand response management**

UDCs, CSPs, participating LSEs and LAs are challenged due to barriers for customer enablement, high cost of service and complex techno-commercial issues. The challenge is how to develop scalable and grid operation integrated demand response with high customer engagement:

- How to facilitate higher customer enablement
- How to help innovate highly scalable, reduced cost and low risk multiple DR operation models

These challenges are addressed by:

- Integrated DR with grid operation from customer registration to load control to DR settlements
- Advanced DR Monitoring & decision support with grid operation intelligence and situational awareness
- Higher customer enablement through single DR platform supporting multiple business models from utility owned to outsourced services
- DR Dashboard for unified commercial & grid operations powered by DR dispatch models & algorithms
ALSTOM Grid deployed one of the most advanced distribution systems in the world. Our customer’s dynamic distribution network model contains approximately 25 million objects and is maintained automatically from their GIS. Updates from the GIS to DMS incur no down-time for the users as no failovers or process restarts are required. It combines a comprehensive set of distribution network visualization and analysis functions with a distribution SCADA and the EMS as well. In addition to real-time distribution power flow analysis integrating SCADA measurements, the system includes optimization functions for network reconfigurations and Volt/VAR management.

The deployment of the full electronic user interface and virtual control center configurability has allowed this utility to consolidate four distribution control centers into two. By the same token, during large storm restoration operations, many smaller virtual control centers can be deployed.

ALSTOM Grid, a major provider of telecommunications products and systems worldwide, successfully deployed a complex telecommunication infrastructure in Algeria for operation of the power distribution network. The telecommunication infrastructure serves the SCADA communications with a high level of performance, voice communications for the maintenance teams, and meter data communications between the four control centers and 25 distribution offices.

ALSTOM Grid proposed a solution based on a hierarchical network entirely based on various radio technologies: Digital Microwave Radio, Point-to-Multipoint TDM/TDMA, UHF Multiple Address Radio System and a TETRA network.

After several generations of in-house DMS development, which met the extreme operational challenges of Alabama weather, the distribution company decided to join forces with ALSTOM Grid and created the Integrated Distribution Management System (IDMS). Based upon the e-terra application family, IDMS is Distribution Management and Outage Management functionality seamlessly integrated with SCADA and AMI through a single user interface.

This system improves operational efficiency and safety through the consolidation of various functions in smart distribution. They will also speed outage restoration and improve feeder Volt/VAR profiles and have a smart distribution operations training environment.

The US Department of Energy (DoE) Gridwise program and EPRI are part of this IDMS project in order to enable smart distribution with a new level of distribution operations application integration and visualization.

Forty-three percent of Denmark’s total generating capacity comes from wind power. For the Danish National Control Center, ALSTOM Grid implemented a dedicated wind power and CHP distributed generation management system, providing crucial information for properly estimating how much generation each turbine produces, consolidated at each terminal substation bus.

In addition, each individual turbine may belong to a different Power Balance Responsible (PBR) party at a given time, and must be accurately accounted for in the aggregation/disaggregation operations, computing the actual generation of each PBR and properly evaluating generation balance. The estimation of the actual individual generation is also done for the next hours to come. A ‘look ahead’ assessment of the network security is included while the Dispatcher Training Simulator (DTS) provides a fully realistic operational behavior simulation environment.