

Course Outline

EL 6623 – Power System Economics and Deregulation-Spring 2010

Structure: Two Parts

Part One: Weight 40 % of the grade

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Part Two : Weight 60 % of the grade

Dr. Sindhu Suresh: ssuresh@poly.edu

Prerequisite : EL 5613 , Introduction to Power Systems.

Course Summary

This course will provide a comprehensive overview of power system economics and the electricity market, starting with a basic understanding of system economics, market structure and the actual financial and operational aspects of the energy grid. This course will be taught in two parts. Part One will encompass the economic and policy component. Part Two will focus on financial and technical aspects of the power market. This section helps students to develop a basic knowledge in making the commitment and dispatch decisions for the reliable and economic operation of the grid. More detail can be found in part two of the syllabus.

Course Goal: This course will provide students with a broad vision of the deregulated energy market. In addition, it will discuss in detail technological, economical and political issues and address aspects of the global power market . This course will describe how utility management makes cost revenue decisions and optimizes power system economics based on those decisions. Participants will attain a basic knowledge of generation economics to meet power system demand and will learn the impact of transmission, distributed generation, demand side management and implementation of Smart Grid. This course will provide a general overview of operational costs including fuel and how these prices impact utility economics and reliability issue related with intermittent generation.

Course Contents:

There will be a strong policy aspect of this course and the factors that broadly influence decision making. In reviewing the energy industry, it is important to connect all components, including engineering, economics, finance, policy and regulation. While the focus will be on the electric power system, this course will provide an overview of energy in general and include consideration of such current topics like global warming, smart grid, intermittent energy sources and deregulation.

Part one:

The Part I of the course will be graded as follows:

Readings: 30%
Class Participation: 20%
Midterm: 50%

Readings for Part One of Course:

Unless indicated, the readings from Part One of the Course are available on the internet.

Suggested Economic Textbook is Robert Pindyck and Daniel Rubinfeld, Microeconomics, 7/e, Pearson Prentice Hall, 2009 or Pearson Custom Business Resources, Compiled by Microeconomics, New York University, Stern School of Business, Pearson Custom Publishing, 2009

Areas of interest for reading: Preliminaries, the Basics of Supply and Demand, Individual and Market Demand, Market Power, Monopolistic Competition and Oligopoly

Suggested background reading: Maury Klein, The Power Makers: Steam, Electricity, and the Men who Invented Modern America, Bloomsbury Press, 2008 (paperback available in bookstores or on Amazon)

Required: The following websites and other readings as indicated: FERC, NY ISO, ISO New England, Harvard Energy Policy Group (HEPG), NARUC, DOE

January 19: Introduction to Energy Economics: Concepts and Terms

Reading: Suggested Textbook Pindyck and Rubinfeld

January 26: Utility Ratemaking and Policies: Issues, Opportunities and Change

Reading: from web

- “Guide to Utility Ratemaking”, Questar Gas Company
- www.epa.gov/RDEE/documents/napee/napee_chap2.pdf
- Utility Deregulation Glossary, LIHEAP Clearinghouse, <http://liheap.ncat.org/iutil2.htm> and from Google search-- Glossary of Electric Utility and Ratemaking terms
- FERC Website:
 - About FERC
 - Strategic Plan: 2009-14

- 2008 Annual Report
- 2000 Market Oversight Report
- NY ISO and ISO NE websites; specifically NYISO, “Power Trends, 2009”; “Fuel Diversity in the New York Electricity Market: A New York ISO White Paper”, October 2008

February 2: Trends in Electricity Markets

Readings:

- “A National Assessment of Demand Response Potential”, June 2009, [www.Ferc.gov/legal/staff-reports/06-09-demand response.pdf](http://www.Ferc.gov/legal/staff-reports/06-09-demand%20response.pdf)
- Articles on the web referencing book by Anne-Marie Borbely and Jan F. Krieder’ Distributed Generation: The Power Paradigm for the New Millennium”
- Congressional Budget Office, “The Current Status of and Prospects for Distributed Generation”, 2003
- US Department of Energy, Office of Electricity Delivery and Energy Reliability, Smart Grid; read article “The Smart Grid: An Introduction”
- NYISO, ISO New England websites
- Miles Keogh, “The Smart Grid: Frequently Asked Questions for State Commissions” NARUC

February 9: Energy and Environmental Issues

Readings: Other to be assigned

Toni Johnson, “Economic Challenges for Climate Change Policy”, Council for Foreign Relations, July 7, 2009, http://www.cfr.org/publication/16009/economic_challenges_for_climate_change-policy

Pindyck and Rubinfeld, “Valuing Clean Air”, Pearson Custom Economics, Example 5: The value of clean air

February 23 : Energy Efficiency

Readings: McKinsey Global Energy and Materials: “Unlocking Energy Efficiency in the US Economy”- from McKinsey Website

Katherine Harmon, ”Top 10 Earth and People Friendly Buildings”, Scientific American, May 26, 2009, <http://www.scientificamerican.com>

March 2: Energy markets and risk

Readings:

S. Stoff, T. Belden, C. Goldman, and S. Pickle, Primer on Electricity Futures and Other Derivatives, Environmental Energy Technologies Division, Ernest Orlando Lawrence Berkeley National Laboratory, University of California, Berkeley, California, January 1998

Kurt Eichenwald, Conspiracy of Fools, Broadway Books, 2005 (optional)

Paul Joskow, “Electricity Restructuring: What’s Gone Right? What’s Gone Wrong? Why Do We Care?”, Resources for the Future, Sixth Annual Hans Landsberg Lecture, October 1, 2008; www.rff.org?events/pages/6thannualHansLandsbergLecturewithPaulJoskow

Identification of key issues for the future: the economic and behavioral nexus; the role of technology; long term outlook for behavioral shifts and change. Review for midterm

Readings- others to be assigned:

Christopher Mims, “The World’s 10 Largest Renewable Energy Projects, Scientific American, June 4, 2009, [http:// www. Scientificamerican.com](http://www.Scientificamerican.com)

David Biello, “First US Powertower Lights up California”, Scientific American, August 6, 2009

March 9 Exam

Part Two :

The Part II of the course will be graded as follows:

- Assignment : 20%
- Class Participation: 10%
- Project : 20%
- Final Exam: 50%

References:

1. J. Wood and B. F. Wollenberg, *Power generation, operation and control*, 2nd Edition, 1996, Wiley-Inter science
2. Mohammad Shahidehpour, Hatim Yamin, Zuyi Li, *Market Operations in Electric Power Systems: Forecasting, Scheduling, and Risk Management*, April 2002, Wiley-IEEE Press
3. IEEE and Science Direct Papers from the Poly-NYU Library
4. <http://www.sandia.gov/>
5. http://eetd.lbl.gov/ea/EMS/EMS_pubs.html
6. Different ISO websites. Will be directed as required.
7. L. Tesfatsion, *Game Theory: Basic Concepts and Terminology*

Software :

Power World Simulator or any software which can do commitment and dispatch algorithms.
CPLEX from ILOG or any optimization solver. All these are available as student version for free.
Minitab and Excel will be required.

Course Policy:

- You are supposed to read the chapter either from book or from handouts posted online (my poly) before the lecture.
- You are encouraged to be active in the classroom and ask questions leading to discussion. You are always welcome to ask question in office hours or through email.
- The handouts will be on-line before the classes and you are supposed to print out them to write down notes.
- Assignments question will be handed over to the class at the end of the class. No Late assignments are accepted. Class attendance is strict. There will be a signing sheet. Please try to be in class 5 minutes before 6.00 PM.
- Students are expected to complete assigned work in a timely manner demonstrating a professionally high standard. Any practice against the code of ethics will result in an F grade.

- 1. March 23: Economic Dispatch**
- 2. March 30: Unit Commitment, Hydrothermal scheduling and Demand forecast**
- 3. April 6: Security Constrained Optimal Power flow, Power Market Trading**
- 4. April 13: Intermittent Generation and its impact on grid system**
- 5. April 20: Electricity Market Trading depends on Transmission Capacity**
- 6. April 27: Demand Side Management**
- 7. MAY 5: Emission Control Technologies**
- 8. MAY 11: Submission of Project and Final exam.**