pre313 - Solar Energy

<table>
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<th>Module label</th>
<th>Solar Energy</th>
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<tr>
<td>Module code</td>
<td>pre313</td>
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<tr>
<td>Credit points</td>
<td>5.0 KP</td>
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<tr>
<td>Workload</td>
<td>150 h</td>
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<tr>
<td>Used in course of study</td>
<td>Master's Programme European Master in Renewable Energy (EUREC) &gt; Mastermodule</td>
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<td>Contact person</td>
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Module responsibility
- Carsten Agert
- Jürgen Parisi

Module counseling
- Hans-Gerhard Holter
- Robin Knecht

Entry requirements

Skills to be acquired in this module
- 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.
McQuiston, Faye, Parker, Jerald & Spiter, Jeffrey, 2005: Heating, Ventilation and Air Conditioning, Wiley
Kulschewski, 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)
Module type: Pflicht
Learning/Teaching Type: Lecture, Laboratory

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<tr>
<th>Examination</th>
<th>Time of examination</th>
<th>Type of examination</th>
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<tr>
<td>Final exam of module</td>
<td>Solar Energy Systems: At the end of the lecture (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