INTRODUCTION

Energy is the lifeblood of industrial economies, and also a key factor in environmental and national security problems. Because of the extensive externalities associated with energy use, and the uneven distribution of energy resources around the globe, balancing the benefits and costs of energy use is one of the major challenges facing humanity. This balancing act involves blending markets and public policy in such a way as to align the incentives of businesses and individuals with the greater good of people and the planet. But do our energy institutions really accomplish this goal? And can they cope with the massive increase in energy use expected in developing countries over the next two decades?

In most developed countries, the marketplace plays the predominant role in determining what energy sources are used, and how. But government policy plays an extremely important role, as well---governments at the local, state, regional, national, and international levels all mold aspects of energy policy. In addition, non-governmental organizations (NGOs) of all sorts affect our energy choices, either by influencing government policy or influencing corporate behavior directly. In developing countries, government often controls most supplies of non-renewable energy resources, as well as the development of the infrastructure needed to exploit energy resources.

We will focus on three key dimensions of energy:

1. **Commodity markets** for energy, including oil, gas, coal, and electricity. Since one of the key management challenges associated with commodity markets is price volatility, we will pay special attention to the role of spot and futures markets. We will also explore the implications of market power in commodity markets, e.g. the role of OPEC in the oil market.

2. **Transmission and distribution infrastructure** for energy, including oil and natural gas pipelines, and the electric grid. Because these systems involve networks with highly specialized investments, we will pay special attention to the role of long-term contracts, vertical integration and regulation in shaping investments in energy infrastructure.

3. **Externalities and Public Goods**, including air pollution and climate change. Energy is highly regulated in all countries, because of the vast range of environmental impacts it produces, from acid rain to mercury poisoning to global warming. Energy R&D is also highly subsidized by government because it produces benefits for society broadly.
Each of these dimensions creates challenges that lead to government intervention in markets. Concerns about market power and volatility in energy markets lead to calls for regulation, price controls and policies of energy independence. The magnitude of infrastructure investments and the market power they create lead to regulation of energy infrastructure. The environmental impacts of energy use mean that it is heavily regulated to control these impacts.

*The goal of this course is to give you a solid grasp of the environmental and social impacts of, and the institutions that govern, energy use, so that you can play a more effective role in shaping future policy or business decisions.* We will begin with basic scientific and technological facts regarding the major uses for and sources of energy. We will then study energy markets (including spot and futures markets), and what they are capable of accomplishing; we will also study the ways energy markets may fail. This will lead into an overview of the role of government in influencing energy decisions. We will begin with a high-level perspective, then work with a series of case studies that examine in depth what government has accomplished in the area of energy policy, and the types of issues facing business managers in the energy industries.

Because politics is so important in the energy industries, we will encounter many situations where profit-seeking and social welfare may come into conflict, Although this is not an ethics course, it will certainly provide numerous cases that you can use to sharpen your own ethical thinking.

**Prerequisites:** Economic reasoning will be used throughout the course, and many readings will take an economic perspective. We will not be doing any complicated economic analysis, but it will be helpful if you have at least been exposed to intermediate economics, have some recollection of what “market failure” means, and are willing and able to read articles that present econometric analysis of data.

**READINGS**

There will be several case studies used in class, which can be purchased through the Study.net coursesite, which in turn can be accessed via Canvas.

All of the other readings for this course can be found on the web or on the course Canvas site.

**STRUCTURE OF THE COURSE**

My intention is that this course be interactive, with substantial student input, and based on dialogue rather than a strict lecture format. Students are expected to master the content of the readings, to make constructive contributions to class discussions, to make occasional presentations, and to perform adequately or better on the midterm examination.
The course is divided into two halves, separated by midterm break.

The first half develops basic concepts of energy supply and demand, energy markets, and energy policy. This section builds the analytical toolbox you need to participate meaningfully in discussions of energy policy and institutions. It will be more lecture oriented than the second half, and less oriented toward current policy issues.

The second half explores in detail a series of energy issues and policies. This section is designed to equip you with a critical perspective regarding what can be accomplished by energy markets and various types of government policy. My intention is to inoculate you against the utopian claims that are often made by well-meaning and/or self-interested players in the energy arena. This section will consider a variety of current energy challenges and policies for a sustainable energy future, using the tools developed earlier in the semester.

ASSIGNMENTS AND GRADING

Your course grade is based on five components:

- Oil and electricity games 20%
- In-class Performance 15%
- Midterm Exam 30%
- Final Project 35%

Some of this will be work done in a team of 4-5 students with whom you will work over the course of the semester.

Games

We will play two extended simulation games that are designed to give you a better feel for the operation of energy markets. The first involves the OPEC cartel, and the second involves bidding into deregulated electricity markets.

OPEC Game

For two weeks in the first half of the semester, we will play the OPEC game. In this game, you will be assigned to play the role of one of the OPEC countries, which differ in their oil reserves, their production capacity, and their costs of producing oil. Working as a team with other students, you will make a series of decisions about the quantity of oil to put on the global oil market. You will have the opportunity to negotiate cooperative production agreements with other OPEC members, but there is no way to enforce those agreements except through market interactions. In addition to OPEC, there are other producers around the world that do not participate in any production agreements. The objective of the game is for you to develop a deeper understanding of the dynamics of rivalry in situations like this where incentives for cooperation and incentives for competition conflict with one another.
The Electricity Strategy Game (ESG)

For most of the second half of the semester, we will play the ESG. The ESG is designed to replicate the exciting and lucrative world of strategic trading in deregulated electricity markets. Players utilize generation portfolios to compete in a sequence of daily electricity spot markets. Spot market conditions will vary from hour to hour and day to day. Players must develop strategies to deploy their assets over this sequence of spot markets while accounting for the cost structure of their portfolio, varying levels of hourly demand, and the strategies of other players. In this game, your team will play the role of one of the electricity generators selling into California’s deregulated wholesale market for electricity. You will begin by bidding for generation portfolios. You will then use the portfolio you purchase to sell power into the California Power Exchange. This involves a much more complex decision process than was involved in the OPEC game, and will give you a very good feeling for how deregulated electricity markets actually work.

Your team’s performance in the two games will comprise 20% of your final grade.

In-class Performance. The Michigan learning experience transforms students by developing the ability to think rigorously, work collaboratively, and lead effectively. The classroom and course work are the foundational components of the Ross learning and growth process. Classroom activities are central to each student’s experience—a shared experience they share with their classmates and faculty to develop each student’s knowledge and personal growth and that of the student body as whole. Due to the importance of this shared experience, students should attend all classes, arrive on time, stay in class throughout and be prepared to contribute to the learning process for all. The expected level of engagement goes far beyond mere physical presence in class. Rather, students should come to each class having read all material, prepared all assignments, and ready to share their insights, thoughts and intellectual struggles with their classmates. Students should remain engaged and attentive throughout class, both for their own learning and in respect to the rest of the Ross community. Violations of these expectations will be reflected by reductions of the class participation grade as well as other penalties the faculty may view as appropriate.

Your attendance and individual contributions will constitute 15% of your grade.

Midterm Exam. The midterm exam will cover the first half of the course. This material forms the basic toolkit we will use in the rest of the class for thinking about energy markets and politics. The midterm will be held Wednesday, October 17, from 4:00 p.m. – 5:30 p.m. in Dana 1028. (This will count for 30% of your grade.)

Final Project: You will work in teams on a topic you select in consultation with me. A team should have no more than 5 members. Your paper should be at most 15 pages (Double spaced; font size 12; one-inch margins) of text, with no more than 10 additional pages of exhibits. A title page does not count towards the page requirement.
My evaluation of your work will be based primarily on the analysis in the main body of the paper.

- **October 10**: 1-page topic proposal is due. Please be prepared to briefly describe your proposal to the class.
- **December 10 before class**: Final paper is due (The paper will count for 25% of your final grade).
- **December 10 in class**: Poster Session presenting your findings (This will count for 10% of your overall grade.)

Some of you may not be familiar with the process of making a research poster. I will post a Powerpoint template in Canvas you can use to make your poster, and will arrange with SEAS to allow you to print one copy of your poster on the large printer there.

There is no final exam.

**Useful Websites**


The Energy Foundation [http://www.ef.org/home.cfm](http://www.ef.org/home.cfm)


Resources for the Future [www.rff.org](http://www.rff.org)

Pierre Desrochers’ Energy and Society Class, with lots of “free market” pop readings: [http://geog.utm.utoronto.ca/desrochers/ggr333a.htm](http://geog.utm.utoronto.ca/desrochers/ggr333a.htm)
Accommodations for Student Disabilities

The University of Michigan is committed to providing equal opportunity for participation in all programs, services and activities. Students wishing to receive testing accommodations must register with the UM SSD (Services for Students with Disabilities) as soon as possible. Students must then submit their Verified Individualized Services and Accommodations (VISA) form via online web form as early as possible, but no later than two weeks prior to the test or quiz for which accommodations are requested.

Requests must be sent using the Accommodations Request form and must include:
- a scanned or photographed copy of the VISA form
- your name
- the classes and related section numbers
- the specific accommodation you are requesting

All requests must be made via the web form. Questions can be directed to the Accommodations Coordinator at RossAccommodationsCoordinator@umich.edu.

In rare cases, the need for an accommodation arises after the two-week deadline has passed (for example, a broken wrist). In these cases, the student should still contact SSD and the Ross Accommodations Coordinator at RossAccommodationsCoordinator@umich.edu, however, due to logistical constraints we cannot guarantee that an accommodation can be made after the two-week deadline has passed. Requests only need to be made once for each class.
Tentative Overview of Daily Topics

Items highlighted in bold are required reading for the class; the others are supplemental. NOTE: Some changes in readings and scheduling may occur---check Canvas.

Section 1: Overview of Energy Issues and Institutions

1. Wed., September 5: The Transition to Sustainable Energy
   - WEA, Overview, pp. 1-26

3. Wed., September 12: An Introduction to Institutions

- Oliver E. Williamson, “Transaction Cost Economics: How it Works, Where it is Headed.”

Section 2: Energy Markets


• “Petroleum Industry Analysis Brief,” http://www.eia.doe.gov/emeu/mecs/iab/petroleum/

• Federal Energy Regulatory Commission, “Manipulations of Published Natural Gas Indices,” Chapter III in Price Manipulation in Western Markets, Docket PA02-2-000.


- “Equilibrium in Futures Markets,” chapter 4 from lecture notes on Futures Markets by Darrell Duffie.


Section 3: Government Involvement in Energy Markets

Guest: Henry J. Decker, Director, Business Planning & Development, DTE Energy


• THE CALIFORNIA DEBACLE


10. Mon., Oct. 8: Natural monopoly and regulation, govt. ownership, and antitrust


(Paper topic proposals due)

- **WEA, Chapter 3, “Energy, the Environment, and Health”**


- **“Cost of New EPA Coal Rules: Up to 1,400 Deaths a Year,”**

- **“EPA Analysis of its Own New Climate Proposal: Thousands will Die,”**


For the EPA’s official New Source Review site, visit [http://www.epa.gov/nsr/](http://www.epa.gov/nsr/)


Improvements: Technological uncertainty and strategic behavior in environmental regulation


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**Wed., Oct. 17: MIDTERM EXAM**

**Oct. 22-26: ROSS MIDTERM BREAK, NO CLASS!**
Section 4: Policies for a Sustainable Energy Future

Note: Schedule may be rearranged somewhat to accommodate outside speakers’ availability.

14. Wed., October 31: Promoting Renewables for Electricity Production


- “What Can We Learn From Germany’s Solar Power Experience?,” https://www.greentechmedia.com/articles/read/what-can-we-learn-from-germanys-solar-experience#gs.QfDd0Ok


- Today we will use a simulation developed by faculty at MIT to build experience with policies to encourage the development of alternative fuel vehicles. It can be found at https://forio.com/app/mit/afv/ You are welcome to experiment with it individually before class so that you are familiar with its basic structure. During class, you will play the role of a particular stakeholder group designing a set of policies that work best for your interests.


- *Transitions to Alternative Vehicles and Fuels*, Committee on Transitions to Alternative Vehicles and Fuels; Board on Energy and Environmental Systems; Division on Engineering and Physical Sciences; National Research Council, 2013.

• **Guest: Brandon Hofmeister, Executive Director of Policy, Research and Public Affairs, Consumers Energy Company**
• *Disruptive Challenges: Financial Implications and Strategic Responses to a Changing Retail Electric Business*, Edison Electric Institute, January 2013.

17. Mon., November 12: Vehicle/Grid Integration
• **Guest: Alex Keros, GM Chief of Maven Smart Cities program**
• *Transitions to Alternative Vehicles and Fuels*, Committee on Transitions to Alternative Vehicles and Fuels; Board on Energy and Environmental Systems; Division on Engineering and Physical Sciences; National Research Council, 2013.
• WEA, Chapter 4, “Energy Security”

- **Guest: Ellen Hughes-Cromwick, former VP Ford Motor Company**
- Catherine Wolfram, “The MPG Illusion,” [http://blogs.berkeley.edu/2013/06/03/the-mpg-illusion/](http://blogs.berkeley.edu/2013/06/03/the-mpg-illusion/)
Improvements: Technological uncertainty and strategic behavior in environmental regulation

- **Case: Equilibrium Capital Group (A): Investing in Energy Efficiency Companies**

- **Case:** “OPOWER: Increasing Energy Efficiency through Normative Influence (A),” (Harvard Business School 911-016)
- Davis, Lucas W. "Evaluating the slow adoption of energy efficient investments: are renters less likely to have energy efficient appliances?." *The design and implementation of US climate policy.* University of Chicago Press, 2011. 301-316.

21. Wednesday, November 28: Carbon Policy and Coal


National Academies of Science, “Novel Approaches to Carbon Management,” https://www.nap.edu/read/10699/chapter/1


22. Mon., December 3: Hydraulic Fracturing of Shale

Guest Speaker: Daniel Raimi, author of The Fracking Debate


• Rasmussen SG, Ogburn EL, McCormack M, et al. Association Between Unconventional Natural Gas Development in the Marcellus Shale and Asthma

- Tustin AW, Hirsch AG, Rasmussen SG, Casey JA, Bandeen-Roche K, Schwartz BS. Associations between Unconventional Natural Gas Development and Nasal and Sinus, Migraine Headache, and Fatigue Symptoms in Pennsylvania. Environ Health Perspect; [http://dx.doi.org/10.1289/EHP281](http://dx.doi.org/10.1289/EHP281)
- Case: Range Resources: A Commitment to Transparency

23. Wed., December 5: International Climate Agreements & the Paris COP
- **Paris 2015: Getting a global agreement on climate change. Green Alliance.**
- Schleussner, Carl-Friedrich, Joeri Rogelj, Michiel Schaeffer, Tabea Lissner, Rachel Licker, Erich M. Fischer, Reto Knutti, Anders Levermann, Katja Frieler,
- Hulme, Mike. "1.5 C and climate research after the Paris Agreement." *Nature Climate Change* 6, no. 3 (2016): 222.

24. **Mon., December 10: Student Project Poster Session**