Engineering Modules (EM)

State-of-the-Art Technology Expertise in Energy Systems & Technologies

EM 1: Renewables

The module starts with a general introduction to the challenges of energy supply, examinig the **historic and future developments of global energy requirements as well as existing primary energy sources and reserves**. Aside from this, it provides an **overview of the energy cascade** from the primary energy sources through the various stages of energy conversion, the transportation and distribution of energy to its ultimate use. Technical, ecological and socio-economic aspects are highlighted.

During the presentation of energy systems based on renewable sources of energy, the focus is placed on **wind and hydroelectric power** as well as **geothermal and solar thermal energy**. For didactic reasons, systems based on other renewables, such as photovoltaics and biomass, are dealt with in other engineering modules.

For the processes covered in this course, the **supply of renewable primary energy** provided by nature is first described, before investigating the **individual technical features of the power plants**. Wind energy plants serve as an example to convey the interdisciplinary nature of energy conversion plants, in which fluid mechanical, static, mechanical, electrical and electronic considerations are all closely linked to systemic and economic aspects.

EM 2: Thermal Energy Conversion

The module provides an **overview on thermal processes for power and heat production from fossil and biogenic fuels**. The whole range of fuel to energy via thermal processes is covered, starting from the **combustion process, coal and gas fired power plants, gas and steam turbines, CO_2 reduction by capture and storage, and finally special aspects of biomass utilization**.

Based on a sound knowledge of the technical fundamentals, the module will lead to the **understanding of complex energy conversion systems and typical plants**. The participants develop and improve their evaluation skills with regards to technology, economy and ecology.

EM 3: Electricity Generation & Energy Storage

In this module, the focus is on the generation of electricity on the one side and energy storage on the other. The most commonly used power generator in electrical power stations is the **gas turbine**. Understanding and knowledge of critical issues related to synchronous generator operation is provided.

In addition, **photovoltaics** is one of the most discussed forms of renewable energy generation. It converts solar radiation directly into electrical energy. Participants will understand photovoltaics as an energy source, it's working principle and mechanisms to improve efficiency. This will provide insights into the public as well as scientific discussion and highlights boundary conditions with regard to requirements of energy storage.

Batteries and fuel cells are one way to store the power. The participants will become familiar with the concepts of electrochemical energy storage and the design of efficient batteries. The module discusses the available state-of-the-art fuel cell technologies and their efficiencies as well as the respective opportunities and limitations.

EM 4: Smart Networks & Energy Distribution

This module gives an overview of **major power system components, structure and main operation behavior**. It starts with an introduction to power systems and basic knowledge of **high voltage engineering**.

The second part focuses on the main components and describes mainly the function, state-of-the art and their behavior.

The **main transmission and distribution aspects** are covered in the third part of the module, including network calculation and control. Due to recent and future changes in power systems a strong focus in part four is on **smart grids and their performance**. Additionally, **building performance with respect to energy balance and energy sources** is included.

EM 5: Energy Economics

Various peculiarities of the energy market (**energy efficiency on the supply and demand side, electric mobility, market opening, regulation**, etc.) are analyzed from a techno-economic point of view within this module.

In order to be able to identify optimal strategies within this complex sector, there is an introduction into **energy systems analysis** at the beginning of the module. Energy systems analysis considers the totality and the interactions of energy systems, among other things, with the commodities industry, the building trade, industry and transport. The **integration of energy systems and e-mobility** concludes this module.

Order your free course guide book with detailed contents of the master program!

Engineering Modules

EM 1: Renewables
Courses: Introduction and Scope of EEM & Energy Systems | Wind & Water Power | Solar & Geothermal Power

EM 2: Thermal Energy Conversion
Courses: Technical Combustion/ Heat & Mass Transfer | Thermal Power Plants including Coal & Gas Power Plants | Turbo Machinery | Carbon Capture and Storage (CCS) & Fracking | Energy from Biomass

EM 3: Electrical Generation & Energy Storage
Courses: Power Generators | Batteries & Fuel Cells | Hydrogen Technology | Photovoltaics | Thermal Energy Storage | Power Electronics

EM 4: Smart Networks & Energy Distribution
Courses: Introduction to Power Systems/ High Voltage Engineering | Components of Power Systems | Transmission & Distribution | Smart Grids & Emerging Technologies

EM 5: Energy Economics
Courses: Energy Markets | European Network Regulations | Energy Systems Analysis | Energy Effiency (Supply & Demand Side) | Integration of Decentralized Energy Systems

EM 0: Engineering Principles

Our special offer for applicants who hold an academic degree other than in the field of engineering but have several years of relevant professional experience in the utilities & energy sector: EM0 will provide you with the fundamentals in energy engineering. Successful participation is the entry criteria for the master program for those particular applicants.