

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 |
| Hours | 3 weekly |
| Courses | 2 weekly |
| Exercises | 1 weekly |
| Number of positions | |

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 H₂, 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>