ALSTOM Grid’s innovative solutions for grid stability, distributed generation and micro grids in substations

As a provider of CO₂-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. Within ALSTOM Grid’s Transmission and Distribution division, ‘Smart Grid’ solutions are an R&D priority.

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**

Due to economic and environmental constraints, the energy supply sector has been subject to considerable changes in recent years. The major challenge will be to balance environmentally friendly energy generation and distribution against technological and economic constraints as well as political demands to allow national economies to grow while protecting the habitat for the future.

Increasing energy demand, increasing distances between load and generation, limitations in transmission capacities and rapid changes in grid topologies may lead to bottlenecks in energy supply and grid stability issues.

**Customer Profiles**

- Power generation
- Transmission or distribution system operators and industries
Our drivers

Innovation & reliability
More than 100 years of experience in network protection shows that innovative ideas have to provide real benefits in terms of additional reliability and security in network operation before becoming a product feature. ALSTOM Grid invests in proven innovation. Extended field implementations ensure a high level of performance even in the challenging environment of modern electrical grid topologies.

High performance tools
Grid stability enhancement demands a deep understanding of dynamic grid status and underlying phenomena. Unique innovative tool sets like Phasor Measurement or Collapse Prediction allow us to analyze the grid, and to determine actions to increase stability.

More flexibility
Each electrical network is unique. ALSTOM Grid customizes Special Protection Schemes (SPS) for Grid Stability, Distributed Generation or Micro Grids. These schemes are specifically designed to fit complex requirements based on the full range of ALSTOM Grid products and solutions.

Extensive expertise
ALSTOM Grid provides consultancy services for analyzing and planning electrical networks and related protection & control solutions, with specific focus on Grid Stability, Distributed Generation and Micro Grids.
Tomorrow’s applications... available today!

Smarter Grids Management Solutions are specific 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.

Grid Stability
Our offering for on-line grid stability solutions consists of GPS synchronized Phasor Measurement Units (PMU) which provide a real-time image of the grid status that can be employed for better situation awareness on SCADA level or for fast Wide Area Monitoring Protection and Control Schemes (WAMPCS). We provide the full solution starting from the PMU devices, Phasor Data Concentrators (PDC), communication infrastructure and state-of-the-art energy management systems (EMS).

Customized Special Protection Schemes are already applying PMU technology as well as innovative, field proven algorithms to detect stability deficits before a network actually becomes unstable. Predictive functions are supervising all kinds of phenomena such as voltage changes, power swings and network frequency fluctuations. Fast detection of topology changes (Open Line Detection) delivers important information about the grid status to avoid blackouts.

The main benefits of ALSTOM Grid’s unique stability product range are:

- Real-time information to maximize situation awareness at SCADA level
- Procurement of an additional time reserve for corrective actions
- Fast automated wide area and local protection and control schemes to ensure real-time reaction to instabilities, and to limit the impact following pre-defined scenarios
- High-level measurement and recording functions to collect data to optimize network planning
- Comprehensive expert advice and consultancy services from network planning through real-time operation to detailed analysis of events

Distributed Generation Efficiency
For more than 100 years, electric power plants have mainly been large, utility-owned facilities, feeding distributed loads based on unidirectional power flow. During the past 20 years, smaller, independent power generation facilities have been developed and set up at various places in electrical networks. This increasing number of Distributed Generation sites, and their rated power from kilowatts to hundreds of Megawatts, creates new challenges for network planning and operation.

To maintain grid stability, specific regulations for grid connection (as listed by DISPOWER) have been established for Distributed Generation. New predictive algorithms developed by ALSTOM Grid are enhancing the selectivity of protection relays in the implementation of Loss-of-Grid and Anti-Islanding schemes.

Currently where large Distributed Generation - such as onshore or offshore windfarms - are connected to the grid, the rating of certain grid components (overhead lines, for example) can be exceeded. ALSTOM Grid’s modern Dynamic Line Rating (DLR) helps to manage power generation according to the actual dynamic ratings of the network assets. Real-time thermal models of overhead lines, cables or transformers, taking account of current environmental conditions, allow active management of embedded generation, thus retaining a given security margin and balancing economic and environmental constraints.

Micro Grid Management
Integrating and balancing loads and Distributed Generation in a well-defined network area, allow system operation in a self-sustaining islanded or interconnected mode. Fast load-shedding and load-restoration schemes and active generator management are pre-requisites for the implementation and operation of a Micro Grid.

ALSTOM Grid offers field proven solutions dedicated to critical infrastructures such as hospitals, airports or Oil & Gas plants. Innovative redundant communication and fast automation schemes provide the required reliability for the management of Micro Grid applications.
Case studies

In close collaboration with Hydro-Quebec, ALSTOM Grid has designed a new innovative Out-of-Step Detection relay - the P848. Based on new algorithms developed by Hydro-Quebec research institute (IREQ), rapid detection of open line conditions and loss of synchronism provides a unique solution for power system stability. Currently the implementation is underway with a testing phase of demanding and extensive procedures at Hydro-Quebec.

Field trials over the last 12 months with E.on UK have demonstrated that the new Dynamic Line Rating features within the P341 protection relays for overhead lines could contribute to a more efficient use of the existing Power Grid infrastructure. Better balancing of economic and environmental aspects can be achieved especially for Distributed Generation integration notably windfarms. P341 relays with DLR have also been installed in the last 3 months on an overhead line connecting a windfarm on the Northern Ireland Electricity (NIE) network.

RWE launched a pilot project to demonstrate interoperability of IEC 61850 based on a real installation incorporating different vendors. Specific focus was given to the implementation of Process Bus (IEC 61850-9-2). The commissioning has been finalized and the Digital Bay became reality in a 380 kV substation starting the test phase. A P444 relay connected to a Merging Unit via Process Bus is feeding a voltage regulator with all necessary real-time measurements via IEC 61850 station bus. This project is providing valuable feedback for the operation and test strategies of future substation automation systems which will be incorporated into new product designs and into the standardization process.