

AGORA FROM SOURCE TO CONSUMPTION

Development of a reliable, cost effective and sustainable energy system based on renewable energy sources. The transformation of the energy system require new

knowledge, theories and methods for developing new technologies, components and solutions in close cooperation between research institutions and industry.



Grp 0: USB
The IEEE PES ISEGT Europe 2013 conference with +500 participants from industry and academia discussing the cutting-edge development of smart grid technologies and the associated solutions related to increased penetration of renewables and distributed energy resources in the power system held at DTU in Lyngby hosted by Center for Electric Power and Energy.

USB



Grp 1: Energy production
Coming from an energy system primarily based on fossil fuel Denmark has the ambition to be 100 pct. Fossil free in 2050 starting by phasing out coal and introducing renewable energy sources such as wind and solar in the system.

Coal from Østkraft on Bornholm, PV Cella from Solon Energy, Wind turbine from Siemens Wind Power.



Grp 2: Power transmission and distribution
Renewable energy sources results in a more dynamic power generation supply at all voltage levels. This causes an increased need for optimal and efficient grid between producers and consumers. The Cable Action Plan 2013 sets out how the total Danish 132-150 kV overhead lines will be replaced by cables. This is partly to avoid costly damages caused by climate change and in order to improve the visual environment.

Overhead line and cable from nkt cables and a high temperature superconducting wire from nkt cables & Southwire.



Grp 3: Measurement and control
In a decentralized energy system, which is connected to a large number of different production units, the integration of ICT-based technologies into energy grids is vital in order to enable constant ongoing monitoring, control, and regulation. Further, measurement and control are being merged in embedded micro-processors to provide distributed and intelligent (automated) decision making.

Analog Multimeter used in experiments and teaching activities from 1970 to 2005 and a digital multi-purpose instrument, enhanced interface and with bluetooth connection.



Grp 4: Storage
Renewable energy sources are intermittent in nature which makes flexibility and storage solutions critical to a future smart grid. Batteries technologies promises to be a key technology in providing sufficient storage and flexibility but the current battery solutions are not yet supporting the needs to the extent that is needed.

A lead-acid battery, 15 Wh and 526 g, and a lithium battery 19.2 Wh and only 96 g. Lithium-ion batteries are more robust in use and powerful than existing batteries and are used in e.g. cell phones. New types of lithium-ion batteries are being tested in hybrid and electric vehicles.



Grp 5: Consumption
A smart energy system based on renewable resources requires energy efficient technologies as well as smart flexible consumers. Energy efficiency can be obtained via new technology such as LED lighting, compact and well-designed rotating machines and heat pumps. Flexibility can be obtained through smarter appliances that are able sense and respond to grid conditions.

A halogen bulb and a Light-Emitting Diode (LED) bulb both from OSRAM. LEDs have many advantages over incandescent light sources including lower energy consumption, longer lifetime, improved physical robustness, smaller size, and faster switching.