ECE 6337: Electricity Markets

Spring 2020, Prof. Santiago Grijalva

Description	This course provides a comprehensive introduction to electricity markets, including power system economics, market models, and market design. The interactions between the physical properties of the grid and the market are modeled and simulated through software. Market interactions are studied through auction and trading exercises. The course covers emerging market aspects including: market operations with high penetration of renewable energy, valuation of distributed energy resources (DERs), and emerging energy business models.
Course Objectives	• Present the fundamentals of power system economics • Describe the design of advanced electricity markets • Describe electricity markets optimization models • Introduce new trends on DERs at the distribution system level • Describe methods for electricity resource long-term decision-making
Pre-requisites:	Graduate Standing, ECE6320 or ECE4320 desirable.
Time and Place:	Van Leer 283, MWF 9-10 am.
Instructor	Prof. Santiago Grijalva
e-mail	sgrijalva@ece.gatech.edu
Office Hours:	Monday 10-11 am
Grading Policy:	Homework (20%) 2 One-Hour Tests (15% each) Term Project (20%) Final (30%)
Text:	Instructor will provide full set of electronic notes.

Tentative Course Schedule

Date	Topic		Approx. HW Due Dates
	Pre-Reading:		
	0a.	Elements of Microeconomic Theory	
	0b.	Basics of Electric Power	
	Course Topics:		
Jan 6	1.	Electricity Industry Trends and Market Challenges	
		Fundamentals	
Jan 8	2.	Electricity Supply and Demand	
Jan 10, 13	3.	Markets and Risk Management, Energy Markets	
Jan 15, 17	4.	Electricity Market Architecture	HW01
Jan 22, 24	5.	Producer Participation: Strategy, Self-Scheduling	
Jan 27	6.	Customer Participation, Demand Response	
Jan 29, 31	7.	Introduction to Utility Regulation	HW02
		Optimization-Based Markets and the Grid	
Feb 3, 5	8.	Optimization Methods	
Feb 7, 10	9.	Grid Modeling and Locational Marginal Prices	HW03
Feb 12	10.	Security Constrained Optimal Power Flow	
Feb 14, 17	11.	Price-Based Unit Commitment	
Feb 19, 21	12.	Distributed Energy Resources (DER)	
Feb 24, 26	13.	Optimal DER Energy Scheduling	HW04
Feb 28	14.	Co-optimization of Energy and Grid Services	
		Imperfect Markets	
Mar 2 ,4	15.	Congestion Management	
Mar 6, 9	16.	Emissions Dispatch and Carbon Trading	HW05
Mar 11, 13	17.	Oligopoly and Market Power Monitoring	
Mar 23	18.	Competition in Distribution, DSOs	
		Planning and Long-Term Decisions	
Mar 25, 27	19.	Introduction to Traditional Electricity Resource Planning	HW06
Mar 30	20.	DER Planning	
Apr 1, 3	21.	DER Portfolio Valuation	
Apr 6, 8	22.	Non-Wires Alternatives	
		Emerging Aspects	
Apr 10, 13	23.	Smart Grid and Market Management Platforms	HW07
Apr 15, 17	24.	New Electricity Industry Business Models	

Supplemental References

1. D. Kirschen, G. Strbac, Fundamentals of Power System Economics, 2nd Edition, John Wiley, 2018
2. Sioshansi, Competitive Electricity Markets: Design, Implementation, Performance, Elsevier, 2008
3. J. Welch, C.J. Bolling, "Competitive Electricity Markets: The Power of Choice", ITC Holdings, 2009
4. D. Gan, "Electricity Markets and Power System Economics", 2013
5. A. Conejo, M Carrion, J. Morales, "Decision Making Under Uncertainty in Electricity Markets", 2010
6. J. Momoh, L. Mili, Economic Market Design and Planning for Electric Power Systems, (IEEE Press Series on Power Engineering), Wiley, 2009

Course Expectations & Guidelines

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit http://www.catalog.gatech.edu/policies/honor-code/ or http://www.catalog.gatech.edu/rules/18/.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or http://disabilityservices.gatech.edu/, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Attendance and/or Participation

Attendance of students to all the lectures is expected and encouraged.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

Assignments are provided with significant notice. Unless you have an emergency, no late assignments or missed exams will be accepted.