phy642 - Renewable Energy Technologies I for Engineering Physics

Module label: Renewable Energy Technologies I for Engineering Physics
Module code: phy642
Credit points: 6.0 KP
Workload: 180 h
(Attendance: 56 hrs, Self study: 124 hrs)

Used in course of study:
- Master's Programme Engineering Physics > Schwerpunkt: Renewable Energies

Contact person:
- Module responsibility: Hans-Gerhard Holtorf

Entry requirements:

Skills to be acquired in this module:
After successful completion of the module students should be able to:
critically evaluate and compare relevant Renewable Energy conversion processes and technologies:
photovoltaics, fuel cells and storage critically appraise various electrochemical storage processes and the respective storage techniques analyse various system components and their interconnections
within a complex Renewable Energy supply system.

Module contents:
This module will give an overview over a selection of the major renewable energy technologies and some possibilities of their storage. The focus is on the scientific principles of components and the technical description of the components.
Further detailed system analysis will be presented in other modules.

Physics of PV:
- Basic and most important properties of solar radiation related to photovoltaics
- PV cells basics: Fundamental physical processes in photovoltaic materials
- Characterisation and basic modelling of solar cells

Component Description:
- PV generator
- Charge controller
- Inverter
- Balance of system components

System Description:
- Grid Connected System
- Stand Alone System

Fuel Cells and Energy Storage (Lecture - 90 h workload):
- Fundamentals of electrochemistry and thermodynamics, energy and environmental balances
- Basics of hydrogen production - starting materials, processes, efficiencies, environmental impacts
- Basics of fuel cells function, materials, construction, systems, applications
- Fundamental setup of most common battery types
- Fundamental chemical reactions in these batteries
- Operational characteristics, wear processes and service lives of these batteries

Reader's advisory:

Photovoltaics:
- Green, Martin A., 1981: Solar cells : operating principles, technology and system applications, Prentice Hall,
- Green, M.A., 2007: Third Generation Photovoltaics, Advanced Solar Energy Conversion, Springer Series in Photonics,
- Nelson, Jenny, 2003: The Physics of Solar Cells (Properties of Semiconductor Materials), Imperial College Press,
- Stuart R. Wenham, Martin A. Green, Muriel E. Watt and Richard Corkish (Edit.), 2007: Applied Photovoltaics, Earthscan Publications Ltd.,

Fuel Cells and Energy Storage
fuelcells.org/fchandbook.pdf),
- D. Fletcher, A First Course in Electrode Processes. The Electrochemical Consultancy, 1991,

Links
Language of instruction English
Duration (semesters) 1 Semester
Module frequency unlimited
Module capacity
Module level MM (Mastermodul / Master module)
Modulart Wahlpflicht / Elective
Lern-/Lehrform / Type of program each lecture: 2 hrs/week
Vorkenntnisse / Previous knowledge

Examination Time of examination Type of examination
Final exam of module
Course type Lecture

SWS 4.00
Frequency SuSe or WiSe
Workload attendance 56 h