Hanzehogeschool Groningen
University of Applied Sciences

Vak: Solar Energy — credits: 5

Vakcode	ZWVH17SLE
Naam	Solar Energy
Studiejaar	2020-2021
ECTS credits	5
Taal	Engels
Coördinator	A.A. Bellekom

Werkvormen	Practicum / Training Werkcollege
Toetsen	Assignment SLE - Overige toetsing Lab SLE - Overige toetsing Solar Energy Theory - Computer, organisatie tentamenbureau

Leeruitkomsten

After the completion of the module the student is able to:

- understand, analyse and optimize the design and operation of solar cells, modules and systems
- analyse and evaluate the similarities and differences between the various technological approaches towards solar energy conversion
- apply the specific features of solar energy systems for integration in the portfolio of energy technologies
- analyse, synthesize and critically evaluate information and findings in the field of solar energy and present it in a clear, fact-based and convincing way
- perform calculations of solar cell device operation and of power and energy production
- make basic PV system dimensioning calculations and simulations
- measure some of the main performance indicators of solar panels
- communicate plans and results with other members of the group and effectively discuss problems encountered.
- present information and findings in the field of solar energy in a clear, fact-based and convincing way
- describe lessons learned and explain them to professional colleagues with a similar background, but without the specific knowledge of the lessons learned.

Inhoud

This Module focuses on photovoltaic conversion of solar energy (with due reference to concentrating solar power). In addition, it treats the basics of a number of solar thermal technologies.

In terms of scientific and technical contents this module will treat the following aspects of solar energy:
The solar resource: properties of sunlight, insolation (amount of sunlight available)
Solar energy conversion technologies compared (electricity, heat);
Photovoltaic conversion:

- the PV sector in a bird’s eye view: general introduction to history, markets, scenarios, roadmaps, etc.
- basic conversion process and efficiency limitations;
- properties of semiconductors, semiconductor processing and basic semiconductor devices;
- basic solar cell design and operation, including current-voltage characteristics, spectral response and quantum efficiency;
- efficiency determining factors, routes to (very) high efficiencies, Standard Test Conditions (STC-) and non-STC (i.e. field) operation;
- photovoltaics in practice: different technologies in lab and production (flat plate and concentrator), various device architectures;
- from cells to modules: module architectures, manufacturing, lifetime & reliability, efficiency definitions, field performance;
- from modules to systems: basic aspects of system design, systems losses and energy production (specific energy yield, performance ration, capacity factor, etc.)
- practical applications: examples of PV systems and their performance;
- economic aspects: system cost (price) components and their evolution, Levelized Cost of Energy (LCoE), grid parity and other indicators;
- environmental aspects: Life Cycle Analyses (LCA), energy pay-back time, materials availability (supply chain), Cradle-to-Cradle and design-for-recycling approaches.

Thermal solar energy:

various system concepts and designs.

Opgenomen in opleiding(en)

European Master in Renewable Energy

School(s)

Instituut voor Engineering

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