Models of Energy Markets
Syllabus

Course Information

OPRE 6V99 Fall 2013
Lecture hours: Saturdays 10:00am-12:45pm
Location: JSOM 2.102

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Office hours: Fridays 2:00-4:00pm

Prerequisites: Open to all graduate level students and qualified junior/senior undergraduate students.

Course description: Effective management of modern energy initiatives requires a comprehensive understanding of energy market fundamentals. This course supplies students with such knowledge through a detailed examination of the history, structure and functioning of modern energy markets. The course focuses on market models for petroleum, natural gas, electricity, and renewable energy, and outlines existing and potential complications related to economic, financial, and regulatory circumstances. The structure of the course blends theoretical framework with case study analysis to give students an understanding of how theoretically formulated models can be applied to real world circumstances, and especially to current issues in global energy markets. Topics include models of supply, demand, and transportation; market structure; game theoretic strategies and risk management; environmental issues; and policy and regulation.

Course objectives:

1. To introduce fundamental economic principles and institutional knowledge of energy industries.
2. To develop modeling, information acquisition, critical thinking, and communication skills necessary to evaluate existing and potential risks and opportunities in energy markets in the context of public policy, investment, and regulation.
3. To promote engagement in energy-related developments through literature and discussion in and outside of the classroom.

Optional Materials:

1. *International Energy Markets: Understanding Pricing, Policies, and Profits*, Carol A. Dahl, PennWell Corporation, Tulsa OK, 2004.
2. *Intermediate Microeconomics: A Modern Approach*, (any edition) Hal R. Varian, W.W. Norton & Company.
3. *The Wealth of Nations*, Adam Smith, Random House, New York, NY, 1994.
4. *Energy Economics: Concepts, Issues, Markets and Governance*, Subhes C. Bhattacharyya, Springer, London, UK, 2011.
5. *Power System Economics: Designing Markets for Electricity*, Steven Stoft, IEEE Press, 2002.
6. Supplemental readings will be assigned during the semester.

Assignment and Grading Policy:

Problem Sets		40%
Exams		40%
Midterm	20%	
Final	20%	
Class Discussion		20%

Draft course outline:

I. Economics of energy markets – an overview

- a. Market structure: players and objective functions
- b. Supply, demand, price setting mechanisms, and equilibria
  - i. Competitive markets, dominant firm with competitive fringe, oligopoly, monopoly, monopsony
- c. Drivers and patterns of energy use
  - i. Long and short term variations (diurnal, seasonal, cyclical)
- d. Role of regulators in regulated and restructured markets

II. Value of mining and energy commodities

- a. Adam Smith on value and price: the theory behind value of mined commodities
- b. Historic accounts: variations in the value of commodities between 1300 and 1700
- c. Price effect of discovery of new deposits, imports and exports, and the wealth of consuming and producing nations

III. Theory of depletable resources (oil and gas markets)

- a. Hotelling's extraction path
- b. Mined byproducts and co-products
  - i. Production value of petroleum vs. natural gas assets
  - ii. Rare earths, stockpiles, and other near-economic commodities
- c. OPEC and Gazprom as dominant firms
- d. Why oil and gas markets are fundamentally different
  - i. Storage, transportation, pricing

IV. Natural gas markets

- a. Developments in liquefied natural gas (LNG)
  - i. How the International natural gas market works (LNG as a pseudo monopsony)
    1. The LNG supply chain
    2. Main market players (buyers, sellers)
    3. Contracting
       - a. Potential for shift away from oil-price indexation
       - b. Contracted deliveries and spot market

ii. LNG tanker industry
iii. Barriers to a global LNG gas market
iv. The U.S. Debate over LNG exports

b. Shale gas developments
    i. Historic and current U.S. shale activity and its effect on price
    ii. Global shale potential
        1. Shale industry challenges (economic, environmental, and political)
    iii. Coal regulations and their impact on the natural gas market
    iv. Innovations in fracking technologies and the extraction of shale gas
    v. New industrial and transportation demands for natural gas in the U.S.
c. Adapting to changes in global gas markets
    i. Case studies: KOGAS and Gazprom

V. Electricity markets

a. Supply: wholesale and retail markets
b. Demand: residential and C&I customers
c. Theories of electricity competition and regulation
    i. Role of regulator in regulated and restructured markets
    ii. Consumer options (retail choice, contracting mechanisms, and more)
    iii. Spotlight: competition in ERCOT and PJM
d. Pricing strategies: from zonal to nodal spot pricing
e. Risk management
    i. The Smart Grid and demand response
    ii. Infrastructure resilience and disaster recovery
f. Expanding electricity sources and uses
    i. Renewable Integration
    ii. Electrified transportation

VI. Sustainability and environmental concerns

a. What does sustainability mean in energy markets?
    i. Energy efficiency, conservation, and transition
b. Cost-benefit analysis of environmental initiatives
    i. Pricing emissions: a Coasean approach
    ii. Emissions markets: carbon tax, emissions quotas, or tradable permits?
    iii. Implications for company profitability
c. Sustainability in the real world
    i. The greening of power: coal power plant decommissioning,
    ii. Effect of Fukushima nuclear incident on investor perceptions of energy sources

VII. Managing risk

a. Real options
b. Cross-listing as economic diversification and political hedging
c. Case study: SouthGobi Resources in Mongolia