Decentralised Electrical Energy Systems
Thomas Poppinga

Storage Integration

Modulbeschreibung

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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

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School of Mathematics and Science, Institute of Physics,

Module: Storage Integration

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

Abstract:

In the theoretical part, the students will learn the fundamentals of electrical power and the different circuits for AC and DC power. The main division of electricity grids will be described and typical grid topologies and the main elements of a grid are explained. A deeper view will be given for compensators and capacitors in AC circuits. To understand the basic operation principle power quality and stability and power quality concepts are identified. The main issues associated with are discussed. For the increasing amount of power electronics the different electronics switches in power converters and its parameters are shown and calculated. At that point the students are able to identify the challenges for RE grid integration and recognise the mechanisms used to integrate RE into the grid. To understand the regulation of an electrical grid the students learn the special characteristics of the electricity market and regulatory conditions. The future role of storage technologies in the electrical Market are discussed with a view on the structure of the electricity wholesale markets. The roles of distributed storage devices are explained to identify the concepts of ancillary services and the application with energy systems. Throughout the composition of the system, principles of operation, technologies involved and associated issues were presented. All that concepts will be concentrated in the assessment of the Power System Analysis in different scenarios. The module concludes with an analysis of a given scenario and developing a solution for implementing storage devices, that will be shown as a presentation.

Duration:	1 semester	Teaching form:	Theoretical – practical seminar. e-learning.
Cycle:	Winter semester	Language:	English
Type of module:	Mandatory	Attainable credit points:	6 ECTS
Level:	MM (master module)	Workload:	180 hours
Pre-requisites:	- Secondary Batteries	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:

- Compare basic electrical concepts associated with electrical circuits like Power, Voltage, Current and Energy.
- Explain the elements of the power system and how they are modelled in a simple way.
- Explain the key parameters to monitor in power system stability are and how they can be affected.
- Understand the main issue concerning the connection of power electronics into the grid.
- Explain the structure of the energy market and its regulation.
- Recognize the mechanisms used to help integrate RE into the grid.
- Understand the concept of ancillary services and the application of them with energy storage systems.
- Know main electrical studies to assess the behaviour of the power system in different conditions

Content of the module:

- Grid Integration
- Charging and Grid
- Operational Strategies
- Energy Market Europe
- Economic Analysis
- Case Studies

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)

- Secondary Batteries

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

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