

ME-460

**Renewable energy (for ME)**

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Cursus	Sem.	Type
Energy Science and Technology	MA2, MA4	Opt.
Mechanical engineering minor	E	Opt.
Mechanical engineering	MA2, MA4	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	Written
Workload	120h
Weeks	14
<b>Hours</b>	<b>3 weekly</b>
Lecture	2 weekly
Exercises	1 weekly
<b>Number of positions</b>	

**Summary**

The students assess and compare all renewable energy resources, their real potentials, limitations and best applications (energy services). Solar thermal, solar electric, wood, bioliquids, biogas, hydropower incl. tidal and wave power, wind, geothermal incl. heat pumps and buildings.

**Content**

Overview of renewable energy vectors, their physical principles and essential equations, their operation technologies, technical details, challenges, applications and potential for supply of heat, transport and electrical services. Solar (photovoltaics and thermal - collectors/concentrators), biomass (a.o. gasification), biogases, liquid biofuels, hydro-electricity, geo-energy (electrical and thermal), wind; hydrogen (as intermediate energy vector). Storage including electrochemical storage and H<sub>2</sub>, electrolysis.

**Keywords**

Renewable electricity / heat / transport; efficiency

**Learning Prerequisites****Recommended courses**

- Master the concepts of mass, energy, and momentum balance
- Understand the main thermodynamic cycles

**Learning Outcomes**

By the end of the course, the student must be able to:

- Compute and design solar collectors and receivers, E16
- Compute and design wind power plants, E17
- Explain and apply the concepts of thermodynamic efficiency, E6
- Explain the principles and limitations of the main energy conversion technologies, E7
- Characterize fossil and renewable energy resources and their corresponding conversion technologies, E8
- Integrate the challenges related to energy: resources, energy services, economic and environmental impacts, E9

**Transversal skills**

- Access and evaluate appropriate sources of information.
- Collect data.
- Demonstrate the capacity for critical thinking
- Give feedback (critique) in an appropriate fashion.
- Take responsibility for environmental impacts of her/ his actions and decisions.
- Assess one's own level of skill acquisition, and plan their on-going learning goals.

### **Teaching methods**

Modules of 2 h interactive lectures completed with 1 h of practical numerical examples

### **Assessment methods**

Written exam

### **Resources**

#### **Bibliography**

Course slides and resolved exercises in extenso on moodle. Additional references/annexes will be given during the course.

#### **Moodle Link**

- <https://go.epfl.ch/ME-460>