ME-460

Renewable energy (for ME)

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Cursus	Sem.	Type
Energy Science and Technology	MA2, MA4	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, their limitations and their 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).

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:

- 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
- Compute and design hydraulic machines, E12
- Compute and design solar collectors and receivers, E16
- Compute and design wind power plants, E17

Transversal skills

- 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.
- Access and evaluate appropriate sources of information.
- Collect data.
- Demonstrate the capacity for critical thinking

Teaching methods

Modules of 2 h interactive lectures completed with1 h of practical numerical examples

Assessment methods

Written exam

Resources

Bibliography

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

Ressources en bibliothèque

- Sustainable energy : without the hot air / MacKay
- Handbook of Energy Efficiency and Renewable Energy / Kreith