

DARTMOUTH COLLEGE  
Department of Economics

## Environmental and Energy Economics

This course examines environmental and energy issues from an intermediate microeconomics perspective. The course begins by discussing fundamental concepts in environment economics including cost-benefit analysis and economic valuation of the environment. We also explore issues of policy design from an efficiency perspective. The class is introduced to issues of energy economics, including oil, natural gas, and electricity markets, and policies regarding renewables, transportation, and climate change. In examining the electricity industry, students will play a competitive strategy game representing firms in an electricity market.

This course is designed for economics majors and others interested in a quantitative and theoretical economics approach to environmental policy. As such, introductory economics and calculus are prerequisites. Intermediate microeconomics is suggested, though not required. While the course discusses some policy issues, it will focus on theoretical developments in the area of environmental and energy economics.

**PRE-REQUISITES:** Econ 1, Math 3.

**CLASS SCHEDULE:**

11: MWF	11:15-12:20, X-period	Tu 12:00-12:50
12: MWF	12:30-1:35, X-period	Tu 1:00-1:50

**CONTACT INFO:** Office in 327 Rockefeller; email is [erin.mansur@dartmouth.edu](mailto:erin.mansur@dartmouth.edu)

**OFFICE HOURS:** Mondays from 1:35-3:35, or by appointment.

**READINGS:** All required readings are available through Blackboard. To access the site, log in to <http://blackboard.dartmouth.edu/>; under 'my courses' click on Econ 075. There will also be details on the strategy games, lecture notes, and past exams.

In addition there are two optional text books:

Bhattacharyya, Subhes. 2011. *Energy Economics: Concepts, Issues, Markets and Governance*. Springer-Verlag. (hereafter Bha)

Keohane, Nathaniel and Sheila Olmstead. 2007. *Markets and the Environment*, Washington, DC: Island Press. (hereafter KO).

**GRADING:**

Class participation & discussion:	10%
OPEC Strategy Game:	15%
Electricity Strategy Game:	15%
Midterm exam:	25%
Final exam:	35%

Class participation and discussion: I evaluate discussion based on both quantity and quality of cold-called and voluntary *responses in class*. Before each class, I expect students to read the material. For half of the classes, *email the professor one question* the night before class based on the readings in order to facilitate discussion.

Games: Students play strategy games to learn about the oil and electricity industries. The students develop their own bidding strategies and write a group memo describing their team's strategy for each game. Grades are based on the memo and the group performance, *i.e.* profits.

Exams: are to be taken as scheduled, except in case of illness or family emergency. Students may bring *one letter-sized sheet of paper* with notes on both sides.

**DISABILITIES:** Any student with a documented disability needing academic adjustments or accommodations is requested to speak to me and give me a copy of your accommodations form by the end of the second week of the term. All discussions will remain confidential, although the Director of Student Disabilities may be consulted if questions arise.

**RELIGIOUS OBSERVANCES:** Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me before the end of the second week of the term to discuss appropriate accommodations.

### **STRATEGY GAME SCHEDULE:**

#### *Rounds of OPEC Strategy Game*

Round a (Sealed Auction)	September 27	by 11:59 PM
Round a (Meeting)	September 30	In-class
Round 1	October 2	by 11:59 PM
Round 2	October 4	by 11:59 PM
Round 3	October 7	by 11:59 PM
Round 4	October 9	by 11:59 PM
Round 5	October 11	by 11:59 PM
Round 6	October 14	by 11:59 PM
Strategy memo due	October 18	In-class

#### *Rounds of Electricity Strategy Game*

Round a (Auction)	October 29	In-class
Round 1	November 1	by 11:59 PM
Round 2	November 4	by 11:59 PM
Round 3	November 6	by 11:59 PM
Round 4	November 8	by 11:59 PM
Round 5	November 11	by 11:59 PM
Round 6	November 13	by 11:59 PM
Strategy memo due	November 18	In-class

## READING LIST

Optional readings are marked with an asterisk (\*).

### Part I: Introduction

September 16, Lecture 1. Introduction to Environmental & Energy Economics

- [Economic Report to the President](#). 2006. "Recent Developments in Energy"
- [Mahoney](#). 2010. "Follow the Flow" *Technology Review*
- [Sharp](#). 2009. "Reflections on Three Decades of Energy Policy"
- [Krauss](#). 2011. "New Technologies Redraw the World's Energy Picture" *NYT*
- \* Bha, Ch. 2, "Energy Data and Energy Balance"

September 18, Lecture 2. Introduction to Electricity Markets

- [Griffin & Puller](#). 2005. "Introduction" *A Primer on Electricity and the Economics of Deregulation*
- [Borenstein](#). 2000. "Understanding Competitive Pricing and Market Power in Wholesale Electricity Markets" *Electricity Journal*
- \* Bha, Ch. 10, "Economics of Electricity Supply"

September 20, Lecture 3. Introduction to Natural Gas Markets

- [Rotman](#). 2009. "Natural Gas Changes the Energy Map" *Technology Review*
- [Jacoby, O'Sullivan & Paltsev](#). 2011. "The Influence of Shale Gas on U.S. Energy and Environmental Policy" *Econ of Energy & Environmental Policy*
- [Rotman](#). 2012. "King Natural Gas" *Technology Review*
- [Wang and Krupnick](#). 2013. "US Shale Gas Development: What Led to the Boom?" RFF Issue Brief 13-04
- \* [Massachusetts Institute of Technology](#). 2011. "The Future of Natural Gas: An Interdisciplinary MIT Study"
- \* Bha, Ch. 8, "Economics of Fossil Fuel Supply"

September 23, Lecture 4. Introduction to Oil Markets

- Introduction to the OPEC Strategy Game
- [Borenstein](#). 2008. "Cost, Conflict, and Climate: U.S. Challenges in the World Oil Market" CSEM WP 177
- [Newell](#). 2008. "What's the Big Deal about Oil?" *Resources*
- \* [Congressional Research Service](#). 2013. "Oil Sands and the Keystone XL Pipeline: Background and Selected Environmental Issues"
- \* Bha, Ch. 14, "International Oil Market"

## Part II: Regulation and Competition in Energy Markets

September 25, Lecture 5. Pricing Exhaustible Resources

- [Krautkraemer & Toman](#). 2003. "Fundamental Economics of Depletable Energy Supply" Resources for the Future Paper 03-01
- \* [Deffeyes](#). 2001. *Hubbert's Peak: The Impending World of Oil Shortage*, Ch. 1
- \* KO, Ch. 6, "Managing Stocks: Natural Resources as Capital Assets"
- \* Bha, Ch. 9, "Economics of Non-Renewable Resource Supply"

September 27, Lecture 6. Competition in Energy Markets

- [Borenstein](#). 2002. "The Trouble with Electricity Markets" *JEP*
- [Gilbert](#). 2011. "Refining Pinched on East Coast" *WSJ*
- [Smith](#). 2003. "Electric Industry Capacity Glut Jolts Investors" *WSJ*
- \* [Borenstein, Bushnell & Lewis](#). 2004. "Market Power in California's Gasoline Market" CSEM Paper 132
- \* KO, Ch. 4, "The Efficiency of Markets"
- \* Bha, Ch. 12, "Energy Markets and Principles of Energy Pricing"

September 30, Lecture 7. OPEC Strategic Meeting

October 2, Lecture 8. Electricity Restructuring

- [Borenstein & Bushnell](#). 2002. "Electricity Restructuring: Deregulation or Reregulation?" *Regulation*
- [Joskow](#). 2008. "Lessons Learned from Electricity Market Liberalization" *Energy J*
- [Joskow](#). 2012. "Creating a Smarter U.S. Electricity Grid" *JEP*
- \* Bha, Ch. 29, "Reform of the Energy Industry"

October 4, Lecture 9. Nuclear Power

- [Davis](#). 2012. "Prospects for Nuclear Power" *JEP*
- [Joskow & Parsons](#). 2012. "The Future of Nuclear Power after Fukushima"
- \* [Davis & Wolfram](#). 2011. "Deregulation, Consolidation, and Efficiency: Evidence from U.S. Nuclear Power" *AEJ: Applied Economics*

October 7, Lecture 10. Economic Regulation

- [Jamison](#). 2007. "Rate of Return: Regulation" in *Encyclopedia of Energy Engineering and Technology*
- [Berg](#). "Introduction to the Fundamentals of Incentive Regulation"
- [Hiltzik](#). 2013. "On San Onofre, Edison is Trying to Pull a Fast One," *LA Times*.
- \* [Joskow](#). 2006. "Incentive Regulation in Theory and Practice: Electricity Distribution and Transmission Networks"
- \* [Alexander and Irwin](#). 1996. "Price Caps, Rate-of-Return Regulation, and the Cost of Capital" The World Bank Group Note 87.
- \* Bha, Ch. 28, "Regulation of Energy Industries"

October 9: no class - Instead, X-Period on October 29

October 11, Lecture 11. Introduction to the ESG and Case Studies of Nuclear Power

- Introduction to the Electricity Strategy Game
- Demoro. 1987. "PUC Staff Says PG&E Should Pay for Diablo" *SFC*.
- Herscher & Dietz. 1988. "Agreement Reached On Diablo Canyon Cost, " *SFC*.
- [Gertner](#). 2006. "Atomic Balm?" *NYT Magazine Article*
- [Nuclear Energy Institute](#). 2005. "Congress Passes First Comprehensive Energy Bill in 13 Years" ([Supplemental reading](#))

October 14, Lecture 12: Natural Gas Regulation

- [Leitzinger & Collette](#). 2002. "A Retrospective Look at Wholesale Gas: Industry Restructuring" *Journal of Regulatory Economics*
- [Natural Gas Supply Association](#). "History of Natural Gas Regulation"
- \* [Borenstein & Davis](#). 2011. "The Equity and Efficiency of Two-Part Tariffs in U.S. Natural Gas Markets" *Journal of Law and Economics*
- \* Bha, Ch. 15, "Markets for Natural Gas"

October 16, Lecture 13. Gasoline Regulation

- [Borenstein & Bushnell](#). 2005. "Retail Policies and Competition in the Gasoline Industry" CSEM WP 144
- [Borenstein, Bushnell & Lewis](#). 2004. "Market Power in California's Gasoline Market" CSEM Paper 132
- \* [Hastings](#). 2004. "Vertical Relationships and Competition in Retail Gasoline Markets: Empirical Evidence from Contract Changes in Southern California" *AER*

October 18, Lecture 14. OPEC Strategy Game Debrief and Review  
**Strategy Memo Due**

October 21. **Midterm Exam**

### **Part III: Environmental Policies for Energy Markets**

October 23, Lecture 15. Review of Environmental Externalities

- [Fullerton & Stavins](#). 1998. "How Economists See the Environment" *Nature*
- [Palmer, Oates & Portney](#). 1995. "Tightening Environmental Standards: the Benefit-Cost or the No-Cost Paradigm?" *JEP*
- \* KO, Ch. 5, "Market Failures in the Environmental Realm"
- \* Bha, Ch. 23, "The Economics of Environment Protection"

October 25, Lecture 16. Externalities of Energy Markets

- [National Research Council](#). 2010. "Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use, Summary"
- [Seelye](#). 2002. "Utility Buys Town It Choked, Lock, Stock and Blue Plume" *NYT*
- \* KO, Ch. 8, "Principles of Market-Based Environmental Policy"

October 28, Lecture 17. Environmental Policies

- [Portney](#). 2003. "Market-Based Approaches to Environmental Policy" *Resources*
- KO, Ch. 9, "The Case for Market-Based Instruments in the Real World"
- \* Bha, Ch. 24, "Pollution Control from Stationary Sources"

**October 29 X-Period**, Lecture 18. Electricity Strategy Game Auction and Catch up

October 30, Lecture 19: Emissions Trading

- [Goulder](#). 2013. "Markets for Pollution Allowances: What Are the (New) Lessons?" *JEP*
- [Schmalensee & Stavins](#). 2013. "The SO<sub>2</sub> Allowance Trading System: The Ironic History of a Grand Policy Experiment." *JEP*
- [Newell, Pizer & Raimi](#). 2013. "Carbon Markets 15 Years after Kyoto: Lessons Learned, New Challenges." *JEP*

November 1, Lecture 20: Climate Change Policy I

- [McKibbin & Wilcoxon](#). 2002. "The Role of Economics in Climate Change Policy" *JEP*
- [Goulder & Pizer](#). 2006. "The Economics of Climate Change" NBER Paper 11923
- [Krugman](#). 2010. "Green Economics: How We Can Afford to Tackle Climate Change" *NYT Magazine*
- \* Bha, Ch. 26, "The Economics of Climate Change"

November 4, Lecture 21: Climate Change Policy II

- [Economic Report to the President](#). 2013. "Climate Change and the Path Toward Sustainable Energy Sources"
- [Parry & Pizer](#). 2007. "Emissions Trading versus CO<sub>2</sub> Taxes versus Standards" *Assessing U.S. Climate Policy Options*, Ch. 5
- [Litterman](#). 2013. "What Is the Right Price for Carbon Emissions?" *Regulation*,
- [Pindyck](#). 2013. "Pricing Carbon When We Don't Know the Right Price" *Regulation*
- \* [Nordhaus](#). 2007. "To Tax or Not to Tax: Alternative Approaches to Slowing Global Warming" *REEP*

November 6, Lecture 22: Policies for Renewable Electricity Supply

- [Borenstein](#). 2012. "The Private and Public Economics of Renewable Electricity Generation" *JEP*
- [Schmalensee](#). 2012. "Evaluating Policies to Increase Electricity Generation from Renewable Energy" *REEP*
- [Lipton & Krauss](#). 2011. "Gold Rush of Subsidies in the Search for Clean Energy" *NYT*
- [Chernova](#). 2011. "Loan Was Solyndra's Undoing" *WSJ*
- \* [Palmer & Burtraw](#). 2005. "Cost-Effectiveness of Renewable Electricity Policies" *Energy Economics*
- \* Bha, Ch. 11, "The Economics of Renewable Energy Supply"

November 8, Lecture 23: Transportation Policies I

- [Portney et al.](#) 2003. "Policy Watch: The Economics of Fuel Economy Standards" *JEP*
- [Parry & Small](#). 2005. "Does Britain or the United States Have the Right Gasoline Tax?" *AER*
- [Ramsey](#). 2010. "As Electric Vehicles Arrive, Firms See Payback in Trucks" *WSJ*
- \* Bha, Ch. 25, "Pollution Control from Mobile Sources"

November 11, Lecture 24: Transportation Policies II

- [Brown et al.](#) 2007. "Reformulating Competition? Gasoline Content Regulation and Wholesale Gasoline Prices" *J of Environmental Economics and Management*
- [Holland, Hughes & Knittel](#). 2009. "Greenhouse Gas Reductions under Low Carbon Fuel Standards?" *AEJ: Economic Policy*
- [Babcock et al.](#) 2007. "Is Corn Ethanol a Low-Carbon Fuel?" *Iowa Ag Review*

November 13, Lecture 25: Energy Efficiency

- [Gillingham, Newell & Palmer](#). 2009. "Energy Efficiency Economics and Policies" *Annual Review of Resource Economics*
- [Owen](#). 2010. "The Efficiency Dilemma" *The New Yorker*
- [Allcott & Greenstone](#). 2012. "Is There an Energy Efficiency Gap?" *JEP*

November 15, Lecture 26: Energy Markets in Developing Countries

- [Wolfram, Shelef & Gertler](#). 2012. "How Will Energy Demand Develop in the Developing World?" *JEP*
- [Spegele](#). "Energy-Hungry China Struggles to Join Shale-Gas Revolution: Royal Dutch Shell Finds Drilling for Shale Gas in China Isn't Easy" *WSJ*
- \* [Energy Information Administration](#). 2013. *Annual Energy Outlook*
- \* [International Energy Agency](#). 2011. *World Energy Outlook: Summary*
- \* KO, Ch. 11, "Sustainability and Economic Growth"

November 18, Lecture 27: Electricity Strategy Game Debrief and Conclusion  
**Strategy Memo Due**

November 26, 3:00 PM: **Final Exam**

Acronyms are as follows: *AEJ* is *American Economic Journal*, *AER* is *American Economic Review*, *JEP* is *Journal of Economic Perspectives*, *NYT* is *New York Times*, *REEP* is *Review of Environmental Economics and Policy*, *SFC* is *San Francisco Chronicle*, and *WSJ* is *Wall Street Journal*.