

ENG-410

**Energy supply, economics and transition**

Ballif Christophe, Binder Claudia R., Thalmann Philippe

Cursus	Sem.	Type		
Energy Science and Technology	MA2, MA4	Obl.	Language of teaching	English
Managmt, dur et tech	MA2	Obl.	Credits	2
Managmt, tech et entr.	MA2, MA4	Opt.	Session	Summer
Microtechnics	MA2, MA4	Opt.	Semester	Spring
Minor in Engineering for sustainability	E	Opt.	Exam	Written
Robotics	MA2, MA4	Opt.	Workload	60h
			Weeks	14
			<b>Hours</b>	<b>2 weekly</b>
			Lecture	2 weekly
			<b>Number of positions</b>	

**Summary**

This course examines the supply of energy from various angles: available resources, how they can be combined or substituted, their private and social costs, whether they can meet the 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)**

- The Grand Challenge: Reconciling demographic and economic growth with the limits of our planet
- Decoupling: What it means, what it takes; green growth
- 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

**Keywords**

Energy resources

Energy supply  
Energy prices  
Energy costs  
Energy transition  
Renewable energy  
Decarbonisation  
Decoupling  
Green growth  
Sustainability

### 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 exam

### Supervision

Office hours	No
Assistants	Yes
Forum	Yes

### Resources

#### Moodle Link

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

#### Videos

- <https://tube.switch.ch/channels/9b65d554>