ABB Smart Grids for Distribution
Network Management - SCADA/DMS and utility communication

- **Business Application**
  - SCADA/DMS - Distribution Management System for efficient operation and analysis of MV & LV networks
  - Utility communication IP-based communication solutions

- **Main Features**
  - Modeling of the MV and LV networks
  - Work management
    - Assess safety for personnel, facilitate communication with crews in the field, support use of mobile devices.
  - Outage management
  - Fixed and wireless communication solutions for mission-critical applications:

- **Customer Benefits**
  - Optimum operations for MV networks, minimize losses and define voltage profiles
  - Access to information on assets, consumers and field operations
  - Enhanced work management
  - Integration to other applications e.g GIS, CMMS, CIS, CRM
  - Integrated communication solution
Distribution Management Systems (DMS)

- **Features**
  - **Basic Functions**
    - World map presentation with real-time data
    - Circuit Tracing and Coloring
    - Temporary Network Devices
  - **Distribution Network Analysis**
    - Load Calibration
    - Operator Load Flow
    - Contingency Analysis
    - Short Circuit Analysis
    - Fault Localization, Isolation and System Restoration
    - Loss Minimization
    - Unbalanced Calculation
    - Distribution Training Simulator
  - **Outage Management Applications**
    - Trouble Call Management
    - Outage Analysis
    - Crew Management
    - Outage Information and Reporting
  - **Switch Order Management**
    - Switch order creation & management
    - Safety tags
    - "What if" studies
    - Emergency switching

- **User Benefits**
  - Planned and unplanned outage handling based on SCADA information and Trouble calls
  - Efficient management of crews
  - Advanced display, monitoring and analysis features for efficient, safe and optimal management of the distribution networks
  - "What if" analysis allowing users to assess the impact of switching actions before making field changes
  - Integration to e.g CIS, GIS and ERP systems
Traditional versus Smart Grids – a transition

**Traditional Grid**
- Centralized power generation
- Uni-directional power flow
- Operation based on historical experience

**Smart Grids**
- Centralized and distributed power generation (renewable)
- Multi-directional power flow
- Operation based on real time data
One definition of a Smart Grid:

The Smart Grid is a system of networked utility and consumer devices and information technology that optimize the secure, reliable and efficient production, delivery and consumption of electricity. (IBM)

### Market Drivers

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<th>Market Drivers</th>
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<td>Increased demand</td>
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<td>High energy prices</td>
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<td>CO₂ reduction</td>
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<td>Security of supply</td>
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ABB portfolio – all over the system!

Smart Grids – why and what
ABB Smart Grids offering
Smart Grids business drivers and solution areas
Smart Grids references
Smart Grids R&D and pilot projects

System operation:
- Network Manager
- SCADA/EMS (incl. WAMS)
- BMS

Power generation:
- Network Mgr. SCADA/GMS
- System 800xA
  - thermal
  - hydro
  - solar

Power transmission and distribution:
- solutions for load flow control and power quality improvement
- Network Manager SCADA
- substation automation
- Network Manager SCADA/DMS
- distribution and feeder automation
- distribution communication

Power system communication
- optical communication
- radio communication

Demand response
- smart metering
- advanced home appliances
Smart Grids and Distribution

- Smart Grids will have the largest impact on distribution - A Paradigm shift in distribution operation is taking place
  - Need for CO2 reduction leads to
    - Introduction of renewable in the MV and LV network e.g. wind power
    - Improved energy efficiency
    - Increase demand for loss reduction
  - Increased reliability demand
  - Utility Customer satisfaction
    - Demand response, intelligent meters and home automation
    - Increased automation to minimize down time
    - More data available in real time and making the distribution networks (MV and LV) more observable
  - Changing set of regulatory framework
Distribution Networks – Rapidly changing

Islanding Control
Voltage & Load Control
SVC
Fault Current Limitation
Storage

Power Flow

Changing Grid Infrastructure
Network Effects & System Solutions

Automated Meter Infrastructure
Outage Management
Fault Localisation
Fast Restoration
Local Energy Management

Source: Ofgem
Smart Grids
Network Management SCADA/DMS

- Addresses distribution customer segments
- SCADA/DMS (Distribution Management System) for efficient operation and analysis of medium and low voltage networks
  - Models sub-transmission and distribution (including medium- and low voltage) networks
  - Trouble call management
  - Switch order management and automatic generation
  - Outage management
- Workforce management
  - Assesses safety for personnel, facilitate communication with crews in the field, support use of mobile devices
  - Crew management
  - Mobile dispatch integration

Smart Grids contribution
- Optimum network operations with minimized losses
- Access to information on assets, consumers and field operations
- Enhanced work management
- Integration to other business applications e.g. GIS, CMMS, CIS, CRM
Smart Grids - Distribution Automation

- Addresses distribution customer segments
- Control and indication (local/remote) of the breakers, switches using COM600
- Set point control of remote IEDs such as tap changer desired voltage level
- Automatic reclosing after fault using PCD, REC523
- Initiation and recognition of sequence of events (SOE), for example, routing the power around transformer by opening/closing circuit breakers using REC501, REC523 IEDs
- Alarm sensing, for example, breaker/switch SF6 leakage using REC501, REC523 IEDs

Smart Grids contribution

- Real time data to SCADA, e.g. trip alarm, fault location, breaker status, metering
- Fast fault isolation and restoration
- Maximum safety for local and remote control
Smart Grids
Distribution communication

- Addresses distribution customer segments
- SCADA Com Unit
  - Cost efficient transmission of IP-based and serial control and monitoring (SCADA), voice over IP (VoIP) and video surveillance data
  - Connectivity over single fibre, copper (SHDSL) and/or E1 (PDH/SDH)
  - Supports advanced management systems

Smart Grids contribution
- Enabler for new real-time monitoring and control applications in distribution
- Improved reliability and availability of power grid with automatic traffic protection and path diversity
- Improves power system efficiency and optimization through integrated communication infrastructure for mission-critical applications
Smart Grids
Optical communication networks

- Addresses generation, transmission and distribution customer segments
- FOX family
  - High-performance optical communication platform integrates Ethernet, fast Ethernet and gigabit Ethernet over PDH, SDH and WDM
  - Integrated architecture based upon open standards
  - Homogenous solution from teleprotection and access to transport
- PC-based, fully graphical network management solution

Smart Grids contribution
- Enabling decentralized, self-healing and efficient grid operations
- Secure integration of operational and cooperate communication infrastructures
Smart Grids
Radio systems solutions

- Addresses generation, transmission and distribution customer segments
- VHF / UHF radio
  PMR private mobile radio microwave PtMP
- UHF/VHF, PMR and MW radio solutions for transmission of advanced control and monitoring, voice and video applications
- Wireless voice communication for mobile workforces

Smart Grids contribution
- Communication coverage, especially in rural and suburban areas
- Enabler of wide-area power grid coordination and fast recovery from failures
- Increased operational efficiency of mobile workforces
Improved controllability of distribution networks

**Challenge/Potentials**
- Integration from Feeder to control center
- Control loops with increased functionality
- Local and central control increased

**Customer benefits**
- Energy efficiency
- Reliability
- Lower operational cost
Operational and business systems integration

Challenge/Potentials

- Integrate the systems from the operational world and the commercial e.g. CRM, GIS and ERP
- Business process oriented solution
- Single data entry

Customer benefits

- Operator efficiency
- A system covering all network districts through common business practices-optimized business process
Integration and usage of AMI data

Challenge/Potentials

- Possibility to interface AMI to SCADA/DMS for improve network applications e.g. load calibration
- Interface AMI with outage management functions system to improve outage detection and restoration notification
- How to handled the information from the meters – how to manage the (missing) topology information?

Customer benefits

- Increase revenue and reduce energy losses
- Improve utility customer satisfaction- minimize outage time
- Improve restoration operations
- Improve system reliability and stability
Hybrid and integrated communication infrastructure

Challenge/Potentials
- System approach for an integrated “hybrid” communication solutions
- Real time communication
- Communication and Smart homes

Customer benefits
- Improved system reliability and performance thanks to dedicated communication infrastructures with path diversity
- Allow various intelligent electronic devices (protection, controller, capacity banks, FACTS devices sensors etc.) and users to interact as a system
Enable distributed generation,

**Challenge/Potentials**

- Control and optimize the intermittent power from renewables such as wind power
- Maintain the grid stability with increased amount of renewable
- Improved prognosis and profiles to optimize use of renewable

**Customer benefits**

- Larger part of renewable in power systems - CO2 reduction
Smart Grid Roadmaps will vary

Main drivers:
- AMI
- CO2 reduction
- Reliability

Examples

Time
Cost

AMI
Substation/Feeder Automation
Communication infrastructure

SCADA/DMS applications

Time
Cost

AMI
Communication infrastructure

SCADA/DMS applications
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Power and productivity for a better world™