

Binh Lam 林平, BU Network Management/ SMART GRID - TAIWAN, 2009-04-08

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

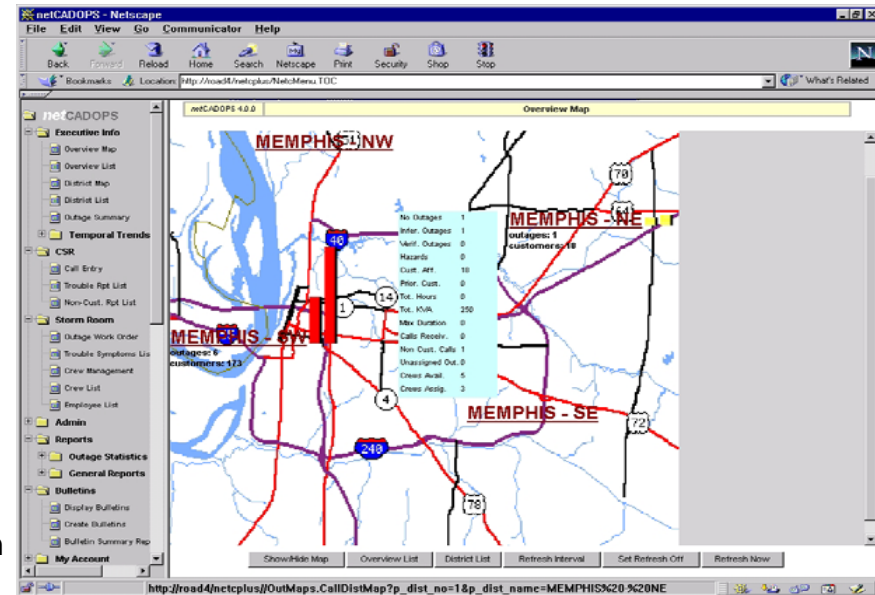
- Load Calibration
- Operator Load Flow
- Contingency Analysis
- Short Circuit Analysis
- Fault Localization, Isolation and System Restoration
- Loss Minimization
- Unbalanced Calculation
- Distribution Training Simulator

■ 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



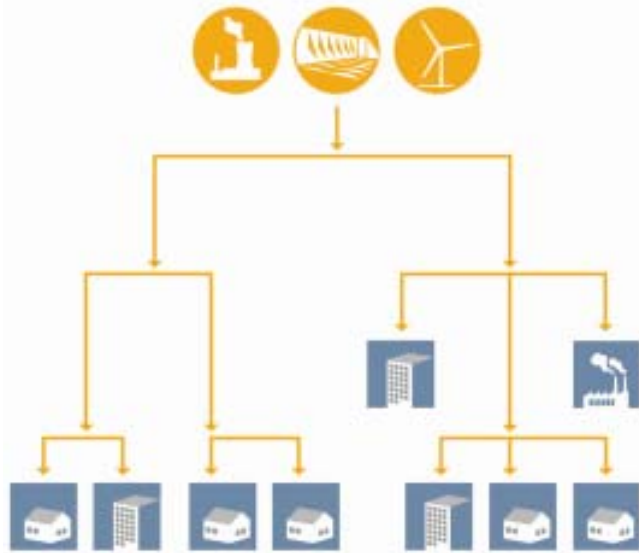
■ User Benefits

- 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

Smart Grids: Definition and Drivers-add

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
Increased demand
High energy prices
CO ₂ reduction
Security of supply



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 system communication

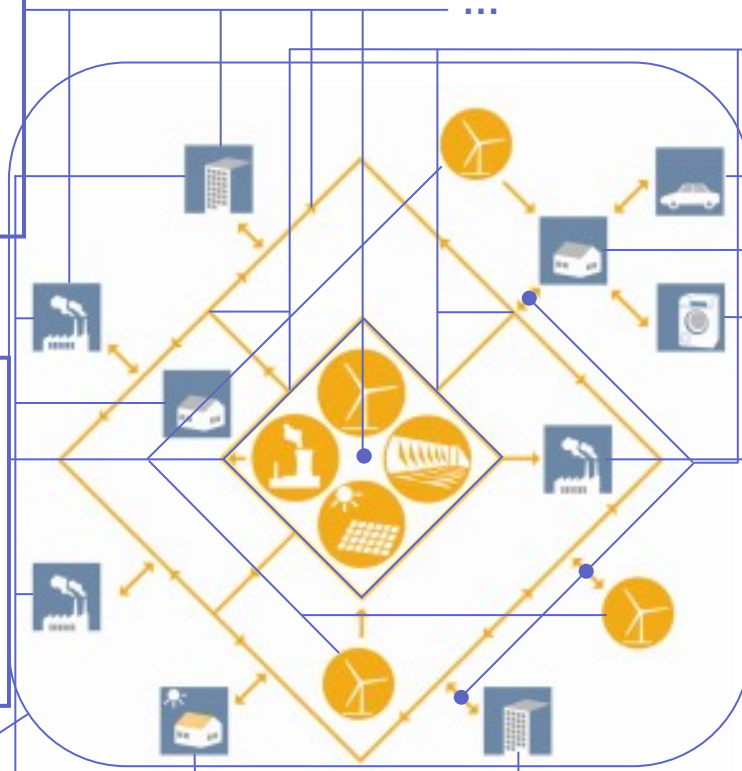
- [optical communication](#)
- [radio communication](#)

Demand response

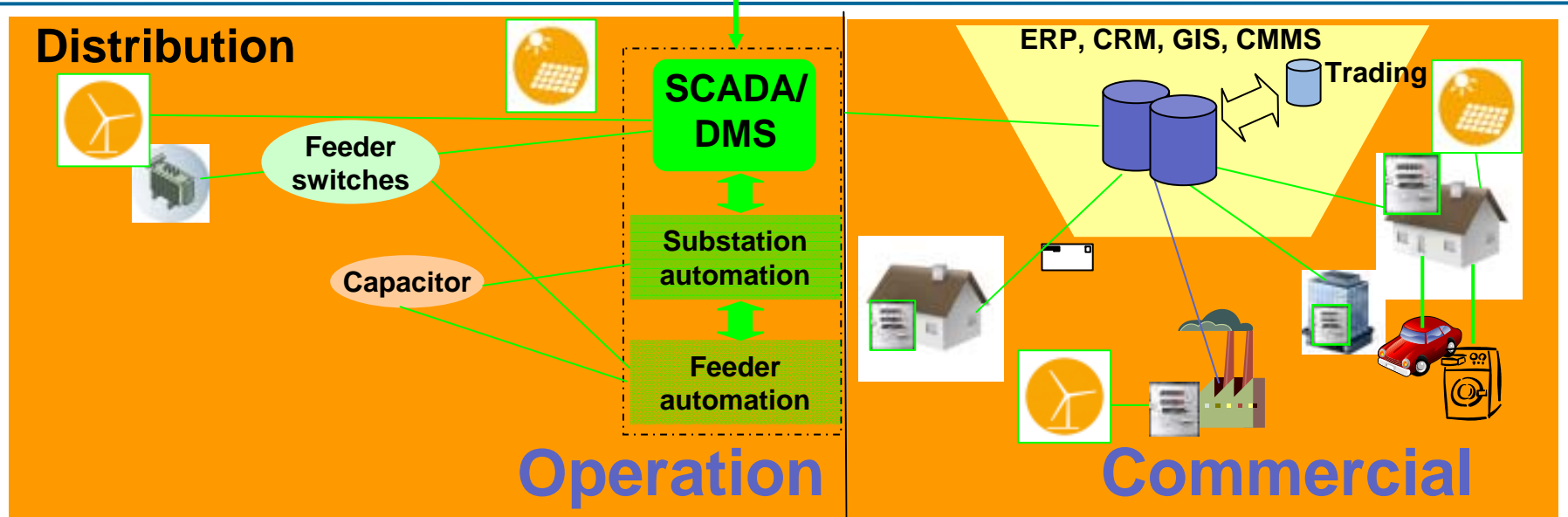
- smart metering
- advanced home appliances

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](#)



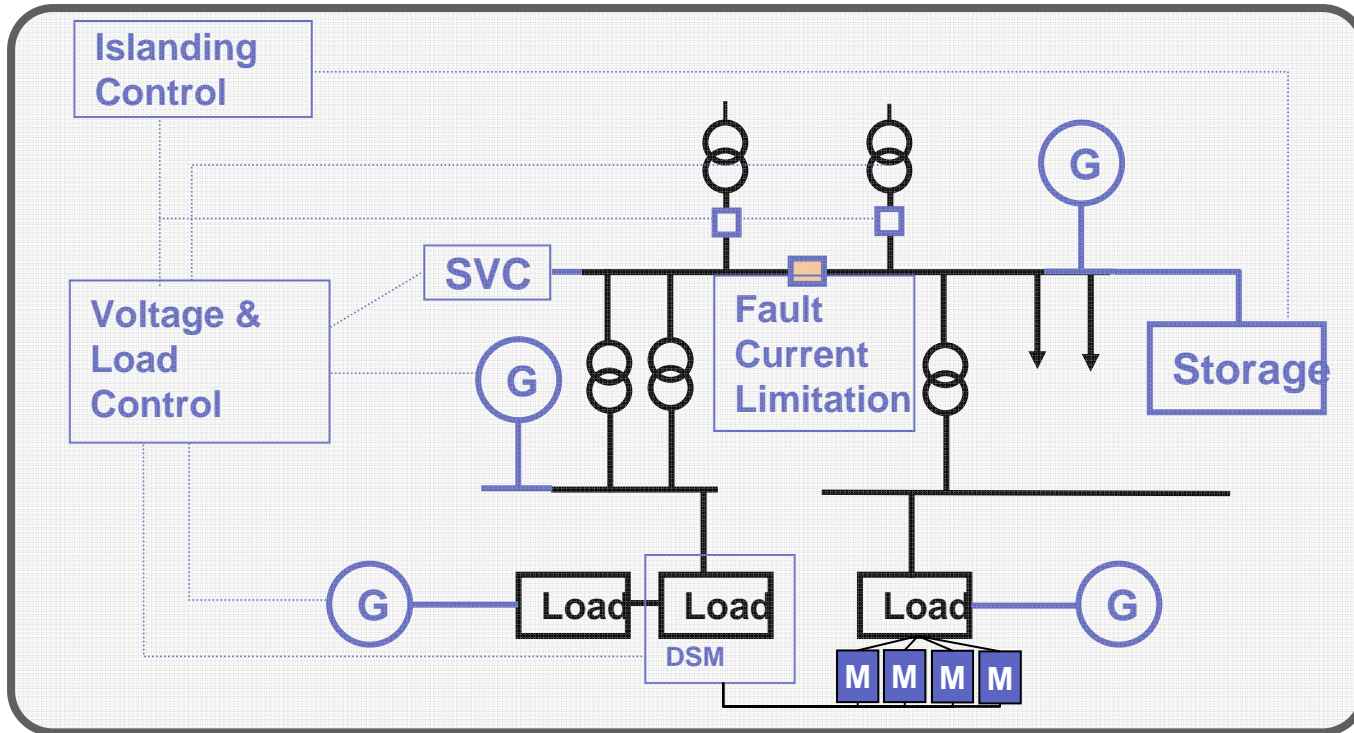
Smart Grids and Distribution



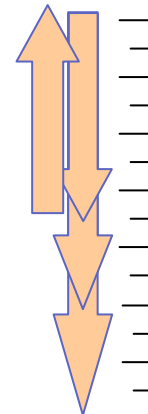
- **Smart Grids will have the largest impact on distribution- A Paradigm shift in distribution operation is taking place**
 - **Need for CO2 reduction leads to**
 - Introduction of renewable in the MV and LV network e.g. wind power
 - Improved energy efficiency
 - Increase demand for loss reduction
 - **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

Source: Ofgem



Power Flow



Changing Grid Infrastructure

Network Effects & System Solutions

Automated Meter Infrastructure

- Outage Management
- Fault Localisation
- Fast Restoration
- Local Energy Management



Smart Grids

Network Management SCADA/DMS



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

- 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 - Distribution Automation



Smart Grids contribution

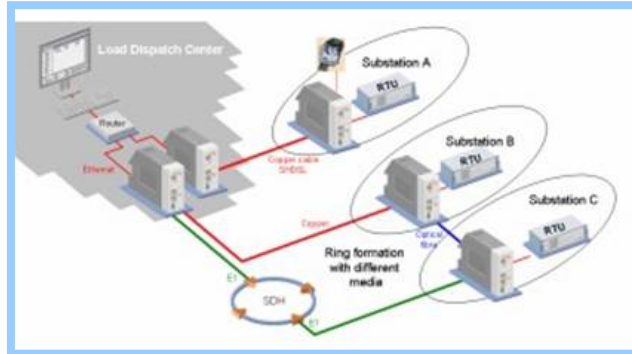
- Real time data to SCADA, e.g. trip alarm, fault location, breaker status, metering
- Fast fault isolation and restoration
- Maximum safety for local and remote control

- 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

Distribution communication



Smart Grids contribution

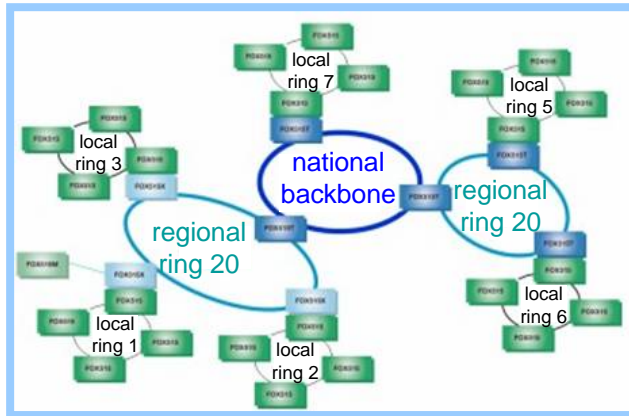
- Enabler for new real-time monitoring and control applications in distribution
- Improved reliability and availability of power grid with automatic traffic protection and path diversity
- Improves power system efficiency and optimization through integrated communication infrastructure for mission-critical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

- 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

Optical communication networks



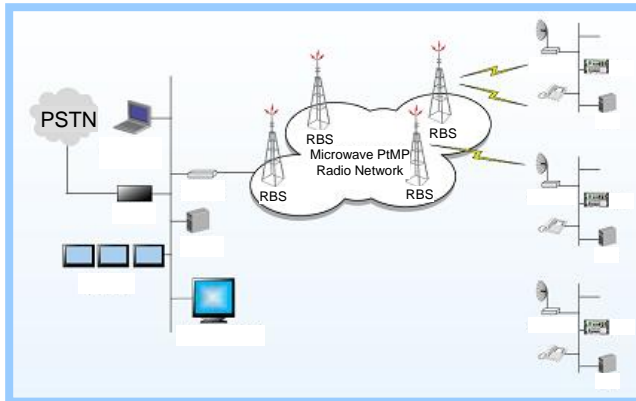
Smart Grids contribution

- Enabling decentralized, self-healing and efficient grid operations
- Secure integration of operational and cooperate communication infrastructures

- 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

Radio systems solutions

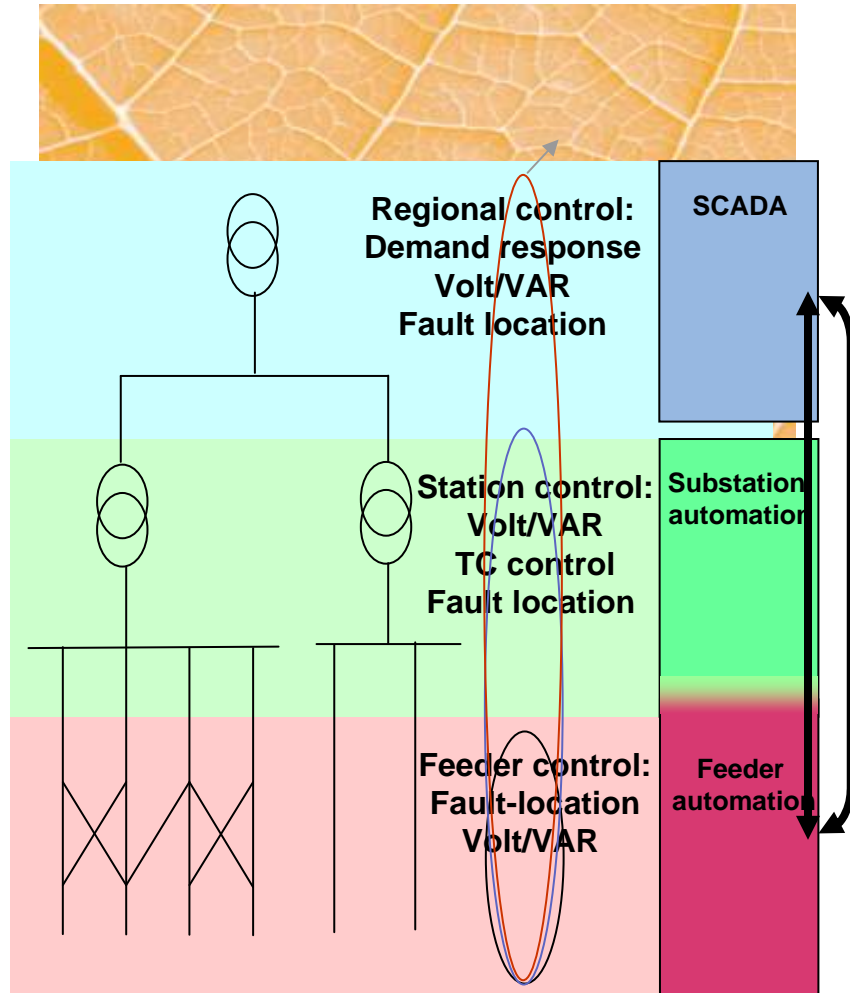


Smart Grids contribution

- 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

- 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

Improved controllability of distribution networks



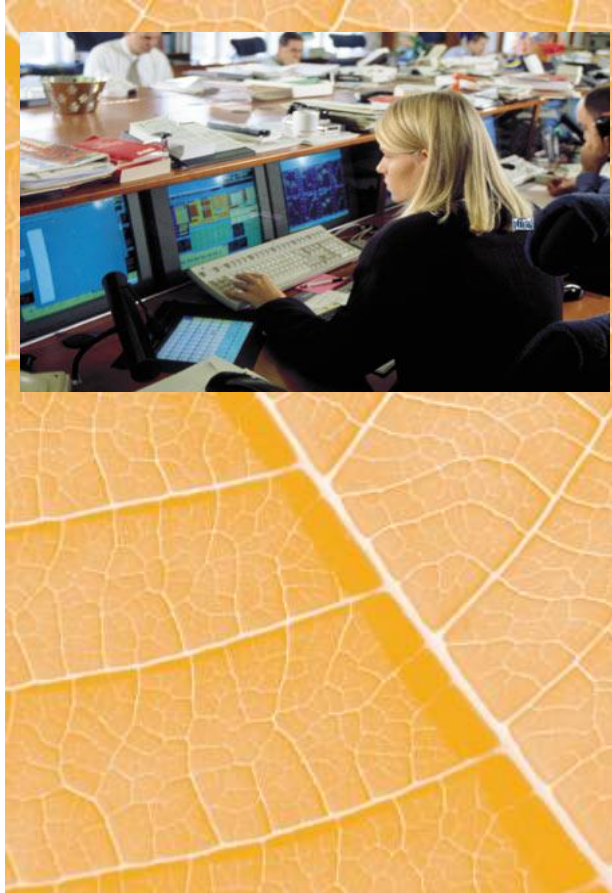
Challenge/Potentials

- 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



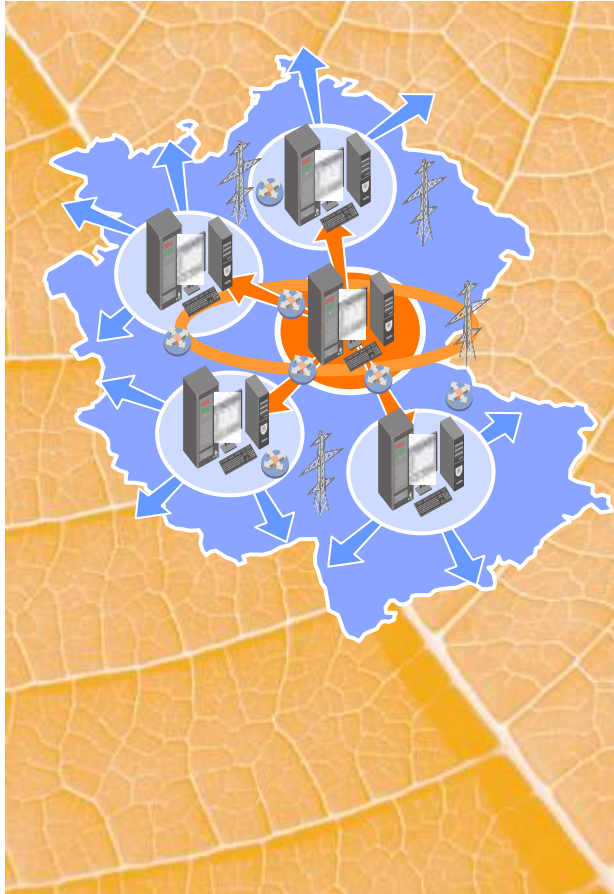
Challenge/Potentials

- 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

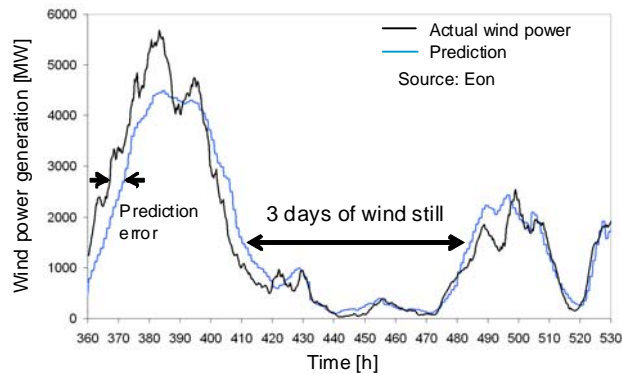
Customer benefits

- 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,



Wind power storage: two time scales



3 - 33 -



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

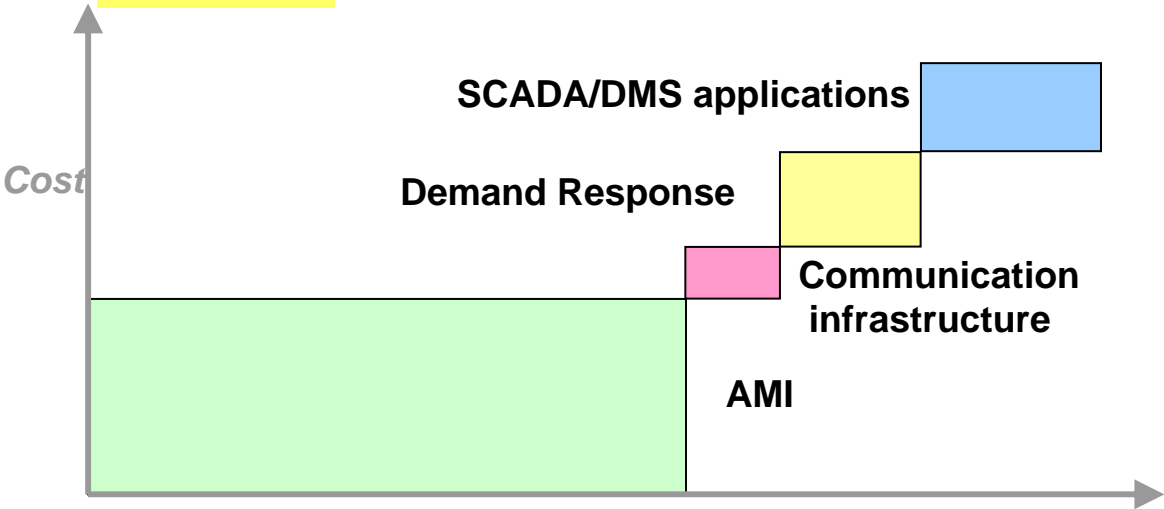
Customer benefits

- Larger part of renewable in power systems- CO2 reduction

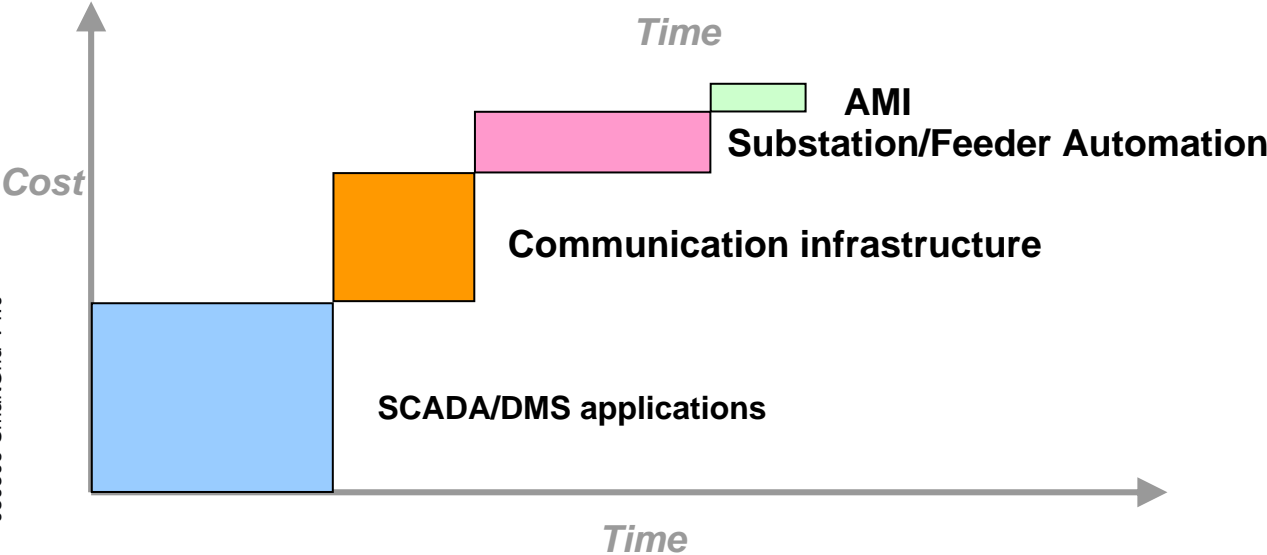


Smart Grid Roadmaps will vary

Examples



- **Main drivers:**
 - **AMI**
 - **CO2 reduction**
 - **Reliability**





Power and productivity
for a better world™