

UC Berkeley  
Spring 2016

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### EEP 147: Regulation of Energy and Environment

Tu/Th 9:30-11:00 AM

#### OVERVIEW

This course is about government regulation of energy with an emphasis on policies that seek to mitigate the impact of energy production and consumption on the environment. It is designed to give students practical experience in making connections between microeconomic concepts and real world policy applications. The emphasis is on the insights that economic theory and concepts can provide when thinking about the following questions:

- How do energy markets work?
- When should the government intervene to regulate a market?
- What is the appropriate form of government intervention in a market?
- What can the structure of a market and/or the nature of a market failure tell us about how to design and implement effective energy and environmental policies?

The course will be divided into three parts:

Part I provides an **overview of microeconomic principles and models** that are particularly relevant to thinking about energy and environmental regulation. We will talk about how firms make production decisions, how markets operate, how markets can fail, and how economic agents make decisions over time. We will formalize the idea of an efficient, perfectly competitive market which will serve as our benchmark throughout the course. The objective here is to develop a theoretical framework that can be used to analyze policy.

In Part II of the course, our time spent studying economic theory starts to pay off. We use the framework developed in Part I to help us understand a range of issues in **economic regulation**. Topics include the regulation of natural monopolies, price and quantity regulation, and energy market institutions. Examples will be drawn mainly from electricity markets, natural gas markets, and transportation.

Part III of the course will focus on what is arguably the fastest growing area of industrial regulation (in terms of costs and scope): **environmental regulation**. We will investigate past, present, and proposed policy interventions to explore how firms and private individuals respond to different environmental policy instruments, how product market structure can inform the design of effective environmental policy, and policies to accelerate innovation in and diffusion of “green” technologies.

**Pre-requisites:** Introductory calculus and an introductory microeconomics course. **These are required courses. You are responsible for making sure you have this foundation.**

**Recommended:** Environmental economics recommended but not required.

**Readings and other resources:**

The required course reader, which includes any copyrighted material that I cannot legally post on bCourses, is available from Copy Central.

We will also draw from two textbooks:

- Keohane and Olmstead, *Markets and the Environment* (Island Press, 2007)
- The second is Viscusi, K., Harrington, J., and Vernon, J. (VHV), *Economics of Regulation and Antitrust*, 4th edition, Cambridge, MA: MIT Press, 2005. Chapters from this book are not included in the reader because the book is available as a free online resource through the UCB library (using a UCB IP address):  
<http://oskicat.berkeley.edu/record=b17708003~S1>.

All other required readings/materials will be posted on bCourses, along with lecture outlines and problem sets.

**How to find/contact me:**

Office Hours: Friday 10-noon

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**How to find/contact Louis:**

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**How I'll contact you:** All course materials and announcements will be posted on the bCourses website. If you register on bCourses, announcements can also be sent to your e-mail accounts.

**Class attendance is required.** Lectures and class discussions will be designed to complement (versus substitute for) the assigned readings. Material that is covered in lecture (but not in assigned readings) will appear on exams and in problem sets. Exam questions will also draw on in-class discussion.

**Class will start promptly at 9:40 am.** Arriving late not only means that you will miss some of the material, it will also disrupt the class and distract everyone else. Please be in class and ready to go by 9:40.

**Section:** In the first half of the semester, section attendance is optional. Section is designed to provide students with an opportunity to ask questions, clarify concepts, and work through practice questions.

**\*\*In the second half of the semester, section attendance is required. You must attend the section you are enrolled in. Attendance will be taken. You will not receive credit for group work if you do not attend section.\*\***

Section is the time for you to meet with your ESG team and plan your strategy. In fairness to your other team members, you are expected to be in section and participating in these meetings.

**Grading:** The table below lists the five components that will comprise your final grade:

Problem sets	10%
Electricity Strategy Game (ESG)	25%
Blog/in-class participation	10%
Mid-term exam	25%
Comprehensive final exam	30%

**Exams:** The in-class midterm exam is scheduled for **March 3 in class**. Exam will be held in the assigned time slot during the final exam period. The final exam is scheduled for **May 11**.

**Problem Sets and assignments:** Homework problems are designed to help you learn how to apply the material presented in class. There will be four assignments. You are encouraged to discuss course material, including homework problems, with other students. However, you are expected to turn in your own individual solutions for each homework assignment. Handwritten solutions are fine, as long as they are legible. In fairness to those who complete assignments on time, **late homework sets will not be accepted**.

**Blog:** An important objective of the course is to help you connect the dots between economics and real-world issues and problems concerning energy and the environment. Students will be encouraged to start reading news and blog about issues they find interesting. In a short blog entry, each student will discuss some issue or recent development in energy and/or environmental policy from an economics perspective. Blogs will be posted on bCourses so that other students can join in the (constructive) conversation.

**The Electricity Strategy Game:** An important part of this course is a team-based market simulation game. Grading will be based on individual performance, two memos, and your team's performance in the game (we'll talk about what that means in class).

**Academic integrity:** I expect it of all of you. The basic expectations of UC Berkeley students with regards to academic integrity are outlined here:

<http://sa.berkeley.edu/conduct/integrity>.

If you are in doubt about what constitutes cheating or plagiarism, please consult with me.

**Disabilities:** If you need an accommodation for a disability, please let me know within the first two weeks of class. (Of course if a problem arises during the semester, you should see me as soon as you

can). Some aspects of this course may be modified to facilitate your participation and progress. As soon as you make me aware of your needs, we can work on arranging for appropriate accommodations. I will treat any information you provide as private and confidential.

**BCourses:** Course related information, ESG results, class handouts, and readings will all be available on the course BCourses site. ESG updates and other announcements will also be distributed via BCourses. Once you have enrolled in the class, you should be able to access the site. Please let me know if you have any difficulties.

The following is a *tentative* outline for the course. I will provide updates as needed.

	Date	Topic	ESG schedule
1	T Jan 19	Intro lecture	
2	R Jan 21	Perfectly competitive markets	
3	T Jan 26	Economics of production	
4	R Jan 28	Economics of production	
5	T Feb 2	Market failures- Imperfect competition	
6	R Feb 4	Models of price and quantity competition – Part I	
7	T Feb 9	Models of price and quantity competition – Part II	
8	R Feb 11	Market failures- Public goods and externalities	
9	T Feb 16	Putting it all together: Shale gas	
	R Feb 18	<b>CLASS CANCELLED</b>	
10	T Feb 23	Inter-temporal decision making	
11	R Feb 25	Introduction to economic regulation	
12	T Mar 1	<b>Midterm exam in class</b>	
13	R Mar 3	Economic regulation of energy markets	
14	T Mar 8	Electricity markets - Introduce the ESG	
15	R Mar 10	Electricity industry restructuring	
16	T Mar 15	Introduction to the theory of environmental regulation	<b>Practice Round 0</b>
17	R Mar 17	<b>In class portfolio auction</b> Market-based emissions regulation: Part I	
<b>SPRING BREAK</b>			
18	T Mar 29	Market-based emissions regulation: Part II	<b>ESG Rd 1</b>
	R Mar 31	State and Federal climate change policy (emphasis on electricity sector)	<b>ESG Rd 2</b>
19	T Apr 5	Renewable energy I	<b>ESG Rd 3</b>
20	R Apr 7	<b>Stakeholder meeting – submit position papers in class</b>	
21	T Apr 12	<b>CLASS CANCELLED</b>	
22	<b>R Apr 14</b>	Renewable energy II	<b>ESG Rd 4</b>
21	T Apr 19	Career panel (tentative)	<b>ESG Rd 5</b>
22	R Apr 21	Energy efficiency I	<b>ESG Rd 6</b>
23	T Apr 26	Energy efficiency II	<b>ESG final round</b>
24	R Apr 28	ESG debrief/conclude	

## Part I. Foundations: Assembling our toolkit

### 1. Introduction: Setting the Stage

KO: Chapters 1 & 2

### 2. Review of the fundamentals: Perfectly competitive markets; static and dynamic efficiency; Pareto optimality; producer and consumer surplus; deadweight loss; partial versus general equilibrium analysis.

KO : Chapter 4

Reader: Kolstad chapter 4

BCourses: Davis, L. (2013) "The Economic Cost of Global Fuel Subsidies", EI @Haas WP247

### 3. Economics of production: Firm and industry supply; factor markets

Reader: Varian Chapter 21, 22; Pindyck and Rubinfeld chapter 14

### 4. Models of imperfect competition and market power: Cournot and Bertrand oligopoly, dominant firm and competitive fringe models.

Reader: Perloff chapter 6

BCourses: Wolfram, C. (1999) "Measuring Duopoly Power in the British Electricity Spot Market." *American Economic Review*, 1999, Vol. 89 (September): 805-826.

### 5. When do markets fail? Market power, externalities, public goods.

KO: Chapter 5

Reader: Perloff chapter 4

### 6. Synthesis/Application: Shale gas

BCourses: Hausman, Catherine and Ryan Kellogg (2015) "Welfare and Distributional Impacts of Shale Gas", NBER Working Paper 21115.

BCourses Bushnell, James and Jacob Humber. "Rethinking Trade Exposure: The Incidence of Environmental Charges in the Nitrogenous Fertilizer Industry. 2015 working paper.

### 7. Intertemporal decision making: Discounting, behavioural anomalies, private versus social discount rates.

Reader: BGVW Chapter 6.

David Roberts blog: <http://grist.org/article/discount-rates-a-boring-thing-you-should-know-about-with-otters/>

## **Part II. Economic Regulation**

1. **Introduction to economic regulation:** Policy instruments, overview of the regulatory process, the theory of regulation.

Reader: VHV Ch. 10

2. **Regulation of a natural monopoly:** rate-of-return regulation, the Averch-Johnson effect, and incentive regulation.

Reader: VHV Ch. 11, 12

3. **Electricity market regulation and “deregulation”**

BCourses: Severin Borenstein and James Bushnell, "The U.S. Electricity Industry after 20 Years of Restructuring"(September 2014 working paper)

BCourses: Borenstein, Severin. 2002. "The Trouble with Electricity Markets: Understanding California's Restructuring Disaster," Journal of Economic Perspectives.

BCourses: Griffin, James and Steven Puller (2005) "A Primer on Electricity and the Economics of Deregulation", pages 1-4 and 12-23 (remainder is optional).

4. **Auction design/ introduction to the Electricity Market Strategy Game (ESG).**

## **Part III. Environmental Regulation of Energy Markets**

1. **Principles of market-based environmental policy**

KO Chapter 8

BCourses: Phaneuf, Daniel (2014). " Introduction to the Theory of Environmental Policy" Ch.3.

2. **Market-based emissions regulation**

KO Chapter 9

Reader: Tietenberg, Chapter 6

BCourses: Goulder, Lawrence H. Markets for Pollution Allowances: What Are the (New) Lessons? Journal of Economic Perspectives.

BCourses: Goulder, Lawrence and A. Schein (2013) "Carbon taxes versus cap-and-trade: A critical review"

### 3. Climate change policy in the United States

BCourses: Burtraw et al (2014) "Comments to the US Environmental Protection Agency on Its Proposed Clean Power Plan"

BCourses: Fowlie, Meredith et al. (2014) "An economic perspective on the EPA's Clean Power Plan", *Science* (14): November 2014.

### 4. Renewable energy

BCourses: Borenstein, Severin. 2012. "The Private and Public Economics of Renewable Electricity Generation." *Journal of Economic Perspectives*, 26(1): 67-92.

BCourses: Popp, David. 2010. "Innovation and Climate Policy," *Annual Review of Resource Economics*, vol. 2, 2010.

### 5. Economics of energy efficiency

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

BCourses: Borenstein, Severin (2014) "A Microeconomic framework for evaluating energy efficiency rebound and some implications", EI @Haas WP 242R

BCourses: Gillingham, Ken, Karen Palmer and Richard Newell (2014). "Bridging the Energy Efficiency Gap: Insights for Policy from Economic Theory and Empirical Analysis"