pre314 - Energy Meteorology & Storage Technologies

Module label: Energy Meteorology & Storage Technologies
Module code: pre314
Credit points: 7.0 KP
Workload: 210 h

Used in course of study:
- Master's Programme European Master in Renewable Energy (EUREC) > Mastermodule

Contact person:
- Carsten Agert
- Detlev Heinemann

Module responsibility:
- Carsten Agert
- Robin Knecht
- Robert Steinberger-Wickens

Entry requirements:
- Critical understanding of the conditions concerning the availability of solar radiation
- Good understanding of fundamental atmospheric processes
- Understanding the close interaction of radiation with the atmosphere and the constraints on wind flows relevant for wind power generation
- Will be able to apply basic radiation laws and to practically perform simple wind power assessments
- Good understanding of various concepts of electrical storage systems and state of the art technical developments
- Ability to critically understand the efficiency of conversion steps in storing and activation of energy
- Overview of the electrochemical, thermodynamic, engineering, and materials science basics of Fuel Cell and Hydrogen technologies, their development status, and their applications.
- Learned about the sensitivity of sensors
- Understood the performance of a battery/load system and able to perform state of charge measurements to express the performance of a battery

Skills to be acquired in this module:
- Solar Energy Meteorology:
  - Radiation laws
  - Solar geometry
  - Interaction of solar radiation with the atmosphere
  - Climatology of solar radiation
  - Solar radiation modelling and measurements
- Wind Energy Meteorology:
  - Origin of atmospheric air flow, energy balance of the atmosphere
  - Basic physics of atmospheric motion
  - Wind climatology: Atmospheric circulation, local wind systems
  - Wind in the atmospheric boundary layer (characteristics, vertical profile)
  - Wind energy resource assessment and measurements
- Electrical Energy Storage Technologies:
  - Primary and secondary batteries
  - Redoxflow batteries
  - Super-capacitors
- Non-electrical storage concepts:
  - Fly wheels
  - Adiabatic-compressed air storage
  - Superconductors
  - Pumped storage systems
  - Heat pumps and Combined heat and power systems (CHPs)
- Fuel Cells and Hydrogen:
  - Introduction and technology overview
  - Hydrogen generation, handling and storage
  - Hydrogen applications and markets
  - Low Temperature Fuel Cells
  - High Temperature Fuel Cells
  - Fuel Cells market introduction
- Lab Work:
  - Solar Spectrum
  - Lead-Acid Battery

Module contents:

Reader's advisory:
IEA: World Energy Outlook, release 2013 (http://www.worldenergyoutlook.org/), last access: May 2014

Links
Language of instruction: English
Duration (semesters): 1 Semester
Module frequency: jährlich
Module capacity: unlimited
Modullevel: MM (Mastermodul)
Modulart: Pflicht
Lern-/Lehrform / Type of program: Lecture, Laboratory

Energy Meteorology: At the end of lecture period (end of January)
Energy Storage: At the end of lecture period (end of January)
Hydrogen & Fuel Cells: After end of lectures (mid-January)
Battery Lab: During Semester

Examination Time of examination Type of examination
Final exam of module Energy Meteorology (35%): Written exam (1.5 hours)
Energy Storage (35%): Written exam (1.5 hours)
Hydrogen & Fuel Cells (15%): Written exam (0.5 hours)
Battery Lab (15%): Written report (10 - 20 pages)

Course type: Seminar
SWS: 0 h
Frequency: 
Workload attendance: 0 h