14.444x: Energy Economics

Instructor:

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Course Descriptions:

With renewable sources playing an increasing role in meeting global energy demand and mitigating climate change, electric power systems and the related markets are changing. To prepare for the future energy landscape, industry professionals, policymakers, and academics must understand these changes and develop specific, relevant skills to drive this energy transition within the necessary timeframe.

In this course, you will learn to apply economic and socio-political analysis to real world regulatory policy questions in a set of extremely important, interrelated energy markets. Specifically, by looking at real-world case studies and emerging research, you will explore key aspects of the oil, natural gas, electricity, and nuclear power sectors, as well as how policies such as carbon taxes and efficiency standards can drive reductions in greenhouse gas emissions. You will also employ systems-level analysis to predict policy outcomes, not only within energy markets but across transportation, building and development, employment, health and social sectors. Overall, you will gain insights into how applied economics and policy tools can effectively move the global energy sector toward renewable and clean energy sources to mitigate climate change while also promoting economic development.

This Course and the MicroMasters:

This course is part of the Public Policy track of the MITx MicroMasters Program in Data, Economics, and Design of Policy (DEDP). The program consists of two tracks, including 10 online courses and proctored exams. This course is an introductory elective in the Public Policy Track. Learners who pass the three core classes and two elective courses can earn their MicroMasters credential. The program is co-designed by and run by MIT's Department of Economics and the Abdul Latif Jameel Poverty Action Lab (J-PAL), a global leader in conducting randomized evaluations to test and improve the effectiveness of programs aimed at reducing poverty. The MicroMasters program is intended for learners who are interested in building a full set of tools and skills required for data analysis in the social sciences, understanding the problems facing the world's poor, and learning how to design and evaluate social policies that strive to solve them. You can learn more about this program on our website – we hope that many of you will decide to join us!

Prerequisites:

There are no prerequisites required for this course.

Assignments and Grading Scheme:

For every week during the course, there will be a homework assignment that covers the main topics in that unit. Homework assignments will be released on Tuesdays along with the videos, and will be due Tuesday. In addition, there will be a comprehensive review at the end of the course. Please see the online calendar for further information.

Grades of the course are calculated as follows:

- Homework Assignments: **14%**
- Finger Exercises: **9%**
- Comprehensive Review: **7%**
- Proctored Exam: **70%**

Lectures and Time Commitment:

The material for each topic will be posted weekly, and you should keep pace with the rest of the class. There will usually be one lecture per week. You will have access to videos of the lecture presented in short segments (8-10 minutes on average), followed by finger exercises. You will also have access to the presentation slides.

The minimum commitment will be approximately 10 hours per week for watching the lectures, doing the readings, and completing the assignments.

Honor Code Pledge:

By enrolling in a MITx Online course or program, you agree that you will:

- Complete all tests and assignments on my own, unless collaboration on an assignment is explicitly permitted.
- Maintain only one user account and not let anyone else use my username and/or password.
- Not engage in any activity that would dishonestly improve my results, or improve or hurt the results of others.
- Not post online or share answers to problems that are being used to assess learner performance.

We will strictly enforce the honor code pledge. If you are found in violation of the Terms of Service or Honor Code, you may be subject to one or more of the following actions:

- Receiving a zero or no credit for an assignment;
- Having any certificate earned in the course or program withheld or revoked;
- Being unenrolled from a course or program; or
- Termination of your use of the MITx Online Site.
- Additional actions may be taken at the sole discretion of MIT.

No refunds will be issued in the case of any corrective action for such violations.

Honor Code violations will be determined at the sole discretion of MIT. You will be notified if a determination has been made that you have violated this Honor Code and you will be informed of the corresponding action to be taken as a result of the violation.

Course Syllabus and Readings:

Week One: Introduction to Economic Principles

- Zaremberg, Allan. "California Oil Extraction Tax a Bad Idea." SFGate, March 11, 2014.

Week Two: Conventional Fuel Markets

- Knittel, Christopher R., Konstantinos Metaxoglou, Anson Soderbery, and André Trindade. "Exporting Global Warming? Coal Trade and the Shale Gas Boom." Canadian Journal of Economics/Revue Canadienne d'économique 55, no. 3 (August 2022): 1294–1333.
- Covert, Thomas, Michael Greenstone, and Christopher R. Knittel. 2016. "Will We Ever Stop Using Fossil Fuels?" Journal of Economic Perspectives 30 (1): 117–38.
- Timmer, John. "Texas' Power Grid Crumples under the Cold." Ars Technica, February 15, 2021.
- "Household Energy Use in Texas." Energy Information Administration, 2009.
- "MIT Study on the Future of Solar Energy: Executive Summary." MIT Energy Initiative, n.d.

Week Three: Externalities and Social Costs

- Greenstone, Michael, Elizabeth Kopits, and Ann Wolverton. "Developing a Social Cost of Carbon for US Regulatory Analysis: A Methodology and Interpretation." Review of Environmental Economics and Policy 7, no. 1 (January 1, 2013): 23–46.

- Greenstone, Michael, and Adam Looney. "Paying Too Much for Energy? The True Costs of Our Energy Choices." Daedalus 141, no. 2 (2012): 10–30.

- Robinson, Ellis. "How Much Does Air Pollution Cost the U.S.?" Carnegie Mellon University College of Engineering, n.d.

Week Four: Policy Solutions

- AP News. "New Wind Farms Would Dot US Coastlines under Biden Plan," October 13, 2021.

- Bentley C. Clinton, Christopher R. Knittel, and Konstantinos Metaxoglou, 2021. "Electrifying transport: issues and opportunities," Chapters, in: Jean-Michel Glachant and Paul L. Joskow and Michael G. Pollitt (ed.), Handbook on Electricity Markets, chapter 18, pages 463-505, Edward Elgar Publishing.

- Goulder, Lawrence H., and Ian W. H. Parry. "Instrument Choice in Environmental Policy." Review of Environmental Economics and Policy 2, no. 2 (July 1, 2008): 152–74.

- Baker III, James A., Martin Feldstein, Ted Halstead, N. Gregory Mankiw, Henry M. Paulson Jr., George P. Shultz, Thomas Stephenson, and Rob Walton. "The Conservative Case for Carbon Dividends." Climate Leadership Council, February 5, 2017.

- Davis, Lucas W. "The Effect of Driving Restrictions on Air Quality in Mexico City." Journal of Political Economy 116, no. 1 (February 2008): 38–81.

- Ansolabehere, Stephen, Elizabeth Thom, and Dustin Tingley. "Public Attitudes on Energy and the Climate -." CEEPR, The Roosevelt Project Special Series, September 2020.

Week Five: Representing and Distributing Policy Impacts

- Green, Tomas and Christopher Knittel. "Distributed Effects of Climate Policy: A Machine Learning Approach." CEEPR, The Roosevelt Project Special Series, September 2020.

- Stauffer, Nancy M. 'Policies to cut carbon emissions.' MITEI, July 21, 2022.

- Bushnell, James. "Can Climate Efforts Be the 'Everything Policy Store'?" Energy Institute Blog (blog), January 19, 2021.
- Dimanchev, Emil G. and Christopher Knittel. "Trade-Offs in Climate Policy: Combining Low-Carbon Standards with Modest Carbon Pricing -." CEEPR (blog), November 9, 2020.
- Waters, Carlos. "This 'Duck Curve' Is Solar Energy's Greatest Challenge." Vox, May 9, 2018.

Week Six: Introduction to Electricity Markets

- Borenstein, Severin, James B Bushnell, and Frank A Wolak. "Measuring Market Inefficiencies in California's Restructured Wholesale Electricity Market." American Economic Review 92, no. 5 (November 1, 2002): 1376–1405.
- Borenstein, Severin, James Bushnell, and Christopher R. Knittel. "Market Power in Electricity Markets: Beyond Concentration Measures." The Energy Journal 20, no. 4 (October 1999): 65–88.
- Knittel, Christopher R., and Konstantinos Metaxoglou. "Diagnosing Unilateral Market Power in Electricity Reserves Market." The Journal of Energy Markets 1, no. 1 (March 2008): 65–95.
- Borenstein, Severin, James Bushnell, Christopher Knittel, and Catherine Wolfram. "Trading Inefficiencies in California's Electricity Markets." Cambridge, MA: National Bureau of Economic Research, December 2001.
- Borenstein, Severin. "Understanding Competitive Pricing and Market Power in Wholesale Electricity Markets." The Electricity Journal 13, no. 6 (July 2000): 49–57.

Week Seven: RPS and Subsidy Policies

- Lazard. "Levelized Cost of Energy+." June 2024
- Burger, Scott P., Christopher R. Knittel, Ignacio J. Perez-Arriaga, Ian Schneider, and Frederik Vom Scheidt. "The Efficiency and Distributional Effects of Alternative Residential Electricity Rate Designs." The Energy Journal 41, no. 1 (January 2020): 199–240.
- Anthony, Abigail. "The Wrong Policies Will Hinder Electrification — Here's What We Need to Do." Utility Dive, October 20, 2021.

Week Eight: Decarbonization Models

- Brown, Patrick R., and Audun Botterud. "The Value of Inter-Regional Coordination and Transmission in Decarbonizing the US Electricity System." Joule 5, no. 1 (January 2021): 115–34.
- Eric Larson et al."Net-Zero America: Potential Pathways, Infrastructure, and Impacts." Princeton University, Dec. 15, 2020.
- Wang, Seaver. "We Need to Plan Ahead for the Narwhal Slope." The Breakthrough Institute, Oct. 28, 2019

Week Nine: Energy Efficiency and Standards

- Cleary, Kathryne, Karen Palmer, and Kevin Rennert. "Clean Energy Standards." Resources for the Future, January 24, 2019.
- Dimanchev, Emil G. and Christopher Knittel. "Climate Policy Tradeoffs: Combining Low-Carbon Standards and Carbon Pricing." Center for Energy and Environmental Policy Research, Nov. 2020.
- UK Department of Energy and Climate Change. "Removing the hassle factor associated with loft insulation: Results of a behavioural trial." Sept. 2013.
- Allcott, Hunt, and Michael Greenstone. "Is There an Energy Efficiency Gap?" Journal of Economic Perspectives 26, no. 1 (February 1, 2012): 3–28.
- Allcott, Hunt, and Christopher Knittel. "Are Consumers Poorly Informed about Fuel Economy? Evidence from Two Experiments." American Economic Journal: Economic Policy 11, no. 1 (February 1, 2019): 1–37.
- Knittel, Christopher, and Samuel Stolper. "Using Machine Learning to Target Treatment: The Case of Household Energy Use." Cambridge, MA: National Bureau of Economic Research, December 2019.
- Davis, Lucas W., Alan Fuchs, and Paul Gertler. "Cash for Coolers: Evaluating a Large-Scale Appliance Replacement Program in Mexico." American Economic Journal: Economic Policy 6, no. 4 (November 1, 2014): 207–38.

- Christensen, Peter, Paul Francisco, Erica Myers, and Mateus Souza. "Decomposing the Wedge between Projected and Realized Returns in Energy Efficiency Programs." Review of Economics and Statistics 105, no. 4 (July 11, 2023): 798–817.
- Davis, Lucas W., Sebastian Martinez, and Bibiana Taboada. "How Effective Is Energy-Efficient Housing? Evidence from a Field Trial in Mexico." Journal of Development Economics 143 (March 2020): 102390.

Week Ten: Global Market and Transition Pathways

- No assigned readings

Week Eleven: Energy and Climate Policy in the Future

- No assigned readings