GG572E

Energy and Environmental Economics

Fall Semester of 2017

Scope and Purpose of the Course:

This exciting course introduces the economic sources of environment, resource, and energy problems and examines policy instruments to address them. The first half of the course is devoted to the *environmental economics* component, and the second half is to the more applied component, *energy economics*. Major concepts and principles of microeconomics may be briefly reviewed wherever necessary to facilitate understanding of the energy and environmental economics concepts that will follow. More specifically, we examine environmental externality problems associated with the consumption of products and services in market economies, including those from the consumption of and production with energy resources and commodities, while at the same time assessing a range of possible policy remedies. We also cover major issues associated with the management of natural resources, involving renewable and non-renewable resources, examining causes of and solutions to the problems. The supply of and demand for energy resources and optimal development of the national and global energy system are also discussed in the climate change context. The purpose of this course is to help students understand major theoretical concepts in energy and environmental economics and apply empirical and mathematical modeling approaches to their own research topics of interest.

Instructor

Jiyong Eom, Ph.D.

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Teaching Assistant

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Office Hours: 10:30-12:00 Friday (place to be arranged upon request)

Prerequisite & Course Requirements

Knowledge of core microeconomics theory at the undergraduate level or above is *required*. Those who are not familiar with basic microeconomics concepts are well advised to take relevant courses before considering taking this applied course or alternatively, are expected to invest a significant amount of time in learning out of the class, although *ad-hoc* microeconomics tutorials and regular TA sessions may be provided.

Textbooks

The main textbook for this course (unfortunately, I could not find any single textbook covering both environmental economics and energy economics):

[CDK] Charles D. Kolstad, "Intermediate Environmental Economics," 2nd Ed., Oxford University Press—*This is the only book you should get for this course.*

[PMMC] Roger Perman, Yue Ma, James McGilvray, Michael Common, 2003, "Natural Resource and Environmental Economics," 3rd Edition, Pearson Education

[VIM] Hal R. Varian, "Intermediate Microeconomics: A Modern Approach," 6th Ed., Norton—*introductory microeconomics textbook for undergraduate students, helpful for those who are new to this area*

Optional reference books that you may want to review are as follows:

[SCB] Subhes C. Bhattacharyya, 2011, "Energy Economics: Concepts, Issues, Markets, and Governance," Springer

[HRV] Hal R. Varian, "Microeconomic Analysis," 3rd Ed., Norton—Advanced microeconomics textbook with solid theoretical coverage and insights, useful for those interested in conducting mathematical modeling research in this area

[CAD] Carol A. Dahl, 2015, "International Energy Markets: Understanding Pricing, Policies, and Profits," 2nd Edition, PennWell

Teaching

Lecture and Discussion

This is mainly a lecture based course with frequent class discussions. So previewing and reviewing the covered topics are essential to make the best use of the course. The instructor will notify materials for preview and provide review materials nearly every

(or every other) class. The instructor may raise major energy or environmental issues for class discussion or ask for student presentation whenever necessary. Your participation is highly encouraged and rewarded by extra credits.

Problem Sets and Paper Review Presentation

Problem sets will be given nearly every week to help students understand the concepts they learned in class and apply them to real-world settings. Problem sets may require one-page critical review of research paper(s) in the relevant field. In addition, each student has at least one chance during the semester to present an introduction and critical assessment of the assigned academic paper for in-depth class discussion. The full list of the papers and individual assignments will be finalized by the second week of the semester.

Midterm and Final Examination

Midterm and final examination will be administered to evaluate students' understanding of major concepts in energy and environmental economics and their ability to apply the concepts to analyze contemporary energy and environmental issues.

Laptop Use Policy!

Laptop use *not allowed*. Students with special need to take notes on their laptop should send an email requesting special permission for the duration of the course.

Evaluation Criteria

Class Participation (15%)

Paper Review Presentation (15%)

Problem Sets (20%)

Midterm Examination (20%)

Final Examination (30%)

Course Schedule and Assignment

Session #	Session Topic	Assignment Due
1 (Aug. 28)	Course introduction	
2 (Aug. 30)	LEC1	
3 (Sep. 4)	LEC2	PS#1
4 (Sep. 6)	LEC3	
5 (Sep. 11)	LEC3	PS#2
6 (Sep. 13)	LEC4	
7 (Sep. 18)	LEC4	PS#3
8 (Sep. 20)	LEC5	
9 (Sep. 25)	LEC6	PS#4
10 (Sep. 27)	LEC6	
11 (Oct. 2)	LEC7	PS#5
12 (Oct. 4)	No Class (National Holiday)	
13 (Oct. 9)	No Class (National Holiday)	
14 (Oct. 11)	LEC7	PS#6
15 (Oct. 16)	No Class (Exam Week)	
16 (Oct. 18)	Midterm Exam	PS#7
17 (Oct. 20)	LEC8 Make-up class for Oct. 23 (conference attendance)	
18 (Oct. 27)	LEC8 Make-up class for Oct. 25 (conference attendance)	PS#8
19 (Oct. 30)	LEC9	
20 (Nov. 1)	LEC9	PS#9
21 (Nov. 6)	LEC10	
22 (Nov. 8)	LEC11	PS#10
23 (Nov. 13)	LEC12	
24 (Nov. 15)	LEC12	PS#11
25 (Nov. 20)	LEC13	
26 (Nov. 22)	LEC13	PS#12
27 (Nov. 27)	LEC14	
28 (Nov. 29)	LEC15	PS#13
29 (Dec. 4)	LEC16	
30 (Dec. 6)	LEC17	PS#14
31 (Dec. 11)	No Class (Exam Week)	
32 (Dec. 13)	Final Exam	

Course Outline and References

*Note: The underline identifies *required* readings for class preparation; and the gray highlights are research papers for assignment or student presentations.

LEC1: Introduction

The Environment and Economics (Chapter 1, CDK)

Normative and Positive Economic Analysis (Chapter 2, CDK)

Cropper, Maureen, Wallace, 1992, "Environmental Economics: A Survey," *Journal of Economic Literature*, 30(2): 675-740

Cropper, Maureen, 2000, "Has Economic Research Answered the Needs of Environmental Policy?" *Journal of Environmental Economics and Management*, 39:328-50

Pearce, 2002, "An Intellectual History of Environmental Economics," *Annual Review of Energy and the Environment*, 27, 57-81

Fullerton and Stavins, 1998, "How Economists See the Environment," *Nature*, 395, 433-434

LEC2: Social Choice

Social Choice: How Much Environmental Protection? (Chapter 3, CDK)

Public Goods (Chapter 35, VIM)

Welfare (Chapter 32, VIM)

LEC3: Efficiency and Markets

Efficiency and Markets (Chapter 4, CDK)

Exchange (Chapter 30, VIM)

Production (Chapter 31, VIM)

Welfare (Chapter 32, VIM)

LEC4: Rationales for Policy Intervention

Market Failure: Public Goods, Public Bads, and Externalities (Chapter 5, CDK)

The Need for Environmental and Natural Resource Policy (Part I, SAJ)

Welfare (Chapter 32, VIM)

Externalities (Chapter 33, VIM)

Monopoly (Chapter 24, VIM)

Hardin, G., 1968. The tragedy of the commons. *Science* 162:1243-47.

LEC5: Environmental Program Evaluation

Making Decisions about Environmental Programs (Chapter 6, CDK)

Cost-Benefit Analysis (Chapter 11, PMMC)

Arrow, et al., 1999, "Is There a Role for Benefit-Cost Analysis in Environmental, Health, and Safety Regulation," *Science*, 272:221-222

Farrow, Toman, 2012, "Using Benefit-Cost Analysis to Improve Environmental Regulations," *Environment: Science and Policy for Sustainable Development*, 41:12-38

Discounting Future Benefits and Costs (Chapter 6, EPA)

LEC6: Measuring the Demand for Environmental Quality I

Demand for Environmental Goods (Chapter 7, CDK)

Hedonic Price Methods (Chapter 8, CDK)

Household Production (Chapter 9, CDK)

Bockstael, McConnell, 1999, "The Behavioral Basis of Non-Market Valuation," In Herriges and Kling, eds., *Valuing Recreation and the Environment: Revealed Preference Methods in Theory and Practice*, Edward Elgar

Smith, 1993, "Nonmarket Valuation of Environmental Resources: An Interpretive Appraisal," *Land Economics*, 69:1-26

Mendelsohn, Nordhaus, Shaw, 1994, "The Impact of Global Warming on Agriculture: A Ricardian Analysis," *The American Economic Review*, 84: 753-771

Bayer, Keohane, Timmins, 2009, "Migration and Hedonic Valuation: The Case of Air Quality," *Journal of Environmental Economics and Management*, 58:1-14

Dastrup, Zivin, Costa, and Kahn, 2012, "Understanding the Solar Home Price Premium: Electricity Generation and "Green" Social Status," *European Economic Review*, 56, 2012, 961-973

Viscusi, Aldy, "The Value of a Statistical Life: A Critical Review of Market Estimates Throughout the World," *The Journal of Risk and Uncertainty*, 27:5-76

Chay and Greenstone, 2005, "Does Air Quality Matter? Evidence from the Housing Market," *Journal of Political Economy*, 113:376-424

Brounen and Kok, 2011, "On the Economics of Energy Labels in the Housing Market," *Journal of Environmental Economics and Management*, 62, 166-179

Eichholtz, Kok, and Quigley, 2013, "The Economics of Green Building," *The Review of Economics and Statistics*, 95(1), 50-63

Kotchen, 2006, "Green Markets and Private Provision of Public Goods," *Journal of Political Economy*," 114:816-834

Nordhaus, 2006, "Geography and Macroeconomics: New Data and New Findings," *Proceedings of the National Academy of Sciences*, 103:3510-3517

Deschenes, Greenstone, 2011, "Climate Change, Mortality, and Adaptation: Evidence from Annual Fluctuations in Weather in the US," *American Economic Journal: Applied Economics*, 3:152-185

Schlenker, Hanemann, Fisher, 2005, "Will U.S. Agriculture Really Benefit from Global Warming? Accounting for Irrigation in the Hedonic Approach," *The American Economic Review*, 95:395-406

Dickie, Gerking, 1991, "Willingness to Pay for Ozone Control: Inferences from the Demand for Medical Care," *Journal of Environmental Economics and Management*, 21:1-16

LEC7: Measuring the Demand for Environmental Quality II

Constructed Markets (Chapter 10, CDK)

Valuing the Environment (Chapter 12, PMMC)

Carson, et al., 2003, "Contingent Valuation and Lost Passive Use: Damages from the Exxon Valdez Oil Spill," *Environmental and Resource Economics*, 25:257-286

Adamowicz, Luviere, Williams, 1994, "Combining Revealed and Stated Preference Methods for Valuing Environmental Amenities," *Journal of Environmental Economics and Management*, 26:271-292

Bresnahan, Dickie, Gerking, 1997, "Averting Behavior and Urban Air Pollution," Land Economics, 73(3), 340-357

Hanemann, 1994, "Valuing the Environment through Contingent Valuation," *Journal of Economic Perspectives*, 8:19-43

Portney, 1994, "The Contingent Valuation Debate: Why Economists Should Care," *The Journal of Economic Perspectives*, 8:3-17

LEC8: Policy Instruments—Taxes, Standards, and Subsidies

Regulating Pollution (Chapter 11, CDK)

Emissions Prices and Fees (Chapter 12, CDK)

Pollution Control: Targets (Chapter 6, PMMC)

Pollution Control: Instruments (Chapter 7, PMMC)

Stavins, 1998, "What Can We Learn from the Grand Policy Experiment? Lessons from SO2 Allowance trading," *The Journal of Economic Perspectives*, 12:69-88

Goulder, Parry, 2008, "Instrument Choice in Environmental Policy," *Review of Environmental Economics and Policy*, 2:152-174

Parry, Evans, Oates, 2014, "Are Energy Efficiency Standards Justified?" *Journal of Environmental Economics and Management*, 67:104-125

Fullerton, Kinnaman, 1996, "Household Responses to Pricing Garbage by the Bag," *The American Economic Review*, 4:971-984

Hahn, 1989, "Economic Prescription for Environmental Problems: How the Patient Followed the Doctor's Orders," *Journal of Economic Perspectives*, 3:95-114

LEC9: Policymaking in Economies with Distortionary Taxes and Tradable Emissions Allowances

Emissions Prices and Fees (Chapter 12, CDK)

Property Rights (Chapter 13, CDK)

Goulder, Parry, Burtraw, 1997, "Revenue-raising versus Other Approaches to Environmental Protection: The Critical Significance of Preexisting Tax Distortions," *RAND Journal of Economics*, 28(4), 708-731

Johnson, Pekelney, 1996, "Economic Assessment of the Regional Clean Air Incentives Market: A New Emissions Trading Program for Los Angeles," *Land Economics*, 72:277-297

Morgenstern, 1995, "Environmental Taxes: Dead or Alive?" *Resources for the Future*, Discussion Paper 96-03

Metcalf, 2009, "Market-based Policy Options to Control U.S. Greenhouse Gas Emissions," *Journal of Economic Perspectives*, 23:5-27

Bovenberg, de Mooij, 1994, "Environmental Levies and Distortionary Taxation," *The American Economic Review*, 4:1085-1089

Goulder, 1995, "Effects of Carbon Taxes in an Economy with Prior Tax Distortions: An Inter-Temporal General Equilibrium Analysis," *Journal of Environmental Economics and Management*, 29:271-297

Williams III, 2002, "Environmental Tax Interactions When Pollution Affects Health or Productivity," *Journal of Environmental Economics and*

Management, 44:261-270

Bovenberg, Goulder, Gurney, 2005, "Efficiency Costs of Meeting Industry-Distributional Constraints under Environmental Permits and Taxes," *The RAND Journal of Economics*, Winter, 951-971

Farrell, Joseph, 1986, "Information and the Coase Theorem," *Journal of Economic Perspectives*, 1:113-29

Coase, 1960, "The Problem of Social Cost," *Journal of Law and Economics*, 3:1-44

LEC10: Uncertainty and Instrument Choice

Managing Risk and Uncertainty (Chapter 18, CDK)

Pollution Policy with Imperfect Information (Chapter 8, PMMC)

Pizer, 2002, "Combining Price and Quantity Controls to Mitigate Global Climate Change," *Journal of Public Economics*, 85:409-434

Lewis, 1996, "Protecting the Environment When Costs and Benefits are Privately Known," *The RAND Journal of Economics*, 27:819-47

Stavins, 1996, "Correlated Uncertainty and Policy Instrument Choice," *Journal of Environmental Economics and Management*, 30:218-232

Weitzman, 1974, "Prices vs. Quantities," *The Review of Economic Studies*, 41:477-491

LEC11: Environment, Growth, and Development

Environment, Growth, and Development (Chapter 20, CDK)

The Efficient and Optimal use of Natural Resources (Chapter 14, PMMC)

Accounting for the Environment (Chapter 19, PMMC)

Porter, van der Linde, 1995, "Toward a New Conception of the Environment-Competitiveness Relationship," *Journal of Economic Perspectives*, 9:97-118

Arrow, Dasgupta, Goulder, Daily, Ehrlich, Heal, Levin, Maler, Schneider, Starrett, and Walker, 2004, "Are We Consuming Too Much?" *Journal of Economic Perspectives*, 18(3), 147-172

Ehrlich, P.R. and Holdren, J.P., 1971. Impact of population growth. *Science* 171:1212-1217.

Grossman, Krueger, 1995, "Economic Growth and the Environment," *The Quarterly Journal of Economics*," 110:353-377

Jaffe, Newell, Stavins, 2004, "Technology Policy for Energy and the

Environment," in *Innovation Policy and the Economy*, Vol. 4, MIT Press

Solow, 1991, "Sustainability: An Economist's Perspective," the 18th J. Seward Johnson Lecture to the Marine Policy Center, Woods Hole Oceanographic Institution

LEC12: Non-Renewable Resource Management

The Theory of Optimal Resource Extraction: Non-Renewable Resources (Chapter 15, PMMC)

Devarajan, Fisher, "Hotelling's "Economics of Exhaustible Resources": Fifty Years Later," *Journal of Economic Literature*, 19: 65-73

Hotelling, 1931, "The Economics of Exhaustible Resources," *The Journal of Political Economy*, 39:137-175

Chong, Sunding, 2006, "Water Markets and Trading," *Annual Review of Environmental Resources*, 31:239-64

Lubowski, Plantinga, Stavins, 2006, "Land-Use Change and Carbon Sinks: Econometric Estimation of the Carbon Sequestration Supply Function," *Journal of Environmental Economics and Management*, 51:135-152

Gosolov, M. et al., 2014. Optimal Taxes on Fossil Fuel in General Equilibrium. *Econometrica,* 82(1):41-88.

Nordhaus, 1982, "How Fast Should We Graze the Global Commons?" *American Economic Review*, 72(2): 242-246

Peck, Wan, 1996, "Analytical Solutions of Simple Optimal Greenhouse Gas Emission Models," Working Paper, *Electric Power Research Institute*, Palo Alto, CA

LEC13: Climate Change Economics

Economics of Climate Change (Lecture Note)

Irreversibility, Risk, and Uncertainty (Chapter 13, PMMC)

Stern, 2008, "The Economics of Climate Change," *American Economic Review*, 2008:1-37

Tol, 2009, "The Economic Effects of Climate Change," *Journal of Economic Perspectives*, 23:29-51

Barrett, 2009, "The Coming Global Climate-Technology Revolution," *Journal of Economic Perspectives*, 23:53-75

Arrow, K.J. and Fisher, A.C., 1974. Environmental preservation, uncertainty, and irreversibility. *The Quarterly Journal of Economics* 88:312-319.

Weitzman, M.L., 2009. On modelling and interpreting the economics of catastrophic climate change. *Review of Economics and Statistics* 91(1):1-19.

LEC14: Energy Systems Analysis

Energy Data and Energy Balance (Chapter 2, SCB)

Understanding and Analyzing Energy Demand (Chapter 3, SCB)

Barrett, 2009, "The Coming Global Climate-Technology Revolution," *Journal of Economic Perspectives*, 23(2), 53-75

Grubler, 1997, "Time for a Change: On the Patterns of Diffusion of Innovation," Technological Trajectories and the Human Environment, 14-32

Holdren, J.P., 2006. The energy innovation imperative: Addressing oil dependence, climate change, and other 21st century energy challenges. *Innovations* 1:3-23.

Ang, B.W. 2005. The LMDI approach to decomposition analysis: A practical guide. *Energy Policy* 33:867-871.

IPCC, 2014, "Chapter 8. Transport," in Working Group III contribution to the IPCC 5th Assessment Report, Climate Change 2014: Mitigation of Climate Change

IPCC, 2014, "Chapter 9. Buildings," in Working Group III contribution to the IPCC 5th Assessment Report, Climate Change 2014: Mitigation of Climate Change

IPCC, 2014, "Chapter 10. Industry," in Working Group III contribution to the IPCC 5th Assessment Report, Climate Change 2014: Mitigation of Climate Change

LEC15: Analysis and Management of Energy Demand

Energy Demand Analysis at a Disaggregated Level (Chapter 4, SCB)

Energy Balances and Energy Demand (Chapter 15, CAD)

Energy Demand Management (Chapter 6, SCB)

Allcott and Greenstone, 2012, "Is There an Energy Efficiency Gap?" *Journal of Economic Perspectives*, 26(1), 3-28

Borenstein, 2013, "Effective and Equitable Adoption of Opt-In Residential Dynamic Electricity Pricing," *Review of Industrial Organization*, 42, 127-160

Bohi, 1981, "Analyzing Demand Behavior: A Study of Energy Elasticities," Johns Hopkins and Resources for the Future

Hughes, Knittel, Sperling, 1998, "Evidence of a Shift in the Short-Run Price Elasticity of Gasoline Demand," *The Energy Journal*, 29:93-114

Reiss, White, 2005, "Household Electricity Demand, Revisited," *Review of*

Economic Studies, 72:853-883

Olmstead, Hanemann, Stavins, 2007, "Water Demand under Alternative Price Structures," *Journal of Environmental Economics and Management*, 54:181-198

Eichholtz, Kok, Quigley, 2013, "The Economics of Green Building," *The Review of Economics and Statistics*, 95(1), 50-63

Brounen, Kok, 2011, "On the Economics of Energy Labels in the Housing Market," *Journal of Environmental Economics and Management*, 62:166-179

Farugui, Sergici, Akaba, 2014, "The Impact of Dynamic Pricing on Residential and Small Commercial and Industrial Usage: New Experimental Evidence from Connecticut," *The Energy Journal,* 35, 1, 137-160

Herriges, Baladi, Caves, Neenan, 1993, "The Response of Industrial Customers to Electric Rates based upon Dynamic Marginal Costs," *The Review of Economics and Statistics*, 75:446-454

LEC16: Energy Investments and Energy Supply

Economic Analysis of Energy Investments (Chapter 7, SCB)

Economics of Fossil Fuel Supply (Chapter 8, SCB)

The Economics of Electricity Supply (Chapter 10, SCB)

The Economics of Renewable Energy Supply (Chapter 11, SCB)

Rogner, 1997, "An Assessment of World Hydrocarbon Resources*," Annual Review of Energy and Environment*, 22:217-62

Larson et al., 2012, "Chapter 12: Fossil Energy," in *Global Energy Assessment*, IIASA

Edenhofer, Madruga, Sokona, 2011, "Renewable Energy Sources and Climate Change Mitigation: Special Report of the Intergovernmental Panel on Climate Change"

McJeon et al., 2014, "Limited Impact on Decal-Scale Climate Change from Increased Use of Natural Gas," *Nature*, 514, 482-485

LEC17: Energy Market Analysis

Energy Markets and Principles of Energy Pricing (Chapter 12, SCB)

Energy Pricing and Taxation (Chapter 13, SCB)

International Oil Market (Chapter 14, SCB)

Markets for Natural Gas (Chapter 15, SCB)

Wolak, 2003, “Measuring Unilateral Market Power in Wholesale Electricity Markets: The California Market, 1998-2000,” *American Economic Review*, 93:425-430

Griffin and Xiong, 1997, “The Incentive to Cheat: An Empirical Analysis of OPEC,” *Journal of Law and Economics*, 40(2), 289-316.

Sweeney, 2002, “The California Electricity Crisis,” Hoover Institution Press and Stanford Institute for Economic Policy Research

Joskow, P.L., 2001. California’s electricity crisis. Oxford Review of Economic Policy, 17(3):365-388.

Griffin and Puller, 2005, “Electricity Deregulation: Choices and Challenges,” The University of Chicago Press

Cairns and Davis, 2001, “Adelman’s Rule and the Petroleum Firm,” *The Energy Journal*, 22(3), 31-54