

## Module Description

# Energy: Production, Consumption and Management

**General Information**
**Number of ECTS Credits**

3

**Abbreviation**

FTP\_Energy

**Version**

19.02.2015

**Responsible of module**

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**Language**

|               | Lausanne  | Bern   | Zürich   |
|---------------|---|--|--|
| Instruction   | <input type="checkbox"/> E <input checked="" type="checkbox"/> F            | <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F | <input type="checkbox"/> D <input checked="" type="checkbox"/> E |
| Documentation | <input checked="" type="checkbox"/> E <input type="checkbox"/> F            | <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F | <input type="checkbox"/> D <input checked="" type="checkbox"/> E |
| Examination   | <input checked="" type="checkbox"/> E <input checked="" type="checkbox"/> F | <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F | <input type="checkbox"/> D <input checked="" type="checkbox"/> E |

**Module category**

- Fundamental theoretical principles
- Technical/scientific specialization module
- Context module

**Lessons**

- x 2 lecture periods and 1 tutorial period per week
- 2 lecture periods per week

**Brief course description of module objectives and content**

Energy is one of the major topics of the future. Even in Switzerland, energy consumption is constantly rising, and politically, it has become an accepted fact that we must find ways to reduce energy consumption on a long-term basis. The 2000-watt society envisages reducing the current output of 6 kW utilized by each citizen to 2 kW by the end of the century.

It is possible to end the existing dependence of a country's Gross National Product on energy consumption. There are numerous ways to lower energy consumption without losing wealth. Often, these solutions are not implemented by decision makers in the political, economic and technological sectors because of a lack of knowledge of the physical connections in energy engineering. The law of supply and demand, which can lever new forms of energy, will only become effective when substantial price increases result from the serious bottlenecks in the power supply. The early discussion and implementation of solutions for the future energy supply is currently providing Switzerland with a long-term substantial economic advantage in international competition.

The objective of this course is threefold: We will begin by dealing with the subject of the energy problem using Switzerland as an example. Afterwards, we will develop feasible solutions, such as using energy rationally, recovering heat, or applying heat pumps for the use of energy potential at a lower temperature. In addition, we will discuss how to implement measures within the private sector, at an industrial site, or in a municipality.

In the course *Energy: Production, Consumption and Management*, we will address the necessary theoretical basic principles of energy technology. Using concrete examples, the functionality of various procedures of energy transformation and of systems with which energy can be used intelligently and efficiently will be conveyed.

This course is aimed particularly at students who have an interest in energy technology and related fields and have recognized the need to seek applicable solutions. The course provides the necessary basic principles for the multifaceted aspects of the topic.

**Aims, content, methods**
**Learning objectives and acquired competencies**

- To become acquainted with short, medium and long-term energy sources which are available nationally and/or world-wide; to gain an understanding of the technical connections of efficient employment of energy in the future (2000-watt society, the carbon dioxide problem);

- Ability to understand and communicate with specialists from the various sectors such as energy management, energy production, and energy consumption;
- Ability to make a sensible choice between different technical systems that satisfy the requirements and the available energy sources, and to do this without disregarding economic, ecological and social aspects. This involves:
  - the knowledge of the economical potential of energy systems,
  - the knowledge of methods of rational energy use, and
  - the ability to quantify energy conservation with thermodynamics methods.

#### Contents of module with emphasis on teaching content

This module addresses the following aspects:

- Available forms of energy (renewable or non-renewable)
- The demand for these forms of energy and their stocks
- The value of the various forms of energy ('Noblesse')
- Small and large-scale power plants
- The potential of recycling energy
- Energy management in industry and in buildings
- The economical advantages of rational energy use
- Mobility
- LCA
- Sustainability

#### Teaching and learning methods

Ex-cathedra teaching, presentations, case studies

#### Prerequisites, previous knowledge, entrance competencies

This course should sensitize students to the questions of sustainable energy employment and is directed towards a wide public. Knowledge of the fundamentals of thermodynamics and energy engineering is advantageous but not mandatory. Generally, the course will be taught in English in ZH and in French in LS.

#### Literature

- *Fundamentals of Engineering Thermodynamics*, 5th INTERNATIONAL Edition  
Michael J. Moran, The Ohio State Univ.  
Howard N. Shapiro, Iowa State Univ. of Science and Technology
- *Introduction to Thermal Systems Engineering: Thermodynamics, Fluid Mechanics, and Heat Transfer*, INTERNATIONAL Edition  
Michael J. Moran, The Ohio State Univ.  
Howard N. Shapiro, Iowa State Univ.  
Bruce R. Munson, Iowa State Univ.  
David P. DeWitt, Purdue Univ.
- *Thermodynamique et Energétique, Tome 1: de l'énergie à l'exergie*, L. Borel & D. Favrat, Presses Polytechniques et Universitaires Romandes, 2005
- *Technische Thermodynamik, Theoretische Grundlagen und praktische Anwendungen*, G. Cerbe und G. Wilhelms, Hanser Verlag
- *Plan directeur de la recherche énergétique de la Confédération pour les années 2013 à 2016*, Office fédéral de l'énergie OFEN. Février 2013 ([www.recherche-energetique.ch](http://www.recherche-energetique.ch))

#### Assessment

##### Certification requirements for final examinations (conditions for attestation)

Evaluation of the seminar contributions from different sections that are co-requisites for the admission requirement for the module examination.

##### Written module examination

|                    |                                 |
|--------------------|---------------------------------|
| Duration of exam : | 120 minutes                     |
| Permissible aids:  | Summary of formulas, calculator |