Energy supply, economics and transition

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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
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
Assistant  Yes
Forum  Yes

Resources
Moodle Link
• https://go.epfl.ch/ENG-410

Videos
• https://tube.switch.ch/channels/9b65d554