

AEM 4940-005 - Business and Economics of Energy - Fall 2018
TuTh 11:40AM - 12:55PM Room: Warren Hall 150

Instructors: Ivan Rudik and Todd Gerarden

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Office Hours: Prof. Rudik: Thursday 4:15–5:15 and Friday 1:30–2:30 until October 4.
Prof. Gerarden: Thursday 4:00–5:00 and Friday 1:30–2:30 starting October 11.

Course Summary: This course will investigate energy issues from an economic and business perspective using a quantitative approach. In the first part of the course, students will learn how to think about energy through an economic and business lens. The second part of the course will focus on topical energy market issues such as imperfect competition, bidding in electricity markets, markets for oil and gas, and environmental regulation.

Course Outcomes:

1. Use and evaluate scientific and economic information to reach defensible conclusions.
2. Describe the implications of using markets to supply and allocate energy.
3. Identify market failures that justify energy policy interventions.
4. Develop skills to evaluate the benefits and costs of different energy policies.

Prerequisites: MATH 1110, AEM 2100, and AEM 2600 or equivalent.

Course Requirements: Students are expected to attend two 75 minute lectures per week for the entire semester. In addition, students are expected to prepare for class, study for prelims, and complete homework outside of class. The work outside of class is typically several hours per week.

Readings: All sections of the course have readings (available on the course blackboard). The lectures, quizzes, homeworks and prelims will draw from these readings.

Grading Scale:

A: 92–100; A-: 90–91
B+: 88–89; B: 82–87; B-: 80–81
C+: 78–79; C: 72–77; C-: 70–71
D+: 68–69; D: 62–67; D-: 60–61
F: < 60

Grading Weights:

Prelims (2): 60%
Homeworks (2): 20%
Quizzes (10, lowest 2 dropped): 10%
OPEC Game: 5%
Electricity Market Game: 5%

Prelims: There will be 2 prelims, one for each half.

Homeworks: There will be 2 homeworks, 1 in each half of the course. Homeworks will be quantitative in nature. Homeworks are due at the *start* of class on the due date.

Quizzes: There will be 10 quizzes, 5 in each half of the course. The quizzes will be written and cover qualitative understanding of recent course material and readings. The quiz should take less than 15 minutes and will be at the end of class. The lowest 2 quiz grades are dropped.

Games: We will play two games to gain hands on experience with energy markets. In the first half of the class we will play the *OPEC Game* to gain an understanding of oil markets and cartel behavior. In the second half we will play the *Electricity Strategy Game* to gain an understanding of electricity markets. After each game concludes there will be a short assignment related to the game.

Missed Prelims and Quizzes: There will be **no** make ups for prelims or quizzes without an excused absence. If you have an acceptable excuse (these must be brought in beforehand except for sickness, injuries, accidents, etc) an alternative prelim/quiz will be scheduled. If you miss a prelim/quiz and do not notify us beforehand you must have a valid document (doctor's note, etc) explaining why you missed class and were not able to let us know beforehand.

Lecture Notes: Lecture notes will be posted on the course blackboard at the end of each section of the course.

Power Plant Trips: Two class periods will consist of trips to the Cornell hydroelectric plant and Cornell combined heat and power plant. Attendance is required.

Class Attendance: Besides the power plant trips, class attendance is not explicitly required.

Grade Appeals: If you wish to appeal your grade on a prelim, quiz, or homework you must bring it to our attention, in writing, within 24 hours of when the prelim, quiz, or homework is returned. Grades brought to our attention after this will not be eligible for a grade appeal. We reserve the right to regrade the entire assignment and the new grade will be final.

Class Conduct: We do not forbid the use of electronic devices in the classroom during normal lectures if they are being used for class purposes. However, they **may not** be used to record the lecture. These devices (laptops, tablets, phones, etc.) are prohibited during prelims. If a student's use of an electronic device is disruptive to teaching and/or learning, we will ask that the student discontinue the use of that device. Please be considerate of those around you.

Group Work and Academic Dishonesty: For homework assignments, you may consult with other students and/or us (during office hours). However, each person must complete his or her own assignment. You must complete prelims without help. This class will follow Cornell University's Code of Academic Integrity: <https://cuinfo.cornell.edu/aic.cfm>. We will discuss any case of academic misconduct directly with the student and report the incident to the Dean of Students Office. Any academic misconduct will result in an F for the assignment.

Important Dates:

Prof. Rudik covers: August 23 – October 4

Prof. Gerarden covers: October 11 – December 4

No class: October 9, November 22

Power plant trips: October 30, November 8

Prelim 1: October 4

Prelim 2: December 4

Course Outline and Readings:

August 23: Introduction to Energy

- Krauss, C., 2011. New Technologies Redraw the Worlds Energy Picture. The New York Times.
- International Energy Agency, 2017. World Energy Outlook 2017.
- Energy Information Administration, 2018. Annual Energy Outlook 2018.

August 28: Market Efficiency and Scarcity Pricing

- Hughlett, M., 2018. Hot Weather Helps Xcel's Profits. Star Tribune.
- Mouawad, J., 2006. A Fast-Growing Independent Strikes Gold in Oil Refining. The New York Times.
- Mouawad, J., 2008. Oil Refiners See Profits Sink as Consumption Falls. The New York Times.
- Krauss, C., 2012. Oil Refinings Fortunes Rise. New York Times.
- Cook, L. and Olsen, B., 2017. Hurricanes Stir Up Profits for Refiners. The Wall Street Journal.

August 30: Monopoly Regulation

September 4: Rate-of-Return and Incentive Regulation

- Lasker, P., 2017. Australia Has a Gold-Plated Electricity Grid that Consumers Can't Afford. ABC News.
- Al-Ubaydli, O., 2018. Economics 101: How Should Arabian Gulf Countries Regulate Privatised Industries?. The National.

September 6: Oil and Natural Gas Extraction and Pricing 1

- Gold, R., and A. Sider, 2017. Long Promised, the Global Market for Natural Gas Has Finally Arrived. The Wall Street Journal.
- Bousso, R., 2017. Global Oil, Gas Discoveries Drop to 70-year Low: Rystad Energy. Reuters.
- Lynch, M., 2018. What Ever Happened To Peak Oil? Forbes.
- Blas, J., 2019. America is Producing the Wrong Kind of Oil. Bloomberg.

September 11: Oil and Natural Gas Extraction and Pricing 2

- Bailey, J., 2007. Southwest Airlines Gains Advantage By Hedging On Long-Term Oil Contracts. New York Times.
- Hamilton, J., 2009. Understanding Crude Oil Prices. The Energy Journal 30(2). Only pages 179-188 required.
- Worstall, T., 2013. But Why Did Julian Simon Win The Paul Ehrlich Bet? Forbes.

September 13: Oil and Natural Gas Extraction and Pricing 3

- API, 2014. Understanding Crude Oil and Product Markets.

September 18: The OPEC Game

September 20: Guest Lecture by Dr. Gabriel Lade on Biofuels Markets

September 25: Unconventional Oil and Gas

September 27: Gasoline Markets and Fuel Economy Standards (and Other Policies)

- Anderson, S., et al., 2011. Automotive Fuel Economy Standards: Impacts, Efficiency, and Alternatives. *Review of Environmental Economics and Policy* 5(1).
- Larrick, R., and J. B. Soll, 2008. The MPG Illusion. *Science*.

October 2: Prelim Review and Previous Class Continued

October 4: **First Prelim**

October 9: No Class (Fall Break)

October 11: Economics of Electricity: Background

October 16: Economics of Electricity: Pricing and Investment

- U.S. EIA. 2017. Today in Energy: Competition between coal and natural gas affects power markets.
- U.S. EIA. 2018. Today in Energy: Combined wind and solar made up at least 20% of electric generation in 10 states in 2017.

October 18: Economics of Electricity: Market Power and Market Manipulation

- M. Slezak, “Energy Companies Withholding Supply to Blame for July Price Spike, Report Finds,” *The Guardian*, 8/17/16.
- P. Healy and K. Palepu, 2003. “The Fall of Enron,” *Journal of Economic Perspectives* 17(2). [read up to p. 12]
- Optional readings:
 - * S. Borenstein, 2002. “The Trouble with Electricity Markets: Understanding California’s Restructuring Disaster,” *Journal of Economic Perspectives* 16(1): pp. 191-211.
 - * D. Johnston. “Competitive Era Fails to Shrink Electric Bills,” *The New York Times*, 10/15/2006.
 - * D. Fitzpatrick, R. Smith and R. Tracy. “J.P. Morgan Staring at Record Fine Over Energy,” *Wall Street Journal*, 7/17/13.

October 23: Electricity Strategy Game

October 25: Electricity Strategy Game

October 30: Tour of the Central Energy Plant

- CEP Tour Safety Guidelines

- **Meet at 150 Maple Avenue, CEP 303 Conf Rm.**

November 1: The Economics of Renewable Energy

- D. Cardwell. “Solar and Wind Energy Start to Win on Price vs. Conventional Fuels,” *The New York Times*, 11/23/2014.
- Optional readings:
 - * S. Borenstein, 2012. “The Private and Public Economics of Renewable Electricity Generation,” *Journal of Economic Perspectives* 26(1): pp. 67-92.

November 6: Renewable Energy Policy

- J. Dizard. “Tricky Tax Equity Erodes US Infrastructure Boom,” *The Financial Times*, 1/6/2017.
- J. Leslie. “Nevadas Solar Bait-and-Switch,” *The New York Times*, 2/1/2016.
- J. Brady. “Solar Firms Plan To Return To Nevada After New Law Restores Incentives,” *NPR*, 6/7/2017.

November 8: Tour of the Cornell Hydroelectric Plant

- Hydro Plant Description
- **Meet at north end of Beebe Footbridge behind Noyes Welcome Center.**

November 13: Solar Innovation Case Study

- [NPR’s Planet Money Episode 616: How Solar Got Cheap](#)
- D. Cardwell. “Bonds Backed by Solar Power Payments Get Nod,” *The New York Times*, 11/14/2013.
- Optional readings:
 - * Lazard. Levelized Cost of Energy Analysis – Version 12.0. November 2018.
 - * Lazard. Levelized Cost of Storage Analysis – Version 4.0. November 2018.

November 15: Solar Innovation Case Study (continued)

- A. Swanson. “To Protect U.S. Solar Manufacturing, Trade Body Recommends Limits on Imports,” *The New York Times*, 10/31/2017.
- [PV Magazine: Seven Trends to Make or Break Corporate PPAs](#)

November 20: Energy Efficiency

- S. Ori, “Why Government Energy-Efficiency Programs Sound Great–But Often Dont Work,” *Wall Street Journal*, 11/13/17.
- Gillingham, Kotchen, Rapson, and Wagener. 2013. “The Rebound Effect is Overplayed,” *Nature* 493: pp. 475-6.

November 22: No Class (Thanksgiving Break)

November 27: Energy and Environmental Policy

- National Academy of Sciences. 2010. Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use.
- L. Taschini, S. Dietz, and N. Hicks. “Carbon tax v cap-and-trade: which is better?” *The Guardian*, 1/31/2013.
- J. Schwartz. “New York Sues Exxon Mobil, Saying It Deceived Shareholders on Climate Change,” *The New York Times*, 10/24/2018.

November 29: Wrap Up and Prelim Review

December 4: **Second Prelim**