Decentralised Electrical Energy Systems
Thomas Poppinga

Secondary Batteries

Modulbeschreibung

PUBLIKATION DER BILDUNGSALLIANZ MINT.ONLINE:
UNIVERSITÄT OLDENBURG, UNIVERSITÄT KASSEL, UNIVERSITÄT STUTTGART, FERNUNIVERSITÄT IN HAGEN, FRAUNHOFER-GESELLSCHAFT, DLR-INSTITUT FÜR VERNETZTE ENERGIESYSTEME (EHEMALS NEXT ENERGY)

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

Das diesem Bericht zugrundeliegende Vorhaben wurde mit Mitteln des Bundesministeriums für Bildung, und Forschung unter dem Förderkennzeichen 16OH11082 gefördert. Die Verantwortung für den Inhalt dieser Veröffentlichung liegt beim Autor/bei der Autorin.

School of Mathematics and Science, Institute of Physics,

Module: Secondary Batteries

This module is associated to the following degrees
Master > Renewable Energy Online> Compulsory Module

Abstract:

In the theoretical part students will learn the changes for the grid by implementing power generation from volatile renewable sources. The course starts with the explanation of the “Energiewende” in Germany and the portfolio of technologies in a 100% renewable energies scenario and the impact for the stability of the grid and sets a focus on the distributed grid. To compensate fluctuations with storage the concepts of several technologies for central electrical energy storage are explained and discussed. A short review of fundamentals of the chemistry of secondary batteries is explained and helps to understand different charging and discharging behaviours. A comparison of different technologies will be given, before the most relevant battery principles are explained and the advantages or shortcomings are discussed. For every type of secondary battery the typical applications are explained by examples. Typical charging strategies are described and typical battery characterisation methods are shown.

In the active part the students focus on a country to examine the grid situation of a country with notable integration of renewables. They analyse a scenario simulation to locate problematic areas in the grid given by volatile resources in a system of demand and load. For implementing storage devices they develop and research solutions for one grid service and a suitable technology. The results are shown in a teamwork presentation.

Duration:	1 semester	Teaching form:	Theoretical – practical seminar. e-learning.
Cycle:	Summer semester	Language:	English
Type of module:	Mandatory	Attainable credit points:	6 ECTS
Level:	MM (master module)	Workload:	180 hours
Pre-requisites:	- Renewable Energy Basics - RE Laboratories and Excursion	Max. No. of students:	30 students

Lecturer(s):	Mentor(s):
Designer(s) of the module: DLR Institute of Networked Energy Systems - Division Energy Systems & Storage	Examiner(s):

Objective of the module /learning outcomes:

After successful completion of the module students should be able to:

- Classify storage systems by their characteristics to different tasks in the power grid.
- Understand the specific advantages and shortcomings of different battery technologies in various applications.
- Explain the effects of deployment of fluctuating renewable sources in power grids and developing strategies for a efficient use of storage power units.
- Explain the basic methods of charging batteries
- Explain basic battery characterisation methods and laboratory techniques of measuring

Content of the module:

- Energy storage
- Storage technologies
- Fundamental batteries
- Secondary batteries
- Charging management
- Laboratory methods

Forms of learning:

The communication during the online phase is predominantly via reading material (self-learning phase) and online forums. Online meetings for discussion of questions and difficult topics are going to take place. The practical exercises are designed for each chapter of the module. Reading material, videos and tasks are provided to support the content of the module.

Helpful previous knowledge:

- Basic knowledge on the use of word processing, spreadsheets and presentations software, such as Open Office or Microsoft Office.
- Basic knowledge of mechanics (statics and dynamics).
- Mathematics for physics and engineering.

Web link:

Associated module(s)

- Storage Integration

Comments:

Requirements for awarding the credit points

Presentation of the solutions of the calculation exercises and tasks in due time. Each set of tasks will be graded. At the end of the module, the average of the grades obtained during its duration will be calculated, giving the final grade.

Examination periods:

Tasks corresponding to each chapter will be given to the students. The tasks are designed to be solved in 2 weeks' time frame. Deadlines to deliver the tasks will be at the end of each month.

Useful literature:

Registration procedure:

C3LLO

Last update: 28.09.2017