ENG-410

Energy supply, economics and transition

Ballif Christophe, Binder Claudia R., Thalmann Philippe

Cursus	Sem.	Type
Computational and Quantitative Biology		Opt.
Energy Science and Technology	MA2, MA4	Obl.
Managmt, dur et tech	MA2	Obl.
Managmt, tech et entr.	MA2, MA4	Opt.
Microtechnics	MA2, MA4	Opt.
Minor in Engineering for sustainability	E	Opt.
Robotics	MA2, MA4	Opt.

Language of teaching	English
Credits	2
Session	Summer
Semester	Spring
Exam	Written
Workload	60h
Weeks	14
Hours	**2 weekly**
Courses	2 weekly
Number of positions	

Summary

This course examines energy systems from various angles: available resources, how they can be combined or substituted, their private and social costs, whether they can meet the energy demand, and how the transition to a renewable energy system can be fostered.

Content

Energy resources and reduction of CO2 emissions (Christophe Ballif)

- Current and future CO2 and CO2 equivalent emissions, impact on climate
- Available resources and their properties (finite resources like fossil, nuclear fuel, vs hydro, non-hydro, renewable resources such as solar, wind, geothermal biomass)
- Energy statistics, direct cost of various energy sources, direct levelised cost electricity (LCOE)
- General aspects of energy transition, scenarios and expectations, at world, European and Swiss level
- Support to the energy transition: efficiency, heat pumps, electric mobility, power-to-gas, short term and long term storage solutions, smart grids, carbon storage

Energy economics (Philippe Thalmann, Sascha Nick)

- Decoupling: What it means, what it takes; green growth
- Energy economics: basic financial calculation, asset stranding, investment choice, levelized cost of electricity
- Energy, human needs and well-being
- Limits to market governance of energy in societal transitions

Energy transition (Claudia R. Binder and team)

- Governance perspectives and social-technical dimensions
- Energy system transitions (from a fossil fuel to a CO2 neutral system) as socio-technical change processes
- Insights into drivers and barriers for the socio-technical transition of the energy system
- Key actors in the Swiss energy sector
- Energy modelling and its challenges

Case study: a CO2-neutral energy system in Switzerland

Learning Outcomes

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

- Critique theories and proposals related to energy supply
- Propose various scenarios for energy systems and their evolution
- Reason on technical, social, political and economic issues
- Explain the relationships between physical energy resources and energy supply
- Differentiate between scientific and propaganda arguments
- Restate concepts and mechanisms seen in class

Transversal skills

- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Set objectives and design an action plan to reach those objectives.
- Communicate effectively with professionals from other disciplines.
- Access and evaluate appropriate sources of information.

Teaching methods

In-depth teaching and educational support.

Assessment methods

Written examen, multiple choice

Supervision

Office hours	No
Assistants	Yes
Forum	Yes

Resources

Moodle Link

- https://go.epfl.ch/ENG-410

Videos

- http://Recordings of lectures accessible through Moodle