Interactive customer interface for active network management and electricity market

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Projects objectives and tasks

Objective

Development of interactive customer interface integrated with supplying distribution system enabling

• market oriented demand and power production control
• system oriented demand and power production control
• efficient use of energy
• on-line management and control of quality of supply
  - interruptions and voltage
• cost-efficient network interface for distributed generation (DG)
• enlarging control center systems also for management the last parts of the network (i.e low voltage network)
• improvements in distribution system economy and reliability

Verifying the benefits of interactive customer interface (i.e intergration of third generation AMR, power electronics and communication) by simulations and demonstrations
Interactive customer interface

ICI = interactive customer interface, AMR = automated meter reading, PE = power electronics

Interactive customer interface is based on 3. generation AMR, power electronics and communication with electricity market, TSO and DSO
Power electronics in distribution systems

- Power electronics enables LVDC distribution and interactive customer interface for electricity users and small scale power producers
- Power electronics enables better cost-efficiency, reliability and voltage quality
Interactive network and customer management at DSO level

- Integration of AMR, DMS and QMS can be applied in network operation, asset management, customer service and other functions.

DMS = Distribution Management System
QMS = Quality Monitoring System
ICI = interactive customer interface
Tasks

A. Determination, specification and development of the technique and functions of interactive customer interface
   • analysis tools for
     • market and frequency driven load and production control
     • on-line power quality control
     • integration of DG with AC and LVDC distribution systems
   • concepts for
     • AC/DC and DC/AC converters
     • AMR applications
     • network interfaces for distributed generation
   • simulation of
     • interaction of interactive customer interface with supplying distribution network by RTDS-simulator
       • market (real time pricing) and frequency driven load control
       • connection of small scale power production
       • DC/AC supply
       • on-line voltage control
       • on-line interruption management
Projects objectives and tasks

Tasks

B. Determination, specification and development of tools and concepts for applying interactive customer interface in different upper-level functions (DSO, TSO, electricity trade, service provider)

- concepts and simulation tools for
  - real time pricing
  - active load and DG control (virtual power plant)
  - management of security of supply
  - management of low voltage network by control center applications
  - reserve capacity management
  - integrated AC and LVDC distribution systems having small scale power sources (load flows, risk analysis, protection)
  - applying information obtained from interactive customer interface in network asset management, network operation and customer service
Projects objectives and tasks

Tasks

C. Demonstrations of

• interactive customer interface and it’s functions
  • some thousands of customers
• integrated distributed generation and LVDC distribution systems
  • some pilot implementations
• DSO, TSO and electricity trade level applications
  • in some DSO, TSO and electricity trade companies
Project organization

Organization

Coordinator: Hermia Technology Center, Tampere (Finland)

Distribution companies: Vattenfall (Sweden), Fortum (Finland), Suur-Savon Sähkö (Finland), Koillis-Satakunnan Sähkö (Finland), Estonia Energy (Estonia), ?

Transmission grid companies: Fingrid (Finland), Estonia Energy (Estonia)

System and equipment developers: ABB Distribution Automation, ABB Drives, Aído (Finland), Nokia Capacitors (Finland, Germany), ?

Research organizations: Tampere University of Technology (Finland), Lappeenranta University of Technology (Finland), University of Milan (Italy), St’Petersburg State Polytechnical University (Russia), ?