Competence E: Integrated Development of New Electric Energy Storage Systems
KIT Facts and Figures

Employees: 9,491
Professors: 359
Campus North

Students: 25,196
Campus South

Annual Budget in Million Euros: 847

Status: Nov 2015
Challenges by Social and Technological Changes

- Environmental Protection Targets
- Change of Power Supplies
- Decrease of Local Emission

E-Mobility
Stationary Energy Stores
System Competence along the Value Chain

Cost-effective product design and production technologies

Material → Cell → Battery → Inverter → System Integration

High-Energy Materials
Compact Cell Designs
Modular Battery Designs
New Manufacturing Concepts

Society Demand, Application Profitability
Devlopment of High-Energy Materials
Doubling of Energy Density with Carbon-Iron
New Production Technology for Electrodes

Cost-optimized technology for novel electrodes
Development of high performance Li-ion pouch cells (up to 20 Ah) and lab cells

- Prototypes and small series
- Development of novel electrolytes and electrodes
- Validation of new raw materials and manufacturing processes
- Examination of failure mechanisms with intentional cell failures
Highly precise cell tests as a basis for development

- Marketscreening state-of-the-art cells and performance analysis
- Post-mortem analysis
- Safety assessment
Modular Battery Concepts
Cost-effective and New Product Designs
Cost-effective Production Processes
Advanced Production Strategies
Economic Power Generation from Renewables –
a Contribution to the Energy Turnaround
KIT-Pilot systems with different industry partners

Two different system designs to identify...
- the best design for different applications
- advantages and disadvantages

AC linked system

DC linked system
System design – AC linked system

Photovoltaic  Wind Turbine  Battery System  Other Renewables  Predictive Control

- Meteorologic data, Control signals of grid operator,

- Biogas, Hydro power,

- CCU

- DC-Bus

- Predictive System design – AC linked system

Photovoltaic  Wind Turbine  Battery System  Other Renewables  Predictive Control

- Meteorologic data, Control signals of grid operator,

- Biogas, Hydro power,

- CCU

- DC-Bus

- Predictive System design – AC linked system

Photovoltaic  Wind Turbine  Battery System  Other Renewables  Predictive Control

- Meteorologic data, Control signals of grid operator,

- Biogas, Hydro power,

- CCU

- DC-Bus

- Predictive System design – AC linked system

Photovoltaic  Wind Turbine  Battery System  Other Renewables  Predictive Control

- Meteorologic data, Control signals of grid operator,

- Biogas, Hydro power,

- CCU

- DC-Bus

- Predictive System design – AC linked system

Photovoltaic  Wind Turbine  Battery System  Other Renewables  Predictive Control

- Meteorologic data, Control signals of grid operator,

- Biogas, Hydro power,

- CCU

- DC-Bus

- Predictive System design – AC linked system

Photovoltaic  Wind Turbine  Battery System  Other Renewables  Predictive Control

- Meteorologic data, Control signals of grid operator,

- Biogas, Hydro power,

- CCU

- DC-Bus
System design – DC linked system

Photovoltaic Wind Turbine Battery System Other Renewables Predictive Control

Meteorologic data, Control signals of grid operator,

Biogas, Hydro power,

BMS DC-Bus

CCU LGC

DC-Bus

L1 L2 L3 N
Economic application: Pilot system at KIT BESS 50

- Power module: 250 kWp
- Battery: 50 kWh
- PV: 36 kWp
Intelligent Energy Management with KIT Control Software

- Self-sufficient control of the PV-battery system

- Independency of external weather forecasts: software can be used at any place worldwide

- Prolongation of battery lifetime due to ideal and gentle operation mode of the batteries
Experimental validation in 1 MW solar power storage park

102 units, supplies for 18 different batteries
Functional validation in modern hardware-in-the-loop test facilities
Wind turbine – optimised for weak wind areas
Complementation of PV-power production in winter

Tests in in-house wind channel
Application Strategy and Cooperation Concepts


Licensing on Patents, Products and Production Technologies

Development on Demand with Use of Background-IP

Transfer of Results to SMEs by ZIM-Projects

Joint Ventures/ Spin-offs

Leitmotif:
- Validation of concrete system solutions in applications
- Concentration on medium-term realizable solutions
- Activate medium-sized suppliers and equipment manufacturers
- Keep openness of technology and non-discriminating access
Contact

Project Competence E
Karlsruhe Institute of Technology
Phone: +49 721 608-26844
Mail: office@competence-e.kit.edu
www.competence-e.kit.edu