ENERGY MARKETS AND POLICY

BEPP/OIDD 763 WEMBA (EAST)

Spring Semester 2016, Philadelphia

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Course overview. Over the last several decades, energy markets have become some of the most dynamic markets of the world economy. Traditional fossil fuel and electricity markets have seen a partial shift from heavy regulation to market-driven incentives, while rising environmental concerns have led to a wide array of new regulations and "environmental markets". This changing energy landscape requires quick adaptation from energy companies, but also offers opportunities to turn regulations into new business. The objective of this course is to provide the economist's perspective on a broad range of topics that professionals in the energy industry will encounter. Topics include the effect of competition, market power and scarcity on energy prices, the impact of deregulation on electricity and fossil fuel markets, extraction and pricing of oil and gas, geopolitical uncertainty and risk in hydrocarbon investments, the environmental impact and policies related to the energy sector, environmental cap-and-trade markets and global energy policy developments.

Readings. A mix of newspaper articles, academic papers, reports, plus the following textbook: Nathaniel Keohane and Sheila Olmstead (KO), *Markets and the Environment*, Washington, D.C.: Island Press, 2007. Starred (*) readings are required. Many starred readings are short. Non-starred readings are optional but I will discuss them in class, and you are highly encouraged to read them if you need or want further background on a specific topic. The best way to use the readings is as a supplement to the lectures, which overlap partially (but certainly not perfectly!) with the readings. You will be responsible for required readings not covered in class.

Prerequisites. Managerial Economics (MGEC 611/612) or an equivalent intermediate microeconomics course approved by the instructor.

Strategy game. The Electricity Strategy Game is a simulation of an electricity market. Student teams manage a portfolio of generation units (coal, natural gas, nuclear and renewables) and bid into an electricity market. This game requires 6 online electricity wholesale market bid submissions plus one round of auction bids in between class meetings.

Assignments and grading. Two equally weighted assignments (30%), an exam (40%), the Electricity Strategy Game (20%) and class participation (10%). The two assignments are take-home. You will be expected to complete them in groups of at most three individuals. The exam will be given in class on the last scheduled class date. You should plan to attend the exam in person.

Cheating policy. It should not be necessary to say this – but for completeness: all students are expected to comply with the University of Pennsylvania's Code of Academic Integrity. It is the policy of the Department, and this course, to immediately fail any student for the course who is in violation of the University's Code of Academic Integrity. Cheating in any manner, on a graded assignment or exam, or violating the rules of the strategy games, will result in a failing grade for this course. Additional sanctions may be imposed of the Office of Student Conduct. The Code of Academic Integrity can be reviewed at: http://provost.upenn.edu/policies/pennbook/2013/02/13/code-of-academic-integrity.

ELECTICITY MARKETS

Lecture 1 (Mar 11): **Course Introduction & Energy Overview**

U.S. Energy Information Administration, 2015. *Annual Energy Outlook*, Executive Summary.

International Energy Agency, 2015. *World Energy Outlook*, Executive Summary.

Lecture 2 (Mar 11): **Market Efficiency and Scarcity Pricing**

Topics: market efficiency; scarcity pricing; electricity markets; refined products markets.

(*) KO Chapter 4: "The Efficiency of Markets".

(*) J. Mouawad, "A Fast-Growing Independent Strikes Gold in Oil Refining", *New York Times*, 5/18/05.

(*) J. Mouawad, "Oil Refiners See Profits Sink as Consumption Falls", *New York Times*, 5/14/08.

(*) C. Krauss, "Oil Refining's Fortunes Rise", *New York Times*, 10/24/12.

(*) L. Denning, "Refiners Can Keep Floating on Cheap Oil", *Wall Street Journal*, 7/21/15.

Lecture 3 (Mar 12): **Market Power in Electricity Markets (1)**

Topics: market power; deregulation.

(*) S. Borenstein, 2000. "Understanding Competitive Pricing and Market Power in Wholesale Electricity Markets", *Electricity Journal*: 49-57.

(*) J. Griffin and S. Puller, 2005. "A Primer on Electricity and the Economics of Deregulation", in *Electricity Deregulation: Choices and Challenges*, Griffin and Puller eds., Chicago: University of Chicago Press, pp. 1-4 and 12-23 (remainder is optional).

Lecture 4 (Mar 12): **Market Power in Electricity Markets (2) & Introduction to the Electricity Strategy Game**

Topics: the California electricity crisis; the rise and fall of Enron.

(*) S. Borenstein, 2002. "The Trouble with Electricity Markets: Understanding California's Restructuring Disaster", *Journal of Economic Perspectives* 16(1): 191-211.

(*) D. Fitzpatrick, R. Smith and R. Tracy. "J.P. Morgan Staring at Record Fine Over Energy", *Wall Street Journal*, 7/17/2013.

P. Healy and K. Palepu, 2003. "The Fall of Enron", *Journal of Economic Perspectives* 17(2): 3-12 (pp. 13-26 are less relevant for this course).

W. Bernstein, 2004. "The Rise and Fall of Enron's One-to-Many Trading Platform," Lieff Cabraser Heimann & Bernstein, LLP, San Francisco, CA.

OIL AND GAS MARKETS

Lecture 5 (Mar 25): **Oil and Natural Gas Extraction and Pricing (1) & Electricity Strategy Game Auction**

Topics: trends in oil and gas reserves; optimal extraction; Hotelling model.

(*) KO Chapter 6: "Managing Stocks: Natural Resources as Capital Assets".

(*) Lecture notes about the Hotelling model for optimal resource extraction, pp. 1-7 and 13-14 (extensions 1, 2 and 3 on pp. 7-13 are optional).

D. Yergin, 2008. *The Quest: Energy, Security, and the Remaking of the Modern World*, Chapter 11: Is the World Running out of Oil?, Chapter 12: Unconventional and Chapter 16: Shale Gas, New York: The Penguin Press.

Lecture 6 (Mar 25): **Oil and Natural Gas Extraction and Pricing (2) & Upstream Investment under Uncertainty**

Topics: oil price volatility; oil price forecasting; NOCs vs. IOCs; upstream contracts; geopolitical risk; expropriations.

(*) A. Ulmer and C. Pons, "Venezuela ordered to pay Exxon $1.6 billion for nationalization", *Reuters*, 10/9/2014.

"Slippery Negotiations: The Give and Take of Oil Contracts in Foreign Countries", *Knowledge@Wharton*, 11/20/2012.

ENERGY & ENVIRONMENTAL POLICY

Lecture 7 (Apr 8): **Global Climate Change**

Topics: measuring climate change impacts; the climate change debate; discounting; risk and uncertainty.

(*) B. Litterman, 2013. "What Is the Right Price for Carbon Emissions?", *Regulation* 36(2): 38-43.

"In the balance", *The Economist*, 4/5/14.

Lecture 8 (Apr 8): **Externalities and Policy Instruments**

Topics: environmental externalities; tragedy of the commons, Coase Theorem; property rights; taxes vs. subsidies vs. standards; effect of regulations on business; double dividend.

(*) "Sorting Frack from Fiction", *The Economist*, 7/14/2012.

(*) KO Chapter 5: "Market Failures in the Environmental Realm".

(*) KO Chapter 8: "Principles of Market-Based Environmental Policy", pp. 125-143.

Lecture 9 (Apr 9): **Cap-and-Trade**

Topics: basics of cap-and-trade; cost-effectiveness; introduction to market design issues.

(*) Lecture notes about the economics of cap-and-trade.

(*) KO Chapter 9: "The Case for Market-Based Instruments in the Real World" pp. 153-168.

(*) “Carbon Tax v Cap-and-Trade: Which is Better?”, *The Guardian*, 1/31/2013.

Lecture 10 (Apr 9): **U.S. and Global Policy Developments**

Topics: market design issues in cap-and-trade markets; EU Emissions Trading Scheme; U.S. climate change policy, international climate agreements.

(*) R. Newell, B. Pizer and D. Raimi, 2013. “Carbon Markets 15 Years after Kyoto: Lessons Learned, New Challenges”, *Journal of Economic Perspectives* 27(1), pp. 123-139 (remainder is optional).

(*) J. Eilperin and S. Mufson, “Everything You Need to Know About the EPA’s Proposed Rule on Coal Plants”, *Washington Post*, 6/2/2014.

(*) A. van Benthem and R. Martin, “Europe’s carbon-trading system is better than thought, and could be better still”, *The Economist*, 12/11/15.

(*) C. Davenport, “Nations Approve Landmark Accord in Paris”, *New York Times*, 12/12/15.

“Inside the Paris Climate Deal”, *New York Times*, 12/12/15.

C. Davenport, “Large Companies Prepared to Pay Price on Carbon”, *New York Times*, 12/5/13.

Lecture 11 (Apr 28): **Electricity Strategy Game Debriefing**

Lecture 12 (Apr 28): **Exam**

PRELIMINARY DUE DATES

Assignment dates

Assignment 1: posted on March 18th, due by April 8th
Assignment 2: posted on April 9th, due by April 22nd

Electricity Strategy Game

March 12	Introduction to the Electricity Strategy Game in class
March 19	Bids due for the ESG test run by midnight EST
March 25	First ESG divestiture auction, in class
March 28	ESG strategies due by midnight EST for year 1, day 1
March 30	ESG strategies due by midnight EST for year 1, day 2
April 1	ESG strategies due by midnight EST for year 1, day 3
April 4	Sealed portfolio bids for year 2 due by midnight EST
April 6	ESG strategies due by midnight EST for year 2, day 1
April 8	ESG strategies due by midnight EST for year 2, day 2
April 11	ESG strategies due by midnight EST for year 2, day 3
April 28	ESG strategy memo due before class
April 28	ESG debriefing in class

Exam

The exam will be in class during the second part of the session on April 28th.