

**University of Wisconsin-Madison**

**AAE/ECON/ENVIR ST/URB R PL 671 Energy Economics**

**Credit: 3**

**Canvas Course URL:** <https://canvas.wisc.edu/courses/180844>

**Meeting Time and Location:** TuTh: 9:30-10:45 PM; Engineering Hall 3024.

**Course Designations and Attributes:** General education

**Instructional Mode:** All fact-to-face

**How Credit Hours are met by the Course:** This class meets for two 75-minute class periods each week over the spring semester and carries the expectation that students will work on course learning activities (reading, writing, problem sets, studying, etc) for about 3 hours out of classroom for every class period. The syllabus includes more information about meeting times and expectations for student work.

**Instructor Title and Name:** Associate Professor Sheldon (Xiaodong) Du

**Instructor Availability (Office hours):** TuTh 1:00-2:00PM, or by appointment; 331 Taylor Hall

**Instructor Email:** [xdu23@wisc.edu](mailto:xdu23@wisc.edu)

### **Course Description**

The method, application, and limitations of traditional economic approaches to the study of energy problems. Topics include microeconomic foundations of energy demand and supply; optimal pricing and allocation of energy resources; energy market structure, conduct, and performance; macro linkages of energy and the economy; and the economics of regulatory and other public policy approaches to the social control of energy.

### **Requisites**

(Senior standing and ECON 101 or AAE 215) or graduate standing

### **Learning Outcomes**

The intentions of this course are threefold: to (1) explain national and global markets and institutions for various energy sources, including coal, crude oil, natural gas, electricity, and renewable energy; (2) examine microeconomic foundations and empirical perspectives of energy demand and supply; (3) apply economic logic and quantitative techniques to understand the main contemporary issues related to energy, for example, optimal pricing and allocation of energy

resources, energy market structure, conduct, and performance, investment in renewable energy sources, and the economics of public policy affecting energy markets.

By taking this course, you should be able to:

1. Understand fundamentals of energy sources and technologies.
2. Be familiar with microeconomic theory with applications to energy industries and markets.
3. Build analytical skills in economic analysis and be able to apply the economic thinking to historical and contemporary energy-related issues.

### **Grading**

The final grade for the class will be calculated using the following weights:

Problem sets	30%
Class participation	10%
Group presentation	10%
Exams	50%

For undergraduate students, the final grade will be determined by the following percentages: A:  $\geq 90\%$ , AB: 85%~89%, B: 80%-84%, BC: 75%-79%, C: 70%-74%, D: 60-69%, F:  $<60$ . For graduate students, the percentages are 4% higher.

### **Recommended Textbooks and Other Course Materials**

Viscusi, W., J.E. Harrington, JR, and J.M. Vernon. 2005. *Economics of Regulation and Antitrust*. 4<sup>th</sup> ed. MIT Press. (VHV)

The following books are also useful,

1. Bhattacharyya, S.C. 2011. *Energy Economics: Concepts, Issues, Markets and Governance*. Springer. (Bhattacharyya)
2. Dahl, C.A. 2004. *International Energy Markets: Understanding Pricing, Policies and Profits*. PennWell. (Dahl)

### **Exams, Quizzes**

There will be two midterm exams.

Make-up exams will be given only under extenuating circumstances, for which appropriate documentation will be required, and if advance arrangements are made with the instructor.

Final exam (optional; comprehensive): **05/05/2020 (Tuesday), 2:45pm-4:45pm** (Location: TBD). If you choose to take the final, your score will be averaged with that of the lowest midterm.

### **Homework**

About six problem sets will be assigned. Students are required to finish independently.

Late assignments will be penalized with 10 points for each day of lateness, unless you have obtained prior approval, or in the case of an unforeseen emergency. Written notification from your advisor or doctor will be required in both instances.

### **Academic Integrity**

By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to [studentconduct.wiscweb.wisc.edu/academic-integrity/](http://studentconduct.wiscweb.wisc.edu/academic-integrity/).

### **Accommodations for Students with Disabilities**

**McBurney Disability Resource Center syllabus statement:** "The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform faculty [me] of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Faculty [I], will work either directly with the student [you] or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA." <http://mcburney.wisc.edu/facstaffother/faculty/syllabus.php>

### **Diversity & Inclusion**

**Institutional statement on diversity:** "Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.

## Tentative Course Schedule

<b>Week 1</b>	<b>Content</b>	<b>Reading</b>
1/21/2020 (Tu)	Introduction (“Energy Challenge”)	
1/23 (Th)	Energy and Energy Economics	CEA 2006; Rotman 2009; Newell and Iler 2013.
<b>Week 2</b> <i>Group list due</i>		
1/28	Energy and Energy Economics	CEA 2006; Rotman 2009; Newell and Iler 2013.
1/30	Energy and Energy Economics	CEA 2006; Rotman 2009; Newell and Iler 2013.
<b>Week 3</b>		
2/4	Energy Demand	Bhattacharyya Ch. 3.
2/6	Energy Demand	Bhattacharyya Ch. 3.
<b>Week 4</b> <i>Problem set 1 due</i>		
2/11	Linear Regression and Gasoline Demand Estimation	Sykes 1993; Hughes, Knittel and Sperling 2008
2/13	Electricity Demand Estimation	Herriges and King (1994); Reiss and White (2005)
<b>Week 5</b> <i>Problem set 2 due</i>		
2/18	Demand Side Management and Dynamic Pricing	Bhattacharyya Ch. 6.2; Borenstein 2010; Joskow 2012; Faruqui and Sergici 2010; Griffin and Puller 2009; Holland and Mansur 2006
2/20	Demand Side Management and Dynamic Pricing	Bhattacharyya Ch. 6.2; Borenstein 2010; Joskow 2012; Faruqui and Sergici 2010; Griffin and Puller 2009; Holland and Mansur 2006
<b>Week 6</b> <i>Problem set 3 due</i>		
2/25	Energy Efficiency	Gillingham et al. 2009; Frederick et al. 2002
2/27	Energy Efficiency	Gillingham et al. 2009; Frederick et al. 2002
<b>Week 7</b>		
3/3	Energy Efficiency	Gillingham et al. 2009; Frederick et al. 2002
3/5	Midterm I	
<b>Week 8</b>		
3/10	The Efficiency of Markets	DOE 2002; Borenstein 2000
3/12	Natural Monopoly	VHV Ch. 11-12
<b>Week 9</b>		

3/17	Spring break; no class	
3/19	Spring break; no class	VHV Ch. 12; Borenstein 2002; Craig and Savage 2013; Joskow 2006
<b>Week 10</b>		
3/24	Natural Monopoly	VHV Ch. 11-12
3/26	Regulation and Restructuring of Electric Power	VHV Ch. 12; Borenstein 2002; Craig and Savage 2013; Joskow 2006
<b>Week 11</b> <i>Problem set 4 due</i>		
3/31	Natural Resource Extraction and Pricing	Pashigian Ch. 16; Livernois 2009
4/2	Natural Resource Extraction and Pricing	Pashigian Ch. 16; Livernois 2009
<b>Week 12</b> <i>Problem set 5 due</i>		
4/7	Understanding Crude Oil Prices	Hamilton 2009; Maugeri 2009
4/9	Understanding Crude Oil Prices	Hamilton 2009; Maugeri 2009
<b>Week 13</b> <i>Problem set 6 due</i>		
4/14	Economic Regulation of Energy: Crude Oil and Natural Gas	VHV Ch. 18
4/16	Economic Regulation of Energy: Crude Oil and Natural Gas	VHV Ch. 18
<b>Week 14</b> <i>Problem set 7 (optional) due</i>		
4/21	Open Access and the Evolution of the US Sport Market of Natural Gas	Doane and Spulber 1994
4/23	Midterm 2	
<b>Week 15</b>		
4/28	Oligopoly, Collusion and Antitrust	VHV Ch. 5
4/30	Economics of Renewable Energy	Heal 2010; Borenstain 2012; Joskow 2011

## References

- Alhaji, A.F. and D. Huettner. OPEC and Other Commodity Cartels: A Comparison. *Energy Policy* 28(15): 1151-1164.
- Allcott, H. and M. Greenstone. 2012. Is There an Energy Efficiency Gap? *Journal of Economic Perspectives* 26(1): 3-28.
- Borenstein, S. 2000. Understanding Competitive Pricing and Market Power in Wholesale Electricity Markets. *The Electricity Journal*. July 2000: 49-57.
- Borenstein, S. 2002. The Trouble with Electricity Markets: Understanding California's Restructuring Disaster. *Journal of Economic Perspectives* 16(1): 191-211.

- Borenstein, S. 2010. Time-Varying Retail Electricity Prices: Theory and Practice.
- Borenstein, S. 2012. The Private and Public Economics of Renewable Electricity Generation. *Journal of Economic Perspectives* 26(1): 67-92.
- Borenstein, S. and J. Bushnell. 2015. The U.S. Electricity Industry after 20 Years of Restructuring. NBER Working Paper 21113.
- Callaway, D. and M. Fowlie. 2015. Greenhouse Gas Emissions Reductions from Wind Energy: Location, Location, Location? Working Paper. University of Michigan.
- Chu, S. and A. Majumdar. 2012. Opportunities and Challenges for a Sustainable Energy Future. *Nature* (488): 294-303.
- Council of Economic Advisors (CEA). 2006. Economic Report of the President, Chapter 11: Recent Developments in Energy.
- Council of Economic Advisors (CEA). 2013. Economic Report of the President, Chapter 6: Climate Change and the Path Toward Sustainable Energy Sources.
- Craig, J. and S.J. Savage. 2013. Market Restructuring, Competition and the Efficiency of Electricity Generation: Plant-level Evidence from the United States 1996 to 2006. *Energy Journal* 34(1): 1-31.
- Cullen, J. 2013. Measuring the Environmental Benefits of Wind-Generated Electricity. *American Economic Journal: Economic Policy* 5(4): 107-133.
- Doane, M.M., and D.F. Spulber. 1994. Open Access and the Evolution of the U.S. Spot Market for Natural Gas. *Journal of Law and Economics* 37(2): 477-517.
- Ellerman, A.D and P. Joskow, 2008. The European Union's Emissions Trading System in Perspective. Pew Center on Global Climate Change.
- Faruqui, A. and S. Sergici. 2010. Household Response to Dynamic Pricing of Electricity: A Survey of 15 Experiments. *Journal of Regulatory Economics* 38: 193-225.
- Fowlie, M., M. Greenstone, and C. Wolfram. 2018. Do Energy Efficiency Investment Deliver? Evidence From the Weatherization Assistance Program. *American Economics Review*, forthcoming.
- Frederick, S., G. Loewenstein, and T. O'Donoghue. 2002. Time Discounting and Time Preference: A Critical Review. *Journal of Economic Literature* 40(2): 351-401.
- Gillingham, K., R.G. Newell, and K. Palmer. 2009. Energy Efficiency Economics and Policy. *Annual Review of Resource Economics* 1: 597-619.
- Griffin, J. and S. Puller. 2005. "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.
- Hamilton, J. 2009. Understanding Crude Oil Price. *Energy Journal* 30(2): 179-206.

- Hausman, C. and R. Kellogg. 2015. Welfare and Distributional Implications of Shale Gas. NBER Working Paper 21115.
- Heal, G. 2010. Reflections-The Economics of Renewable Energy in the United States. *Review of Environmental Economics and Policy* 4(1): 139-154.
- Herriges, J.A. and K.K. King. 1994. Residential Demand for Electricity under Inverted Block Rates: Evidence from a Controlled Experiment. *Journal of Business and Economic Statistics* 12(4): 419-430.
- Holland, S. and E.T. Mansur. 2006. The Short-Run Effects of Time-Varying Prices in Competitive Electricity Markets. *Energy Journal* 27(4): 127-155.
- Hughes, J., C.R. Knittel, and D. Sperling. 2008. Evidence of a Shift in the Short-Run Price Elasticity of Gasoline Demand. *Energy Journal* 29(1): 93-114.
- Joskow, P.L. 2006. Markets for Power in the United States: An Interim Assessment. *Energy Journal* 27(1): 1-36.
- Joskow, P.L. 2011. Comparing the Costs of Intermittent and Dispatchable Electricity Generating Technologies. *American Economic Review* 100(3): 238-241.
- Joskow, P.L. 2012. Creating a Smarter U.S. Electricity Grid. *Journal of Economic Perspectives* 26(1): 29-48.
- Livernois, J. 2009. On the Empirical Significance of the Hotelling Rule. *Review of Environmental Economics and Policy* 3(1): 22-41.
- Maugeri, L. 2009. Understanding Oil Price Behavior through an Analysis of a Crisis. *Review of Environmental Economics and Policy* 3(2): 147-166.
- Moffitt, R. The Econometrics of Kinked Budget Constraints. *Journal of Economic Perspective* 4(2): 119-139.
- Newell, R.G. and S. Iler. 2013. The Global Energy Outlook. NBER Working Paper 18967.
- Novan, K. 2011. Valuing the Wind: Renewable Energy Policies and Air Pollution Avoided. *American Economic Journal: Economic Policy*, forthcoming.
- Pashigian, P. "Depletion of a Natural Resource," in *Price Theory and Applications*, McGraw-Hill, 1995, pp. 606-619.
- Reiss, P.C. and M.W. White. 2005. Household Electricity Demand, Revisited. *Review of Economic Studies* 72: 853-883.
- Rotman, D. 2009. Natural Gas Changes the Energy Map. MIT Technology Review.
- Sykes, A. 1993. An Introduction to Regression Analysis. Chicago Working Paper in Law and Economics No. 20. [http://www.law.uchicago.edu/files/files/20.Sykes\\_Regression.pdf](http://www.law.uchicago.edu/files/files/20.Sykes_Regression.pdf)

U.S. Department of Energy (DOE). 2002. A Primer on Electric Utilities, Deregulation, and Restructuring of U.S. Electricity Markets. Office of Energy Efficiency and Renewable Energy. Washington, D.C.