

## MBA212 – Energy and Environmental Markets

The University of California at Berkeley

Haas School of Business

Spring 2015

Professor Severin Borenstein

### Syllabus, version 1.0

**Course Description:** In the past 40 years, some of the largest industries have transitioned from regulated to market-based paradigms. Managers in many transportation, information technology, and energy companies have had to devise strategies to cope with changes in economic and environmental regulations and the evolution of new markets and trading platforms. The energy industries feature a complex mix of regulation and market-driven incentives. Over the last two decades, energy markets that had previously been viewed as staid and conservative have been rocked by deregulation initiatives, the California electricity crisis, volatile oil and natural gas prices, the fracking revolution in oil production, innovations in renewable energy and the challenge to reduce greenhouse gases.

Drawing on the tools of economics and finance, we study the business and public policy issues that these changes have raised in energy markets. Topics include traditional and alternative models of utilities in electricity and natural gas markets; the political economy of deregulation; climate change, environmental policy and markets for green energy; competition and market power in energy markets; transportation and storage constraints in energy commodities; and the development of organized spot, futures, and derivative markets in energy. We examine the impact of regulation in these industries, study firms' successful and unsuccessful competitive strategies, and explore the rationale for and effects of public policies in energy and environmental markets.

**Class Meeting:** Monday/Wednesday, 11:10-12:30, Cheit Hall C135. PLEASE NOTE: The last class meeting is May 11. Haas MBA courses run on a 15-week schedule. The final exam will be in class on May 11.

**Office Information:** Office number F661, Phone: 2-3689

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**Office Hours:** Office Hours will be posted on the course website.

**Course Website:** on bcourses

**Grading:** 30% quizzes, 30% final exam, 30% Electricity Strategy Game (ESG), 10% class participation. There will be three quizzes (40 minutes each) and a final exam (80 minutes,

on May 11). Your lowest quiz score is dropped if it is lower than your final exam, in which case quizzes are 20% and final exam is 40%.

**Electricity Strategy Game:** The ESG is an electricity market simulation in which each team owns a portfolio of generation units and bids those units into an electricity market. The ESG starts with a relatively simple cost and bidding structure. Later, complexity is added with transmission constraints, different auction formats, and the addition of a tradable greenhouse gases permit market, as well as other unforeseen events. Grading is based on performance in the ESG, strategy memo assignments, and quality of participation in the ESG debriefing. The schedule for the ESG is on the last page of this syllabus. There will be three phases (“Years”) of the ESG. Students will be assigned to one team for Years 1 and 2, then to a different team for Year 3.

**Class Expectations:** The class will start promptly at 11:10 AM. Please arrive at least a couple of minutes before that so you are seated and ready to start on time. Arriving late not only means that you will miss some of the material, it will also disrupt the class and distract everyone else. Late arrivals should have a very good excuse. Likewise, the class is 80 minutes long, substantially shorter than a typical movie. You are certainly allowed to go to the bathroom or get a drink of water when it is necessary, but walking in and out of class is distracting to the other students and to me. Please minimize it.

If you do find that you need to enter or leave during class, please open and close the door quietly. Classroom doors will close loudly if you don’t close them gently. Please make sure that doesn’t happen.

**Class participation and Attendance:** Class participation is a significant part of your grade and the learning process. I will cold call. Please come prepared for each class. If for some reason you are not prepared (or are missing class entirely), please let me know in advance, so I will not call on you. Because so little of the course material exists in textbooks or readings, it is extremely important to attend class regularly. It will also affect your class participation grade.

**No Electronics Policy:** This course will follow the “no electronics” policy that has been adopted in the MBA core. Use of laptop computers, cellphones, ipads, or other electronic devices during class will not be permitted. If you have a certified medical need to use a laptop in class, please come and talk to me about it.

**Course Prerequisites:** BA201A or equivalent (MBA-level Microeconomics or undergraduate intermediate microeconomics) is required. If you haven’t taken at least a solid

intermediate undergraduate microeconomics course, this course will likely be difficult to pass.

**Readings:** There are two optional textbooks. One is K. Viscusi, J. Harrington, and J. Vernon, *Economics of Regulation and Antitrust*, 4th edition, Cambridge, MA: MIT Press, 2005 (hereafter VHV). The book isn't as up to date as I'd like, but it does a good job on the basic economics and there are many used copies available. It's also available electronically to UCB students through the library, at <http://site.ebrary.com/lib/berkeley/docDetail.action?docID=10225297> .

I have also listed several readings from N. Keohane and S. Olmstead, *Markets and the Environment*, Washington, DC: Island Press, 2007 (hereafter KO).

All other required readings will be available on bcourses. There is little required reading, but it is very important that you read the required assignments *before* the day on which the reading will be discussed. I will let you know beforehand which readings are required for each day. The readings listed here include both required reading and optional material for those who want to learn more about a topic. I will announce in class each week which readings are required for the following week.

**Screencasting Videos:** In order to allow more time in class for interactive learning, there will be screencast videos (my voice over either a whiteboard or slides) required before most Monday classes. The videos (typically 4 or 5 modules, 30-40 minutes total) will be posted by Thursday night and you will need to watch them before class on Monday. It is critical that you watch and absorb this material at the time it is assigned. The following class will assume that you have covered the video material and will pick up from there.

## COURSE SCHEDULE

### WEEK 1

#### 1. January 21: Course Intro, Energy Overview, Scarcity/Pricing/Markets

C. Krauss, “New Technologies Redraw the World’s Energy Picture,” *New York Times*, 10/26/11.

S. Borenstein, “Cost, Conflict and Climate: U.S. Challenges in the World Oil Market”

J. Griffin and S. Puller, “A Primer on Electricity and the Economics of Deregulation” in *Electricity Deregulation: Choices and Challenges*, Griffin and Puller eds., Chicago: University of Chicago Press, 2005.

M. Mahoney, “Follow the Flow,” *Technology Review*, May/June 2010.

### WEEK 2

#### Screencast Video: Scarcity, Pricing and Market Power

S. Borenstein, “Understanding Competitive Pricing and Market Power in Wholesale Electricity Markets,” *Electricity Journal*, July 2000, pp. 49-57.

KO, Ch. 4, “The Efficiency of Markets”

R. Smith, “Coal-Fired Plants Mothballed by Gas Glut,” *Wall Street Journal*, 9/11/12.

R. Smith, “Electric Industry Capacity Glut Jolts Investors,” *Wall Street Journal*, 11/11/03.

J. Mouawad, “A Fast-Growing Independent Strikes Gold in Oil Refining,” *New York Times*, 5/18/05.

J. Mouawad, “Oil Refiners See Profits Sink as Consumption Falls,” *New York Times*, 5/14/08.

#### 2. January 26: Market Power in Energy Markets

S. Borenstein, J. Bushnell and M. Lewis, “Market Power in California’s Gasoline Market,” Center for the Study of Energy Markets Working Paper #132, University of California Energy Institute, May 2004, pp. 1-11.

Transcript of Reliant Traders during California Electricity Crisis.

#### 3. January 28: Introduction to Electricity Markets and the California Electricity Crisis

S. Borenstein, “The Trouble with Electricity Markets,” *Journal of Economic Perspectives*, 2002, pp. 191-201.

## **WEEK 3**

### **Screencast Video: Economics of Energy Transportation**

A. Gonzalez, "Statoil Using Rails to Ease Bottleneck," *Wall Street Journal*, 8/29/12.

J. Bussey, "Export U.S. Gas, Yes or No?" *Wall Street Journal*, 11/15/12.

C. Cummins, "Oil Jumps on Pipeline Deal," *Wall Street Journal*, 11/17/11.

D.C. Johnston, "Grid Limitations Increase Prices for Electricity," *New York Times*, 12/13/06.

T. Aeppel, "Commodity-Freight Rates Slip As Global Growth Slows Down," *Wall Street Journal*, 6/13/05.

### **4. February 2: Economics of Energy Storage and Auctions**

T. Carlisle, "Asset Helps Keep Canada's EnCana Afloat," *Wall Street Journal*, 10/7/02.

J. Ball, "Unbridled Energy: Predicting Volatile Wind, Sun," *Wall Street Journal*, 10/2/09.

R. Smith, "Solar Plant to Generate Power After Sundown," *Wall Street Journal*, 12/31/10.

### **5. February 4: Auctions and problem set questions**

"Going, going, gone! A Survey of Auction Types," Agorics, Inc.

## **WEEK 4**

### **Screencast Video: Commodity and Futures Markets**

U.S. Department of Energy, Energy Information Administration, "Derivatives and Risk Management in the Petroleum, Natural Gas, and Electricity Industries," October 2002, Section 2, pp. 3-14.

### **6. February 9: Long-term Contracts and Hedging**

D. Strumpf, "New Oil Contract Weighed," *Wall Street Journal*, 12/8/11.

J. Wilke and C. Cummins, "U.S. Accuses BP Of Manipulating Price of Propane," *Wall Street Journal*, 6/29/06.

### **7. February 11: In-class Exercise on Hedging, ESG introduction and problem set questions**

"Introduction to the ESG"

## **WEEK 5**

**8. February 18: FIRST QUIZ, ESG team meetings**

## **WEEK 6**

**Screencast Video: Natural Monopoly Regulation**

VHV, Ch. 11, "Theory of Natural Monopoly," pp. 401-423.

VHV, Ch. 12, "Natural Monopoly Regulation," pp. 429-436.

**9. February 23: Rate Design, Time-varying pricing, Smart Grid**

**10. February 25: ESG team meetings, review quiz, problem set questions**

## **WEEK 7**

**Screencast Video: Natural Monopoly Regulation in Practice**

VHV, Ch. 12, "Natural Monopoly Regulation," pp. 436-447.

H. Demoro, "PUC Staff Says PG&E Should Pay for Diablo," *San Francisco Chronicle*, 5/15/87.

E. Herscher and D. Dietz, "Agreement Reached On Diablo Canyon Cost," *San Francisco Chronicle*, 6/28/88.

**11. March 2: ESG portfolio auctions, natural monopoly regulation in practice**

**12. March 4: In-class exercise, Problem set questions**

## **WEEK 8**

**Screencast Video: Price Controls in Non-Monopoly Markets**

**13. March 9: Electricity Restructuring and Competition**

S. Borenstein and J. Bushnell, "Electricity Restructuring: Deregulation or Reregulation?" *Regulation*, Vol. 23, No. 2, 2000.

D. C. Johnston, "Competitive Era Fails to Shrink Electric Bills," *New York Times*, 10/15/2006.

J. Fialka, "Lawmakers Struggle to Define Gasoline Price 'Gouging'," *Wall Street Journal*, 11/9/05.

**14. March 11: Competition Policy and Problem set questions**

**WEEK 9**

**Screencast Video: Vertical Incentive Conflicts**

L. Denning, “Delta Chases Fuel’s Gold,” *Wall Street Journal*, 4/5/12.

R. Tracy and C. Sweet, “Fueled by Cheap Chinese Panels, U.S. Solar Use Soars,” *Wall Street Journal*, 9/9/12. .

VHV, Ch. 8, “Vertical Mergers and Restrictions.”

L. Meckler, “Pump Games: Fill Up With Ethanol? One Obstacle Is Big Oil,” *Wall Street Journal*, 4/2/07.

I. Ordoñez and D. Gilbert, “ConocoPhillips to Split in Two,” *Wall Street Journal*, 7/15/11.

R. Dezember, “Shell Won’t Exit Refining,” *Wall Street Journal*, 9/22/11.

S. Borenstein and J. Bushnell, “Retail Policies and Competition in the Gasoline Industry,” Center for the Study of Energy Markets Working Paper #144, University of California Energy Institute, May 2005, pp. 8-end.

**15. March 16: Vertical integration and boundaries of the firm**

**16. March 18: SECOND QUIZ, In-class exercise on vertical integration**

**SPRING BREAK, March 23-27**

**WEEK 10**

**17. March 30: Externalities and Property Rights**

**18. April 1: Problem set questions, ESG team meetings**

**WEEK 11**

## **Screencast Video: Externalities and Market Efficiency**

M. Totty, “The Gas Tax Is Running Low. But What Should Replace It?” *Wall Street Journal*, 9/17/12.

National Research Council, *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use*, Summary, 2010.

K. Seelye, “Utility Buys Town It Choked, Lock, Stock and Blue Plume,” *New York Times*, 5/13/02.

KO, Ch. 5, “Market Failures in the Environmental Realm”

## **19. April 6: Command & Control versus Market-Based Regulation**

E. Rosenthal, “Carbon Taxes Make Ireland Even Greener,” *New York Times*, 12/27/12.

P. Portney, “Market-Based Approaches to Environmental Policy,” *Resources*, Summer 2003.

I. Parry and B. Pizer, “Emissions Trading versus CO<sub>2</sub> Taxes versus Standards,” Chapter 5 of *Assessing U.S. Climate Policy Options*, 2007, *Resources For the Future: Washington D.C.*, pp. 80-86.

## **20. April 8: Problem set questions, ESG team meetings**

## **WEEK 12**

### **Screencast Video: Tradable Pollution Permits in Practice**

S. Reed, “European Lawmakers Try to Spur Market for Carbon-Emission Credits,” *New York Times*, 2/6/14.

E. Rosenthal and A.W. Lehen, “Profits on Carbon Credits Drive Output of a Harmful Gas,” *New York Times*, 8/8/12.

S. Williams and A. Torello, “As Carbon Prices Sink, Unease Rises,” *Wall Street Journal*, 4/4/12.

A.D. Ellerman and P. Joskow, “The European Union’s Emissions Trading System in Perspective,” Pew Center on Global Climate Change, May 2008.

## **21. April 13: Leakage and Hybrid Regulation**

J. Spencer, “Why China Could Blame Its CO<sub>2</sub> on West,” *Wall Street Journal*, 11/12/07.

H. Karp, “It’s Less Easy Being ‘Green’ as Los Angeles Yanks Plug on Free Parking for Electric Cars,” *Wall Street Journal*, 1/4/2013.

S. Borenstein, J. Bushnell, F. Wolak, and M. Zaragoza-Watkins, “Expecting the Unexpected: Emissions Uncertainty and Environmental Market Design”, draft paper.

**22. April 15: THIRD QUIZ, ESG team meetings**

**WEEK 13**

**Screencast Video: Product Standards and Consumer Information**

- J. Fialka and K. Kranhold, "Lights Out for Old Bulbs? — U.S. Plans a Switch To All Fluorescents For Efficiency's Sake," *Wall Street Journal*, 9/13/07.
- K. Gillingham, R. Newell, and K. Palmer, "Energy Efficiency Economics and Policies," *Annual Review of Resource Economics*, 2009, Vol. 1, pp. 597-619.
- L. Meckler and K. Lundegaard, "New Fuel-Economy Rules Help the Biggest Truck Makers," *Wall Street Journal*, 8/24/05.
- S. Borenstein, "A Microeconomic Framework for Evaluating Energy Efficiency Rebound And Some Implications," *Energy Journal*, forthcoming January 2015.

**23. April 20: Energy efficiency standards, measurement and rebound**

**24. April 22: Problem set questions**

**WEEK 14**

**Screencast Video: Market-based Valuation of Alternative Energys**

- S. Borenstein, "The Private and Public Economics of Renewable Electricity Generation," *Journal of Economic Perspectives*, Winter 2012.

**25. April 27: Incorporation non-market attributes in valuation**

**26. April 29: Problem set questions**

**WEEK 15**

**Screencast Video: Economics of Cleantech Innovation**

- S. Mufson, "The Race to Rule the Sun," *Washington Post*, 12/18/11.
- Y. Chernova, "Loan Was Solyndra's Undoing," *Wall Street Journal*, 9/16/11.
- J. Rather, "Is the Answer Blowing in the Wind?," *New York Times*, 11/5/06.

L. Etter, "Ethanol Craze Cools As Doubts Multiply — Claims for Environment, Energy Use Draw Fire," *Wall Street Journal*, 11/28/07.

L. Denning, "Solar Market is Risking Sunstroke," *Wall Street Journal*, 12/11/10.

M. Wald, "Giant Holes in the Ground," *Technology Review*, November/December 2010.

M. Wald, "Making Renewables Reliable," *New York Times*, 11/19/09.

**27. May 4: Cleantech innovation in practice**

**28. May 6: ESG Debriefing in class**

## **WEEK 16**

**29. May 11: FINAL EXAM, in class**

## EXAM AND ASSIGNMENT SCHEDULE

### Exams

February 18	1st in-class quiz
March 18	2nd in-class quiz
April 15	3rd in-class quiz
May 11	Final Exam in class

### Electricity Strategy Game Schedule:

Feb 10 (Tu)	ESG team assignments posted for ESG Years 1 and 2
Feb 11 (W)	Introduction to the Electricity Strategy Game in class
Feb 19 (Th)	ESG strategies due by 10pm for Year 1, Period 1
Feb 23 (M)	ESG strategies due by 10pm for Year 1, Period 2
Mar 2 (M)	ESG portfolio auction for Year 2, in class
Mar 5 (Th)	ESG strategies due by 10pm for Year 2, Period 1
Mar 9 (M)	ESG strategies due by 10pm for Year 2, Period 2
Mar 12 (Th)	ESG strategies due by 10pm for Year 2, Period 3
Mar 16 (M)	ESG strategies due by 10pm for Year 2, Period 4
Mar 19 (Th)	ESG strategies due by 10pm for Year 2, Period 5
Apr 1 (W)	Intro to Cap and Trade in the Electricity Strategy Game, in class
Apr 9 (Th)	Sealed-Bid Portfolio Auction for ESG Year 3, bids due by 10pm
Apr 13 (M)	Sealed-Bid Allowance Auction for ESG Year 3, bids due by 10pm
Apr 16 (Th)	ESG strategies due by 10pm for Year 3, Period 1
Apr 20 (M)	ESG strategies due by 10pm for Year 3, Period 2
Apr 23 (Th)	ESG strategies due by 10pm for Year 3, Period 3
Apr 27 (M)	ESG strategies due by 10pm for Year 3, Period 4
Apr 30 (Th)	True-Up Deadline for ESG Year 3 Allowances, 10pm
May 6 (W)	ESG debriefing, in class