CIVIL-603

Energy planning: modeling and decision support systems

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Cursus	Sem.	Type
Energy		Obl.

Language of teaching	English
Credits	3
Session	
Exam	Project report
Workload	90h
Hours	**56**
Lecture	28
Practical work	28
Number of positions	

Frequency

Every 2 years

Remark

!! ONLINE !! 9:15-12:00/14:15-17:00. Register in ISA or contact edey@epfl.ch to receive the Zoom link

Summary

Solving the problems of energy planning : demand forecasting, evaluation of supply matrixes, probabilistic evaluation of demand/supply adequacy, multi-criteria assessment of medium and long term energy strategies, risk assessment of energy supply portfolios.

Content

1. Introduction to Energy Economics and Modeling
1.1 Basic economics: microeconomic, macroeconomic theories
1.2 Economic-Environment-Energy Modeling: optimization, simulation, time and space dimensions
1.3 Various modeling approaches: Top-down, Bottom-up, Hybrid/Integrated approach
1.4 Theory of energy economics: Cost-Benefit analysis, social welfare, marginal cost and investment decision, energy pricing

2. Energy Demand/Supply Adequacy
2.1 Energy Demand modeling and forecasting: projection, econometric, techno-economic and hybrid models
2.2 Electrical Power generation planning: deterministic, probabilistic models; generation planning in a competitive environment; planning of distributed energy resources
2.3 Comparative assessment of energy strategies: Mono-Criterion, Multi-objective programming, Multi-Criteria Decision Making
2.4 Simulation of energy markets: Multi-agent simulation of generation expansion in the markets of electricity, system dynamics

3. Modeling externalities of Energy
3.1 Evaluation of environmental externalities
3.2 Internalizing external effects in energy planning
3.3 Case of Electrical Power Generating System
3.4 Discussing the pricing of environmental externalities

4. Energy Risk Management
4.1 Price volatility and risk management
4.2 Energy derivatives
4.3 Value-at-Risk
4.4 Portfolio risk analysis and application to electricity supply planning

5. Case studies: Least cost planning of electrical generating system expansion
5.1 Electricity demand forecasting
5.2 Candidates for expansion and configurations of the system
5.3 Modeling the operation of the system
5.4 Elaborating expansion strategies
Case of electrical generating systems dominated by non-renewable energy sources
Case of electrical generating systems dominated by renewable energy sources

Assessment methods

Reading and Presentation of two articles by group: 30%
Cases studies using the software PLANELEC-PRO or HOMER : 70%

Resources

Websites

- http://bpe.epfl.ch