EE-570

Power system restructuring and deregulation

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Cursus	Sem.	Type
Electrical and Electronical Engineering	MA2, MA4	Opt.
Energy Management and Sustainability	MA2, MA4	Opt.
Energy Science and Technology	MA2, MA4	Opt.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	During the semester
Workload	90h
Weeks	14
Hours	**3 weekly**
Lecture	2 weekly
Exercises	1 weekly
Number of positions	

Summary

This course presents different types and mechanisms of electricity markets. It addresses in particular their impacts on power/distribution systems operation and consequently the appropriate strategies capable to ensure a secure and reliable functioning.

Content

Key points of electricity market liberalization: unbundled structure, competition, studies of new paradigms, market efficiency.

Supply and demand modeling: definition, bidding and demand profiles, marginal cost, utility cost, revenue and benefit, complex bids for a multiple period market.

Energy contracts and market mechanisms: spot market vs. open energy market, forward and futures contracts, bilateral trading: long term - over the counter - electronic trading, pool trading: market clearing price - impact of demand elasticity and price CAP, risk management: price volatility - call & put options - contracts for difference, examples.

Bidding strategies: perfect competition vs. imperfect competition, market power: definition - HHI calculation, Game Theory and its variations: complete/incomplete information - cooperative/non cooperative game, - static/dynamic game - ..., Nash equilibrium & Pareto optima, best response function - Minmax & Maxmin methods - dominant strategy method, particular cases: Cournot & Bertrand models, examples.

System security & ancillary services: definitions and system security requirements, transmission facilities vs. system security, ancillary services: compulsory provision vs. provision through markets, example of balancing market mechanism, introduction to congestion management: market solution & technical solution (examples using FACTS devices or phases shifter transformers), examples.

Transmission pricing & congestion management: rolled-in methods: postage stamp method - contract path method - MW mile method - ..., Available Transmission Capacity calculation (ATC), PTDF calculation, TLR method, willingness to pay method, Inc-Dec method (redispatching), counter-flow methods, auctioning method (cross-borders), zonal pricing: market splitting/coupling, nodal pricing & Locational Marginal Prices (LMP) calculation: analysis of the appropriateness - application of market power - hedging (FTR, TTC, ...), examples.

Keywords

Electricty market, spot market, forward/futures market, bilateral/pool trading, risk management (options & contract for difference), market power, game theory, ancillary services, balancing market, congestion management, zonal pricing, nodal pricing, hedging.

Learning Prerequisites

Recommended courses

Electric power systems

Learning Outcomes

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

- Explain the different electricty market mechanisms
- Choose appropriate risk management instruments
- Analyze market power
- Choose appropriate congestion management mechanisms

Teaching methods

Ex cathedra lectures with illustrative examples

Expected student activities

attendance at the lectures; completing exercices

Assessment methods

Continuous control

Resources

Bibliography

lecture slides