Smart Grid
– the Industry Perspective

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Energy systems change – worldwide...
Utilities’ business framework is changing

System requirements

- Affordability
- Climate protection
- Efficiency
- Reliability

Technology trends

- Large and flexible generation
- Distributed generation
- New grid technologies
- Storage, new consumers, Intelligent Buildings

Customer Specific Solutions

Smart Grid is an integral part of the solution set
There is not one global Smart Grid
Regional drivers are different: some examples

- Aging infrastructure
- Non-technical losses
- Distributed Generation
- Electrification of Megacities
- Renewables Integration
Europe: Large push for renewables and eMobility

Lillegrunden, Sweden

Electrification of transport

Rural Germany
Paradigm shift in power grids / the new age of electricity

### Traditional power Grid
- Centralized power generation
- One-directional power flow
- Generation follows load
- Operation based on historical experience

### Smart Grid
- Centralized and distributed power generation
- Multi-directional power flow
- Consumers become also producers
- Intermittent renewable power generation
- Load adapted to production
- Operation based on real-time data

#### From
No environmental concerns

#### To
Environmental awareness
Smart Grid layers

Integrated system consists of several layers:

- **Application layer** (services, solutions and applications)
- **Data layer** (communication, data transportation and control)
- **Physical layer** (generation, transmission and distribution, consumption)
Smart Grid Suite enabling all vertical solutions

Vertical SG solutions
- Generation Grid Applications
- Transmission Applications
- Industrial & Infrastr. Grid Applications
- Rail Electrification
- Distribution Applications
- Microgrid / DG / VPP Applications
- Demand Response
- Smart Metering

Horizontal IT
- Grid-specific Enterprise IT

Grid control platform
- Energy Mgt. System
- Ind. Distribution Mgt. System
- Rail SCADA System
- Distribution Mgt. system

Grid application platform
- Demand Mgmt. System
- Resp. Meter Data Management

Operational IT
- Information & Communicat.
- Grid specific communication platform
- Automation
- Grid automation platform

Field Equipment
- Solutions incl. Primary equipment

Enterprise IT
- Horizontal IT

Solutions incl. Primary equipment
- Electr./Gas/Water/Heat

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Sector Infrastructures & Cities
Why standards?

- **Unprecedented Speed of standardization efforts**
  - Standardization organizations have picked up the topic at top speed

- **Market: Standards build global markets**
  - E.g. Harmonization of Smart Metering to build European market (M441)

- **Politics: Public stimulus packages support standards**
  - US: Standards are the base for ARRA Smart Grid projects (5”$)
  - EU: Mandate 490 Smart Grid Standardization

- **Technology: Interoperability is key area for standards**
  - Communication and data models need to be standardized to allow interoperability of solutions and the development of new applications
International Activities

- Smart Grid Coordination Group
- Smart Grid Mandate M/490
- Smart Metering Mandate M/441
- Electrical vehicle Mandate M/461
- DKE, VDE „German standardization roadmap E-Energy“
  BMWI Uslar et al „Investigation of standardization for BMWi-project E-Energy“
- BDI „Internet of Energy“

- METI, JISC
  Roadmap to international standardization Smart Grid

- SGCC
  The State Grid Corporation of China – Smart Grid Framework

- IEC/SMB Strategy Group 3 (SG3)
  „Smart Grid“ - Roadmap
- UCAiug - Open Smart Grid Subkomitee
- ITU Smart Grid
- CIGRE D2.24
- IEEE SCC21 Standards Coordinating Committee on Fuel Cells, Photovoltaics, Dispersed Generation, and Energy Storage
- IEEE P2030 Standard Interoperability Smart Grid Concepts

- NIST Framework and Roadmap for Smart Grid Interoperability Standards
- SGIP
- Intelligrid
- Gridwise Alliance

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Identified Core Standards

- IEC 62357: Seamless Integration Reference Architecture
- IEC 60870: Transport protocols
- IEC 61970/61968: Common Information Model CIM
- IEC 62325: Market Communications using CIM
- IEC 61850, 61850-7-4XX: SAS, Communications, DER
- IEC 61400: Communications for monitoring and control of wind power plants
- IEC 62351: Security for Smart Grid
- IEC 61334: DLMS
- IEC 62056: COSEM
- EN 50090 (KNX)
- ZigBee
Challenges in standardization?

Horizontal complex issue
Silos vs. holistic view

A lot of stakeholders
IT, Energy, Consumer, etc.

Different innovation speeds
E.g. hardware vs. software

Moving targets
Lot of still immature R&D, pilots and demonstration projects

Political influence
Regulated markets; Mandates in Europe

Race for global standards
Premature standards may be pushed internationally
Trends in standardization?

Horizontal complex issue

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Strategic Groups

Coordinating established

Cooperation

SG-CG, Liaisons, SGIP

Functional Architecture

Separate functions from implementation

Flexible Frameworks

Focus on continuous processes

Link Politics to Standardization

Mandates; EC-CG; METI-JISC; DOE-NIST

Top-down approach

Don’t standardize too fast and too much
Thank you for your attention!