German Smart Energy Challenges for medium sized DSOs in context of local Smart Micro Grids
Agenda

• Introduction
• „Smart Energy“ Views
• Market View – bottom up
• Challenges for Energy suppliers and utilities
• Communication as a Key-Factor
• Grid View – top down
• Collaborating Smart Micro Grids (CoSSMiC)
• „Smart-Street Lighting“
Introduction

- Constance – Birthplace of count „Zeppelin“
- Located in southern Germany / Swiss Border
- Lake of Constance – Central Europe’s third biggest lake
- Stadtwerke Konstanz - Municipal utility

Constance:
- Roman origin
- Population 85,000
- Two universities
- Tourist area
- Historical city centre
- Natural reserve
- EU-external frontier
- No major industries
Introduction

- **Stadtwerke Konstanz**
  - Power, Gas and Water Supplier
  - Energy Service, City bus traffic
  - Thermal Spa, Ferry Boats, cruise vessels

- Distribution Grid (110/20kV/0,4kV)
- Redundant Suppliers (Germany / Switzerland)
- 350 Substations / 53.000 Power Meters
- Central SCADA System (NCC)
- >10MW Photovoltaic Power (No Wind power)
- Telecommunications carrier (FTTC/B/H)
- Distributed Datacenter Operator (Tier3+)
- Submarine fibre optic cables
„Smart Energy“ Views

Grid View

- Grid - HV
- Grid - MV
- Grid - LV

Market View

- Smart Meters & Gateways

legislation, regulations, etc.

„GLUE“

Communications, IT, Security, etc.

Energy Automation, SCADA

Systems, etc.

Applications

MDM, etc.

Datacenter

costs vs. financing

market, roles, users, etc.

several uncertainties
Market View – Smart Metering

bottom up
German Smart Meter Regulations

- 2012-2013 Cost-Benefit Analysis for Germany (Ernst&Young)
- Economic Benefits and Several Rollout Scenarios
- Proposal for Germany:

  Rollout Scenario Plus

Role of the Smart Meter Gateway-Administrator
Rollout Scenario Plus

• intelligent Metering System (iMSys)
  – Smart Meters connected to a Gateway
  – Gateway connected to further systems (IP based)
  – mandatory for consumers >6.000kWh/a
  – mandatory for renewables >7kW

• intelligent Meters (iZ)
  – Smart Meters not connected to a gateway
  – connectable to remote Display

• Rollout
  – 68% Rollout until 2022 (1/16 per year)
  – 100% Rollout until 2030 (1/16 per year)

• SMGW Administrator is primarily the DSO (Metering Operator)
Smart Metering Gateway

SMGW Administrator

- Operations and monitoring of Metering Systems
- User-Management
- Configuration & collection of Billing, Tariffing, Accounting & Status data
- Security and Crypto Key Management
- Firmware and Configuration Management
- Administration of Meters (connected to LMN)
- Time synchronisation
- Providing relevant Data to further market participants
- Monitoring the whole life cycle of the metering system
- Performing exchange processes
- etc.
Challenges for DSOs

- Konstanz: 53,000 Power Meters & 15,000 Gas Meters
- Installation costs per remote Display around 90€ (VKU)
- Installation and operating costs for LMN / WAN access uncertain
- Meter locations often difficult to access and to install communication links
- Network access of meter location often inadequate (GSM/DSL/FttX)
- Extensive IT-Knowledge, Infrastructure and processes necessary

→ challenge for small and medium sizes DSOs in Germany
Challenges for DSOs

- Several uncertainties, not clarified today
- Costs, financing and refinancing not clarified
- No concrete regulations until now ➔ no investment protection
- Rollout-regulations not finally fixed
- Certifications (i.e. ISO27001...) necessary

➔ Make of Buy decision (black/white)?

Communication as the key factor is the „GLUE“ which keeps the system together
Practical approach in Konstanz

- Holistic view of several parameters
- Concentrate on reliable environment parameters
- Leverage synergies with other departments
  - Telecommunications, Energy Automation and IT
  - Avoidance of costs

- Usage of Real Options to be capable of acting in the future
- Generate as much know how as possible (research projects)

- Division and Separation of Value Chain
- Substation Automation in order to realise Smart Grid
- Cooperation will be necessary and crucial
Grid View – top down
Telecommunications Activities

- Fibre optic backbones since 1996
- Originally used for substation automation

⇒ FTTB/H rollout for whole city area

⇒ Stadtwerke Konstanz:
  - Carrier for Internet, Telephone, TV, IPTV, Datacenter and Cloud Services
  - Cooperation of 5 utilities in southern Germany to generate products and services
  - Modern distributed Datacenter, virtualisation environment
  - ISO27001 certification in 2015
  - MDM System

⇒ Key success factor for „Internet of the Energy“
  Two fibers per building reserved for „Smart X“
Communications as the „GLUE“

• Experiences of past smart metering activities
  – Low acceptance with customers (today) / No real benefit for consumers
  – Establishment of communication links (bidirectional) is expensive
    But: Energy grids have to be highly automated (Smart Grids)

• Challenges for Smart „X“
  – Automation of numerous Systems and levels, controlling various parameters
  – SCADA System plays a central role (central control of all systems)
  – Collection, storage and evaluation of data (Data Mining)

• Convergence of Energy- and Communication Networks
  Bidirectional, fast, secure and reliable Communication
  based on Fibre Optic is essential for future proof automation purposes

➔ First Step: „FTTS“ Fibre to the Substation
Fibre to the Substation

- High Reliability
- Future Proof Fibre Optic Infrastructure
- Secure Networks
- Scalable Technology
- Distribution Grid
- Micro Grid
- Smart Meters
- Telecomm.
- FttH
- Broadband
- 380 kV
- 20 kV
- Gigabit Ethernet
- Generation & Transport
- Broadband
- Grid
- Micro Grid
- Smart Meters
- Scalable Technology
- Secure Networks
- Distribution Grid
- Future Proof Fibre Optic Infrastructure
- High Reliability
Communications Strategy

- Intensify Top-Down Strategy
- Combine of Substation Automation with Fibre Rollout
- Combine Smart Meter Rollout with Fibre Rollout
- Adjust Business Processes
- Combine Energy automation, TK & IT as a business unit
- Try to get Experience and Know How
- Rise degree of Automation
- Rely on sustainable parameters like Fibre Optic Networks
Smart Energy

Research Activities
Smart Metering Activities

• Various „Field Tests“ of Smart Metering Systems
  – Power Line, DSL, TETRA, GSM/UMTS, etc.

• Two Research Projects
  – CoSSMic (EU founded, FP7)
  – Smart Street Lighting
Research Project „CoSSMic“ (EU)

- Collaborating Smart Solar-powered Micro Grids
  - EU Founded
  - Prosumer collaboration within a local „neighborhood“
  - Enable higher rates of automated self consumption
  - Reduce energy losses / raise system stability
  - Distribution Network used as a „energy bus“
  - Aggregation of Micro Grids and peer-to-peer collaboration

- Development of an autonomic ICT based system controlling local Generation, Consumption and storage of Energy

http://www.cossmic.eu
Research Project „CoSSMic“ (EU)
Smart Street Lighting

- University of Constance (Computer Science Dept.)

- Development of a „Universal Home Service Gateway“ (Hardware), IP-Based

- Development of a Software-System to manage meters (bidirectional) – data collection and storage

- Web based customer front-end to visualize data
- Standard database-interfaces for third-party-systems
- Data encryption through standard VPN-technologies
Smart Street Lighting

- Research Project to reduce OPEX for Street Lighting
- Metering of energy consumption of Street Lights (per cluster)
- FttS in combination with industrial Ethernet switches
- SCADA System connection

- Overall consumption: ca. 1MW

- Project-Goals:
  - Automatic indication of defect lamps
  - Cancellation of manual routine controls during daytime
  - Transparent visualization of energy efficiency and consumption data
Smart Street Lighting

Substation Installation

- IEC1107 (RS485)
- Ethernet

Fibre Optic Network

Web-Interface, Data visualization
Summary

- Smart Metering and Smart Grids are strongly related to automation aspects
- Complete grid automation cannot be done within a few years
- Substation automation is crucial
- Certainty on all levels is essential necessary for Smart Metering
- Fibre optical networks are necessary to provide reliable, fast and secure communication
- FTTH-Projects can generate huge synergy Potentials in order to realize various efforts
Summary

Provision mega-/gigabits!

Control power with kilobits!

Sell the rest!

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