pre313 - Solar Energy

Module label: Solar Energy
Module code: pre313
Credit points: 5.0 KP
Workload: 150 h
Used in course of study: Master's Programme European Master in Renewable Energy (EUREC) > Mastermodule

Module responsibility:
- Carsten Agert
- Jürgen Parisi

Module counseling:
- Hans-Gerhard Holtorf
- Robin Knecht

Entry requirements
Skills to be acquired in this module:
After completing the module students will:
- critically understand the characteristics of components of solar thermal and photovoltaic systems
- critically understand the architecture and characteristics of solar thermal and photovoltaic systems
- be able to critically perform the energy balances of systems
- have a good understanding of sensor systems for controlling and monitoring of thermal and electric solar systems and their components
- be able to scientifically describe solar systems (operation, efficiency, performance parameters)
- be able to compare solar thermal systems to solar electric systems in terms of energy output and dependencies on meteorological input
- be able to compare solar systems to other renewable energy systems in terms of energy and dependencies on meteorological input.
- have a good understanding of the characteristics of solar and solar thermal collectors
- be able to establish measurement procedures in order to analyse characteristics of the given setups
- be able to apply standard physical and mathematical formulas to evaluate the experimental setups
- be able to analyse and critical review the retrieved data from experiments

Module contents:
Solar system’s components in stationary and dynamic operation:
- their functioning,
- the different technologies,
- the state of the art
- their characteristics and working points
Photovoltaics (PV):
- PV-cells
- charge controller
- inverter
- storage (batteries)
- further components (cabling, generator stand, electric protection)
Solar thermal:
- collectors (flat plate, vacuum tube, concentrating systems)
- thermal storage
- miscellaneous components (circulation pumps, piping, heat insulation)
Photovoltaic Systems:
- PV stand alone systems
- PV grid connected systems
- photovoltaic pumping systems
- hybrid systems
Solar Thermal Systems:
- domestic hot water supply
- heating supporting systems
- concentrating solar thermal systems.
Lab Work:
- PV cell characteristics
- solar collector characteristics

Reader’s advisory:
Green, Martin A., 1981: Solar cells : operating principles, technology and system applications, Prentice Hall.
Markvart, Tom and Castaner, Luis, 2003: Practical Handbook of Photovoltaics, Fundamentals and
Applications, Elsevier Science
McQuiston, Faye, Parker, Jerald & Spiller, Jeffrey, 2005: Heating, Ventilation and Air Conditioning,
Wiley
College Press.
Successful Planning and Construction, Earthscan
Publications Ltd.
Photovoltaics, Earthscan Publications Ltd.
Combisystems, IEA
Kuhschewski, Udo & Knecht, Robin et al., update 2013: Reader for the Winter Laboratory Course:
Physical Principals of Renewable Energy Converters

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

Vorkenntnisse / Previous knowledge

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<tr>
<th>Examination</th>
<th>Time of examination</th>
<th>Type of examination</th>
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<tbody>
<tr>
<td>Final exam of module</td>
<td>Solar Energy Systems: At the end of the lecture period (end of January)</td>
<td>Solar Energy Systems (60%): Oral exercise (1 hour)</td>
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<td>PV Cell Laboratory: During Semester</td>
<td>PV Cell Laboratory (20%): Written report (10 - 20 pages)</td>
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<td>Solar Collector Laboratory: During Semester</td>
<td>Solar Collector Laboratory (20%): Written report (10 - 20 pages)</td>
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Course type: Seminar

SWS
Frequency
Workload attendance: 0 h