

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.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	During the semester
Workload	90h
Weeks	14
<b>Hours</b>	<b>3 weekly</b>
Courses	2 weekly
Exercises	1 weekly
<b>Number of positions</b>	

**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**

Electricity 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 electricity 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 exercises

## **Assessment methods**

Continuous control

## **Resources**

### **Bibliography**

lecture slides