An Interdisciplinary Collaboration Platform for Smart Grid Research

S. Lehnhoff, M. Sonnenschein, H.-J. Appelrath

Energie
Energy

Future Energy Systems
(a.k.a. Smart Grids)

▶ Integrating large amounts of active components into operation

   ▶ Environmentally dependent and hard to forecast

   ▶ Automated operation and (on-line) optimization necessary

ICT-based Solutions Necessary

▶ Appropriate information, communication and automation systems are known from other domains

  ▸ But: long-term use in safety-critical energy systems mostly untested
  ▸ High risk for stakeholders in energy supply

▶ Rigorous testing necessary!

  ▸ Learning from other application domains...
  ▸ **„Hardware in the Loop"**
  ▸ Operation of the real electric controller hardware or a mechatronic component in a simulation of the real environment

  ▸ *But: what belongs into this simulated environment?*

Quelle: Daimler „Driving Simulator in Sindelfingen", 2014

Influencing Factors of Future Energy Systems

▶ Relevant scope of „Smart Energy Systems" is hard to determine

  ▶ Renewable – fossil generation

  ▶ Distribution grid – transmission grid

  ▶ Users – consumers

  ▶ Markets

  ▶ ICT

  ▶ …

▶ *Complex interactions*

▶ *Small effects gain relevance through scaling*

SESA-Lab

Smart Energy Simulation and Automation Laboratory
(Hard- and Software Integration Platform)

Co-Simulation Framework
(OFFIS – Institute for Information Technology)

Real-time Automation Lab
(University of Oldenburg)

SESA-Lab
Mission

▶ Systematic design of operational concepts/controllers in more and more complex/extensive energy systems

▶ Development of tools/models for systematic integration and handling of heterogeneous/external models and processes

▶ SESA-Lab is NO replacement for existing tools and models
  ▷ Integration platform for established tools and approaches

▶ Goal of energy informatics at OFFIS/University of Oldenburg
  ▷ Interdisciplinary collaboration with domain experts from electrical engineering, economy, social sciences etc.
  ▷ Creating system competence, developing system intelligence

▶ International network
  ▷ **CO**-simulation-based energy **SY**stem **M**odeling pl**A**tform (COSYMA)
  ▷ UC Berkeley/Berkeley National Lab (us), NREL (us), CMU (us), TU Delft (nl), AIT (at), DTU (dk), OFFIS (de)

Collaborative Smart Grid Experiments
with SESA and mosaik
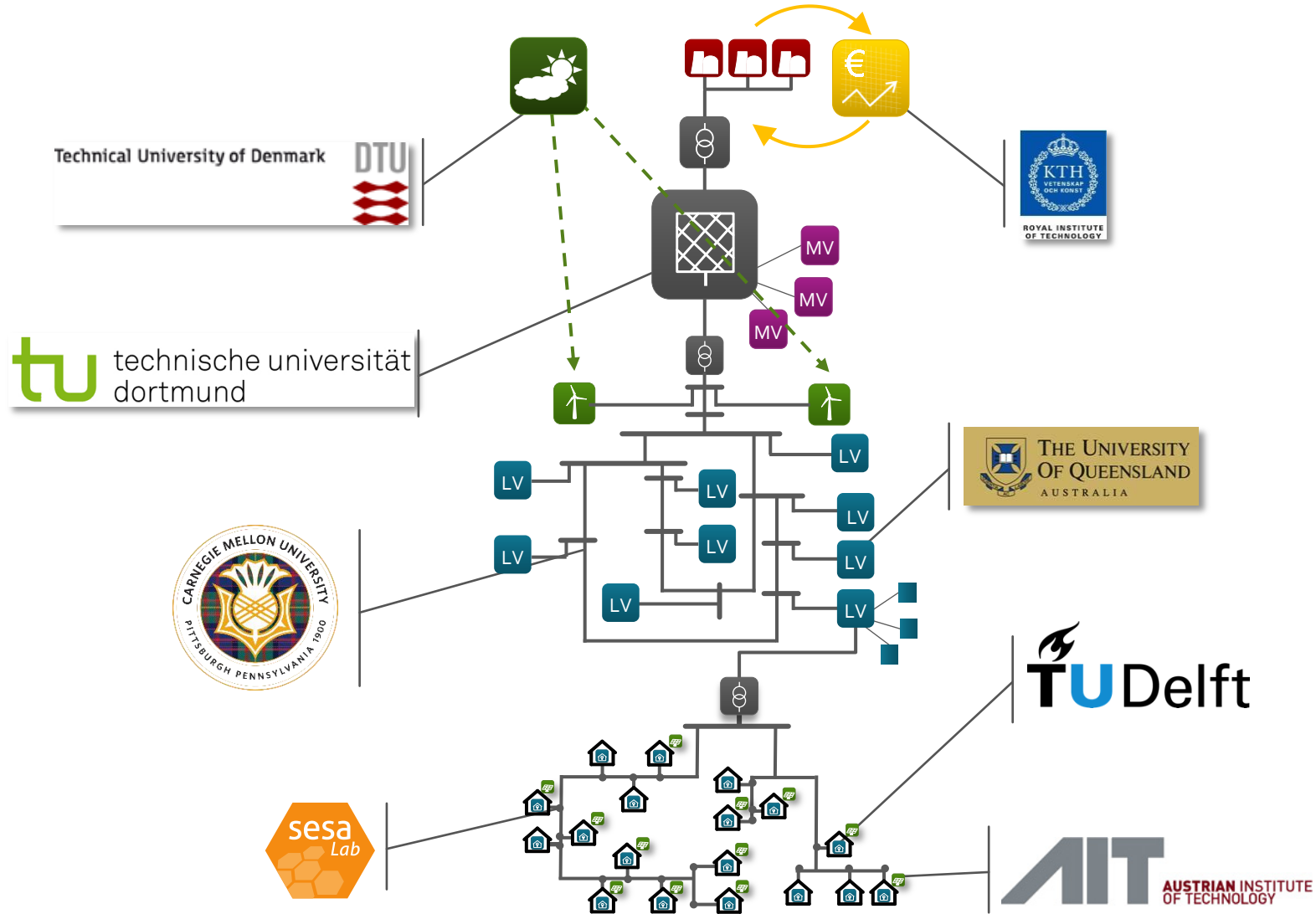
Practical mosaik Workshops

Recruiting interested PhD-Students for Exchanges to Oldenburg

- ▶ Regular mosaik courses and user workshops abroad
- ▶ Hands-on model integration (simulators and hardware)

- ▶ Recent workshops on 24.09.2014
  - ▶ DTU Denmark (Sept. 2014)
  - ▶ Carnegie Mellon University, Pittsburgh (March 2015)
  - ▶ AIT Vienna (April 2015)
  - ▶ ~20 international participants from el. engineering, physics, mathematics and computer science

- ▶ "Bring your own model!"
- ▶ Integration into coupled experiments

Researcher Exchange

Experiences with IPID4all

- ▶ Incoming
  - ▶ Mario Faschang (1.1.-31.3.2015), from AIT Vienna
  - ▶ PhD-Thesis „**Rapid Control Prototyping for Networked Smart Grid Systems based on an Agile Development Process**"
  - ▶ Joint supervision by Prof. Dr. Dietmar Dietrich (Vienna TU) and Prof. Dr. Sebastian Lehnhoff (Uni Oldenburg)

- ▶ Outgoing
  - ▶ Marita Blank (1.5.-31.7.2015), to KTH Stockholm
  - ▶ PhD-Thesis „**Reliability Assessment of Coalitions for the Provision of Ancillary Services**"
  - ▶ Joint supervision by Prof. Dr. Sebastian Lehnhoff (Uni Oldenburg) and Prof. Dr. Lars Nordstrøm (KTH Stockholm)

Thank you!

Prof. Dr. Michael Sonnenschein
Environmental Informatics

michael.sonnenschein@uni-oldenburg.de

sebastian.lehnhoff@offis.de