ONLINE TRAINING MODULES IN PHOTOVOLTAICS

SOLAR ENERGY ENGINEERING

Starting **June 2, 2014** the University of Freiburg in cooperation with Fraunhofer will be offering free special training modules in Solar Energy Engineering with a focus on Photovoltaics. The online training modules have been designed for highly qualified professionals who want to gain insight in the areas of photovoltaic research, development and consulting.

The modules can be booked individually and cover the following areas of expertise:

Module 1:	Fundamentals of Photovoltaics (prerequisite)
Module 2:	Photovoltaics and the Renewable Electricity Grid
Module 3:	Crystalline Silicon Photovoltaics
Module 4:	Material and Solar Cell Characterization and Modelling
Module 5:	Photovoltaics Beyond Silicon

Attending at least one of the courses in Module 1 is required before enrolling in Modules 2-5. Note: Equivalent skills or prior experience that a participant possesses may also be accepted as a prerequisite for taking modules 2-5.

Who can participate?

Professionals in R&D, Equipment Production & Automation, Technical & Business Consulting, and Management who want to specialize in or make a career change to the PV industry.

Scope

There are **no tuition fees** during the first run of the modules from June 2014 to March 2015. The course concept involves online tutorials and regular online meetings as well as campus phases at the University of Freiburg. About two hours of studying per day will keep you on track. During the pilot phase, your participation in our course evaluations is required.

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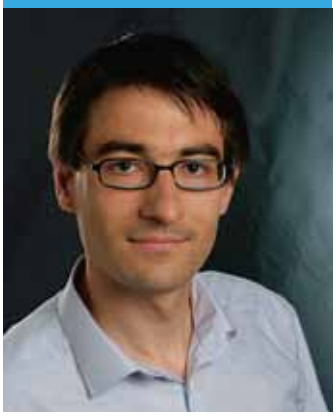

For more information on the individual modules please contact:
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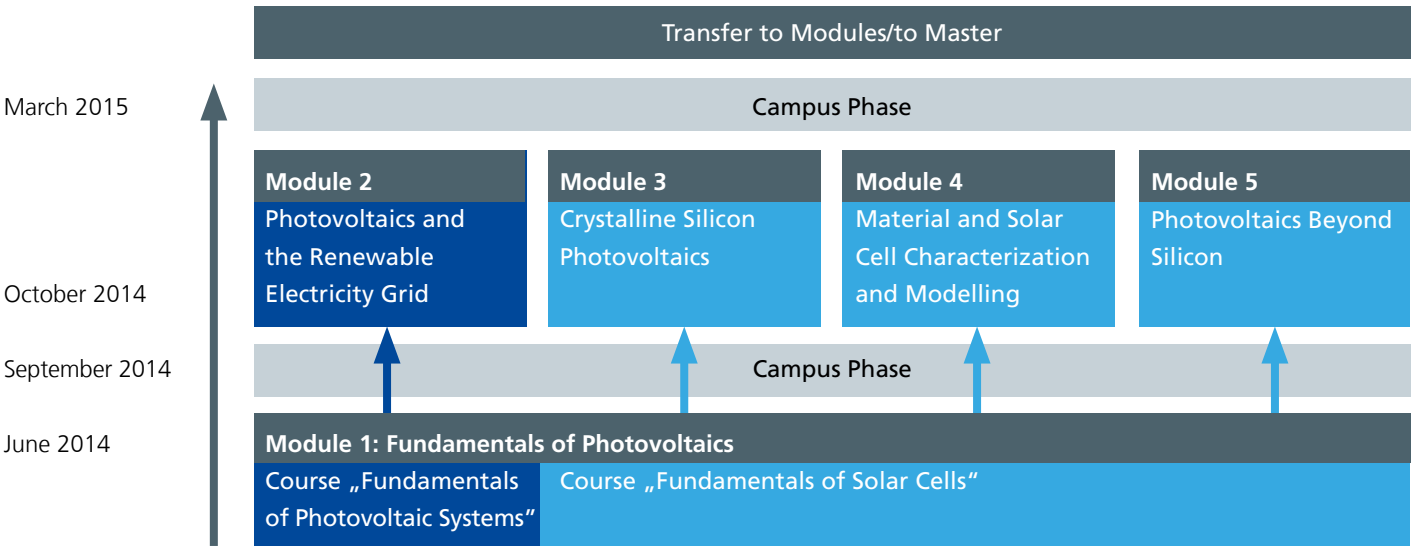
ONLINE TRAINING MODULES IN PHOTOVOLTAICS

Overview and Timeline



The modules at-a-glance

Participants	Professionals, studying part-time and online, from all over the world
Tuition Fee	Free of charge during first run
Degree	Attendance certificate
Admission Requirement	Master in Science or Engineering with well-fitting degree or professional PV background. For an assessment of your qualifications please contact us
Application	See: www.pv-academy.de

Your benefits

- Part-time distance learning
- Program specially designed to accommodate the needs of working professionals
- Focus on physics and engineering
- Take a career shift and move into PV sector
- Benefit from expertise of Fraunhofer ISE
- Well-established e-learning platform
- Courses credits transferable to module studies or the Online M.Sc. in Photovoltaics of the University of Freiburg

Funded by

Federal Ministry of Education and Research

ESF European Social Fund for Germany

European Union

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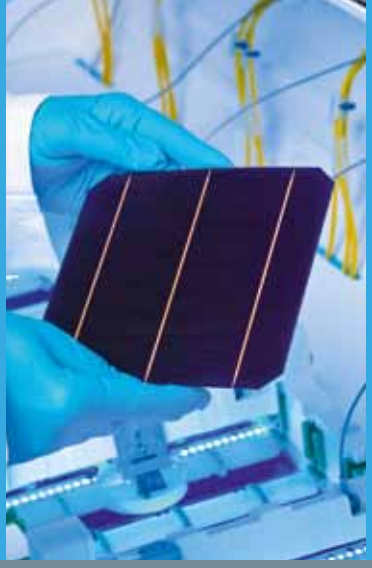

MODULE 1

FUNDAMENTALS OF PHOTOVOLTAICS

The module "Fundamentals of Photovoltaics" consists of two courses, which can be booked individually.

The course "Fundamentals of Solar Cells" provides profound insight into the physics, technology and design of solar cells. By understanding physical mechanisms, limitations and design rules the student is able to understand all different types of solar cells like silicon, thin-film, organic or dye solar cells and so on. This helps the student to develop, design and optimize photovoltaic devices with respect to efficiency, cost and lifetime.

The course "Fundamentals of Photovoltaic Systems" deals with basically everything around the solar cell once it is implemented in any kind of photovoltaic application. The student is able to design and optimize photovoltaic systems based on their understanding of the environment and its influence on photovoltaic energy conversion. They are also able to describe and design photovoltaic systems for optimized energy production, transport and storage.

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Application Deadline May 26, 2014
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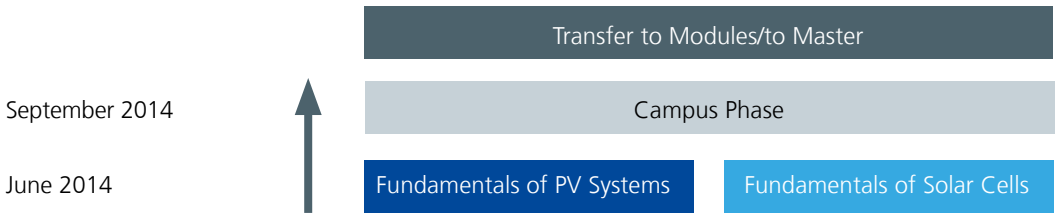

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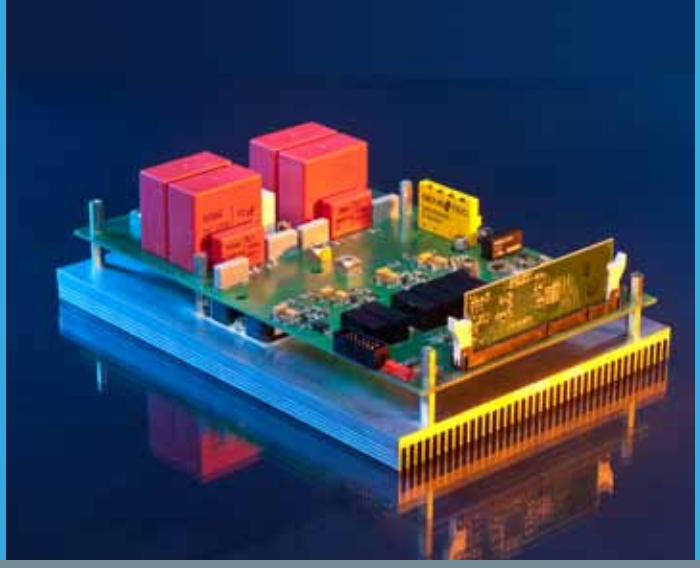

MODULE 2

PHOTOVOLTAICS AND THE RENEWABLE ELECTRICITY GRID

Decentralized electricity generation and fluctuating availability pose a challenge on grid stability. This module provides comprehensive understanding of interaction between PV systems and the power grid. It is about control aspects of PV Systems and the integration of a huge amount of PV energy in the electricity grid. Furthermore, this module gives a wide overview on smart grid and renewable energy systems. Starting with basic issues of energy and efficiency, grid technology will be discussed to balance complex systems with available storage components.

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Overview and Timeline

	Transfer to Modules/to Master
March 2015	Campus Phase
	Technologies for Renewable Energy Conversion
	Smart Grids and Energy Autonomous Communities
	Selected Semiconductor Devices
October 2014	Grid Integration and Control of PV Systems
September 2014	Campus Phase
June 2014	Fundamentals of Photovoltaic Systems

The Module "Photovoltaics and the Renewable Electricity Grid" is particularly suited for professionals with electrical engineering background.

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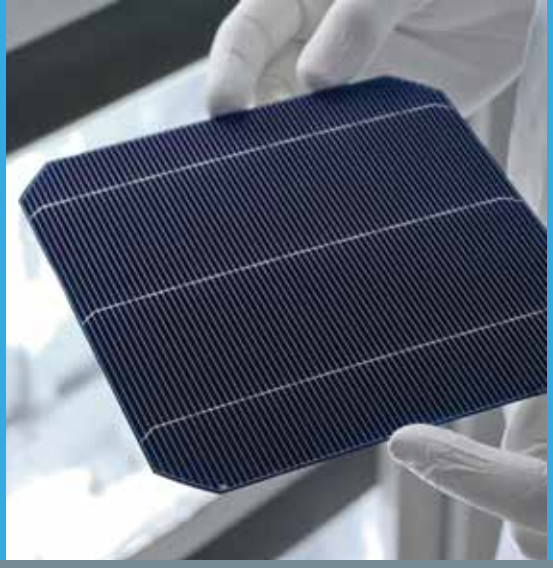

MODULE 3

CRYSTALLINE SILICON PHOTOVOLTAICS

In this module the students will get an overview about the value chain of silicon solar cells starting from quartz up to the finished module. Students will learn how silicon is produced from quartz and how this silicon is purified, crystallized and cut into wafers. Based on this knowledge, students should be able to develop new and optimized processing sequences and design concepts for silicon solar cells. Finally, students will learn how modules are produced from silicon solar cells and which aspects are particularly important to ensure a long module lifetime. The module contains a laboratory course "Solar Cell Processing" in Fraunhofer ISE labs in Freiburg during the final Campus Phase.

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	Transfer to Modules/to Master
March 2015	Campus Phase
	Lab Course: Solar Cells Processing
	Silicon Module Technology and Reliability
	Solar Cell Production Technology
	Silicon Solar Cells – Structure and Analysis
October 2014	Feedstock and Crystallization
September 2014	Campus Phase
June 2014	Fundamentals of Solar Cells

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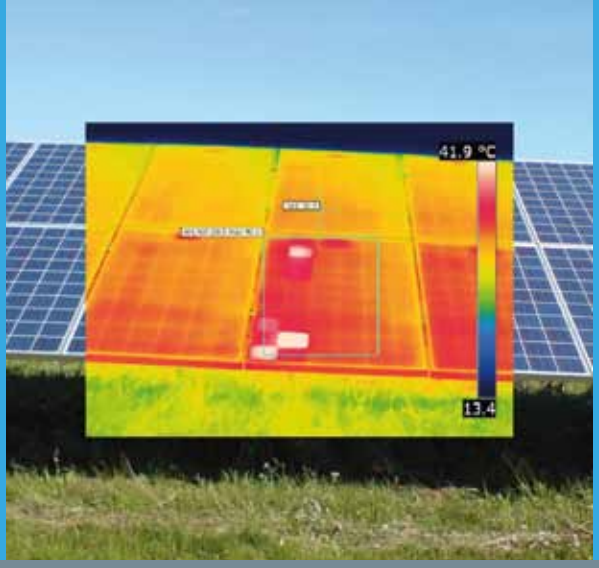

MODULE 4

MATERIAL AND SOLAR CELL CHARACTERIZATION AND MODELLING

Understanding prototype solar cells is key to further development. This module provides a practical as well as theoretical insight into common characterization techniques used for solar cell characterization. The module also provides an advanced understanding of multi-dimensional effects in solar cell and material characterization. Students will also learn how a simulation package for solar cell simulation works, by providing an insight into the numerical techniques to discretize the governing equations to describe solar cells. The module contains a laboratory course "Measurement Instrumentation" in Fraunhofer ISE labs in Freiburg during the final Campus Phase.

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	Transfer to Modules/to Master
March 2015	Campus Phase
	Lab Course: Measurement Instrumentation
	Advanced Material and Solar Cell Characterization
	Numerical Simulation of Solar Cells
October 2014	Material and Solar Cell Characterization
September 2014	Campus Phase
June 2014	Fundamentals of Solar Cells

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MODULE 5

PHOTOVOLTAICS BEYOND SILICON

This module provides understanding of photovoltaic devices which are not wafer based silicon solar cells. The module provides comprehensive fundamental understanding of the basics for Si-based thin-film (crystalline, a-Si, a/µc-Si), CIGS, and CdTe thin-film solar cells, modules, and module production. It also covers III-V material and multi-junction concepts as well as concentrator systems. The module also gives a wide overview about existing concepts to overcome the thermodynamical limit for single junction solar cells, the so-called third generation photovoltaics. Different strategies to push efficiency further up will be discussed and it will be shown how they all try to realize one thing: to absorb more photons and/or to convert a higher fraction of the photon energy to electrical energy.

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Overview and Timeline

	Transfer to Modules/to Master
March 2015	Campus Phase
	Advanced Solar Cell Processing
	New Concepts for Photovoltaic Energy Conversion, Organic and 3. Generation Photovoltaics
	III-V Solar Cells and Concentrator Systems
October 2014	Inorganic Thin Film Solar Cells
September 2014	Campus Phase
June 2014	Fundamentals of Solar Cells

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