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.

ELECTRICITY MARKETS

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


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”.


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

*Topics*: market power; deregulation.


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.


**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).

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.


“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.


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.


(*) 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.


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

Lecture 12 (Apr 28): **Exam**
PRELIMINARY DUE DATES

Assignment dates
Assignment 1: posted on March 18\textsuperscript{th}, due by April 8\textsuperscript{th}
Assignment 2: posted on April 9\textsuperscript{th}, due by April 22\textsuperscript{nd}

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 28\textsuperscript{th}. 