Valid from 2024.HS

Module description: Solar Technology Solar Power

Module Code	t.BA.EU.GSOL.19HS
ECTS Credits	4
Language of Instruction/Examination	German
Organizational Unit	IEFE
Module Coordinator	Franz Baumgartner
Legal Framework	The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail.
Module Characteristic	Type 2a 4 consecutive lecture lessons per semester week and class
Module Description	The functional principles of solar cells and module technology are covered. Software tools are used in the engineering design of PV plants, starting with very basic simulation tools and progressing to commercial software tools in a project. Performance calculations and energy analysis are taught.
Module Content	• Solar irradiance, spectra, calculation short circuit current of a solar cell • Solar cell, semiconductor, functional principal • Efficiency, theory, products, STC, IV characteristic MPP • Solar module structure, type • Partial shading of PV modules • Basic components of PV power plants including inverter • Outdoor characteristics of crystalline silicon solar modules • Basic performance calculation model of PV plant based on the solar vector • Simulation PV power flow using an additional battery to improve solar self consumption • Engineering of PV power plants – design matching of PV module and PV inverter • AC Yield simulation of a PV power plant • Economy analysis of profitability and market trendsPractical training in the • Economics LCOE - Levelized Costs of Energy of PV electricity without battery
Prerequisite Knowledge	https://gpmpublic.zhaw.ch/GPMDocProdDPublic/2_Studium/2_02_Grundlagen_Studium/T_CL_Modulauspraegungen_SM2025.pdf

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Learning Objectives (Competences)

Students...	Competencies	Taxonomies
The basic physical relationships of solar radiation and the engineering principles of its use in PV power plants are the focus of this course. Students know Planck's radiation law and the composition of the solar spectrum. From their knowledge of the differences in the structure and function of common radiation sensors such as pyranometers and silicon photodiodes, they can evaluate the differences in sensitivity. Students can calculate the maximum short-circuit current of an ideal solar cell with a given band gap from the photon current, as well as calculate and evaluate the STC parameters of standard PV modules made of crystalline silicon.	F	K2, K3
The students will calculate and evaluate the current and voltage characteristics of typical partially shaded, crystalline PV modules. You can calculate the sun's trajectory as well as the annual, monthly, daily and hourly solar radiation. The definitions of PV yields such as nominal operating hours and performance ratio are known. In addition, these solar yields and the electricity generation costs for a single-family home from a PV system with battery in a project are calculated, taking into account the solar self-consumption rate.	F	K2, K3
The engineering design of photovoltaic systems is the focus of this section. Knowledge of the relevant technical parameters of the components of grid-connected PV systems with inverters and PV direct current stand-alone systems with battery storage are the basis of the design, including commercial software tools. The students know important influencing factors of highly accurate yield reports of solar power plants and current market trends.	F	K4
The students know the basic production steps for the manufacture of photovoltaic cells and modules. They know the other basic components of photovoltaic power plants such as inverters or batteries, module assembly systems and solar thermal systems with collectors and storage. The students can plan a PV power plant with the essential technical components and also carry out a cost calculation for this PV electricity.	F	K2, K3

Performance Assessment

End-of-module exam	Assessment	Length (min.)	Weighting	Form
written exam	Grade	90	60	

Performance assessment during the semester	Assessment	Length (min.)	Weighting	Form
report	Grade		10	acc. to module agreement
written exam	Grade		10	acc. to module agreement
written exam	Grade		20	acc. to module agreement

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Classroom Attendance Requirement	None
Learning material	
Comments	Anyone who can present 2 accepted reports from the associated practical training will be admitted to the end of semester exam.