

**API-164
Energy Policy Analysis**

Lecture: Mondays and Wednesdays, 2:45–4:00, L382

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The Course

This course provides an overview of energy policy issues with an emphasis on the analysis necessary to frame, design, and evaluate policy remedies to energy problems. The course is intended for doctoral students and advanced masters students interested but not necessarily specializing in energy issues. The course is offered in support of the Harvard University Center for the Environment (HUCE) Graduate Consortium on Energy and Environment <http://environment.harvard.edu/student-resources/graduate-consortium>.

Prerequisites

Multivariate calculus.

Readings

There is no required text for the course. Assigned readings will be available through the API-164 course website. Note that the readings on this syllabus have direct hyperlinks for online access by Harvard students in the readings list below. Readings should be completed prior to class. In particular, each reading designated with a * will serve as the basis for classroom discussion.

Evaluation

Energy Policy Paper: 40%

Each student will define an energy policy problem of interest and provide: (i) a one page précis of the policy issue with identification of the key analytical questions and associated readings and (ii) a final paper (submitted in both hard-copy and electronic versions) that presents the research question and analysis that addresses this question or describes a research plan, including the tasks going forward in order to address the selected energy policy issue. Students may opt to pair with a fellow student on this project.

Policy Analysis: 20%

Students may work together in groups in undertaking the modeling analysis, but each student must submit an individual memo summarizing the results of the analysis. Students must also note who they worked with on their submitted memo.

Participation in classroom discussion: 20%

Contribution to classroom discussion, with an emphasis on comments reflecting reading and providing value-added to the conversation, will be evaluated. Unexcused absences will adversely affect participation grade.

OPEC Exercise: 10%

Students will be assigned to groups that will each play the role of an OPEC producer. Each group will submit daily production decisions over 10 business days and two brief memos (less than one page each) describing their production strategies.

Referee Reports: 10%

Students will submit two referee reports on current working papers.

Complete descriptions of these assignments will be provided over the semester. **Late assignments will not be accepted.** Students are expected to be familiar with and abide by the [HKS Academic Code](#). Violations of the academic code will not be tolerated.

Schedule of Course Meetings

Date	Topic
January 28	Imperfect Competition: Oil Markets
January 30	Imperfect Competition: Oil Markets
February 4	Imperfect Competition: Power Markets
February 6	Externalities: Introduction
February 11	Externalities: Value of Statistical Life
February 13	Externalities: Social Cost of Carbon
February 18	No Class
February 20	Externalities: Social Cost of Carbon
February 25	Externalities: Catastrophic Risk
February 27	Public Goods: International Environmental Agreements
March 4	Macroeconomics of Energy Shocks
March 6	Distributional Issues
March 11	Libertarian Paternalism
March 13	Energy Prices and Fossil Fuel Subsidies
March 18-20	No Class
March 25	Fuel Economy Standards
March 27	Quantity Instruments: Introduction
April 1	Quantity Instruments: EU ETS
April 3	Quantity Instruments: SO ₂ Cap-and-Trade Program
April 8	Quantity Instruments: NO _x Budget Program
April 10	Price Instruments: Introduction
April 15	Price Instruments: Renewable Subsidies
April 17	Price Instruments: Energy Efficiency Subsidies
April 22	Instrument Choice
April 24	No Class
April 29	Competitiveness
May 1	Innovation, Technological Change, and R&D Policy

January 28/30: Imperfect Competition: Oil Markets

- * [Kellogg, R. 2014. The Effect of Uncertainty on Investment: Evidence from Texas Oil Drilling. *American Economic Review* 104\(6\): 1698-1734.](#)
- [Hotelling, H. 1931. The Economics of Exhaustible Resources. *Journal of Political Economy* 39\(2\): 137-175.](#)
- [Anderson, S.T., R. Kellogg, and S. Salant. 2014. Hotelling Under Pressure. NBER Working Paper 20280, July.](#)
- [Cuddington, J.T. and Moss, D.L. 2001. Technological Change, Depletion, and the U.S. Petroleum Industry. *American Economic Review*.](#)
- [Griffin, J.M. and Xiong, W. 1997. The Incentive to Cheat: An Empirical Analysis of OPEC. *Journal of Law and Economics* 40\(2\).](#)
- [Pindyck, R.S. 1978. Gains to Producers from the Cartelization of Exhaustible Resources. *Review of Economics and Statistics* 60\(2\).](#)
- [Smith, J. 2005. Inscrutable OPEC? Behavioral Tests of the Cartel Hypothesis. *The Energy Journal* 25\(1\).](#)

OPEC Role-Playing Simulation Assigned

February 4: Imperfect Competition: Power Markets

- * [Cicala, Steve. 2015. When Does Regulation Distort Costs? Lessons from Fuel Procurement in U.S. Electricity Generation. *American Economic Review* 105\(1\): 411-444.](#)
- [Davis, Lucas and Catherine Wolfram. 2012. Deregulation, Consolidation, and Efficiency: Evidence from U.S. Nuclear Power. *American Economic Journal – Applied Economics* 4\(4\): 194-225.](#)
- [Fabrizio, Kira R., Nancy L. Rose, and Catherine D. Wolfram. 2007. Do Markets Reduce Costs? Assessing the Impact of Regulatory Restructuring on U.S. Electric Generation Efficiency. *American Economic Review* 97\(4\): 1250-1277.](#)
- [Borenstein, Severin. 2002. The Trouble with Electricity Markets: Understanding California's Restructuring Disaster. *The Journal of Economic Perspectives* 16\(1\): 191-211.](#)
- [Joskow, Paul L. 2008. Lessons Learned from Electricity Market Liberalization. *The Energy Journal*, Special Issue—The Future of Electricity: Papers in Honor of David Newbery.](#)
- [Bushnell, James B., Erin T. Mansur, and Celeste Saravia, "Vertical Arrangements, Market Structure, and Competition: An Analysis of Restructured US Electricity Markets," *American Economic Review*, 98, 1 \(2008\): 237 – 266.](#)

February 6: Externalities: Introduction

- * [Muller, Nicholas Z. and Robert Mendelsohn. 2009. Efficient Pollution Regulation: Getting the Prices Right. *American Economic Review* 99\(5\): 1714-1739.](#)
- [Fraas, Arthur G. and Randall Lutter. 2012. A Comment on "Efficient Pollution Regulation: Getting the Prices Right." *American Economic Review* 102\(1\): 602-607.](#)
- [Parry, Ian W H and Kenneth A. Small. 2005. Does Britain or the United States Have the Right Gasoline Tax? *American Economic Review* 95\(4\).](#)
- [National Research Council \(2010\), "Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use," National Academies Press, Washington, D.C., Summary \(3-21\).](#)
- [Coase, Ronald H. 1960. The Problem of Social Cost. *Journal of Law and Economics* 3: 1-44.](#)
- [Anderson, Michael and Maximilian Auffhammer. 2014. Pounds That Kill: The External Costs of Vehicle Weight. *Review of Economic Studies* 81: 535-571](#)

February 11: Externalities: Value of Statistical Life

- * [Aldy, Joseph E. and Kip W. Viscusi. 2008. Adjusting the Value of a Statistical Life for Age and Cohort Effects. *Review of Economics and Statistics* 90\(3\).](#)
- [Viscusi, Kip W. and Joseph E. Aldy. 2003. The Value of a Statistical Life: A Critical Review of Market Estimates Throughout the World. *Journal of Risk and Uncertainty* 27\(1\).](#)
- [Aldy, Joseph E. and Kip W. Viscusi. 2007. Age Differences in the Value of Statistical Life: Revealed Preference Evidence. *Review of Environmental Economics and Policy*, 1\(2\).](#)
- [Aldy, J.E. and S.J. Smyth. 2014. Heterogeneity in the Value of Life. NBER Working Paper 20206, June.](#)
- [Krupnick, Alan. 2007. Mortality-risk Valuation and Age: Stated Preference Evidence. *Review of Environmental Economics and Policy*, 1\(2\).](#)
- [Lavaine, Emmanuelle and Matthew J. Neidell. 2013. Energy Production and Health Externalities: Evidence from Oil Refinery Strikes in France. NBER Working Paper 18974.](#)
- [Currie, Janet and Reed Walker. 2011. Traffic Congestion and Infant Health: Evidence from E-ZPass. *American Economic Journal: Applied Economics* 3\(1\): 65-90.](#)

February 13: Externalities: Social Cost of Carbon

- * [Nordhaus, William. 2014. Estimates of the Social Cost of Carbon: Concepts and Results from the DICE-2013R Model and Alternative Approaches. *Journal of the Association of Environmental and Resource Economics* 1\(1/2\): 273-312.](#)
- [Greenstone, Michael, Kopits, Elizabeth, and Wolverton, Ann. 2013. Developing a Social Cost of Carbon for US Regulatory Analysis: A Methodology and Interpretation. *Review of Environmental Economics and Policy* 7\(1\): 233-46.](#)
- [Pizer, William et al. 2014. Using and Improving the Social Cost of Carbon. *Science* 346: 1181-1182.](#)
- [Aldy, J.E. 2015. Pricing Climate Risk Mitigation. *Nature Climate Change* 5: 396-398.](#)
- [Heutel, G., Moreno-Cruz, J., and Shayegh, S. 2018. Solar geoengineering, uncertainty, and the price of carbon. *Journal of Environmental Economics and Management* 87: 24-41.](#)

February 18: No Class: President's Day

February 20: Externalities: Social Cost of Carbon

- * [Burke, M., Hsiang, S. M., and Miguel, E. 2015. Global non-linear effect of temperature on economic production. *Nature* 527\(7577\): 235-239.](#)
- [Carleton, Tamma, et al. 2018. Valuing the Global Mortality Consequences of Climate Change Accounting for Adaptation Costs and Benefits. Working paper, University of Chicago.](#)
- [Dell, M., Jones, B. F., and Olken, B. A. 2014. What do we learn from the weather? The new climate-economy literature. *Journal of Economic Literature* 52\(3\): 740-98.](#)
- [Dell, M., Jones, B. F., and Olken, B. A. 2012. Temperature shocks and economic growth: Evidence from the last half century. *American Economic Journal: Macroeconomics* 4\(3\): 66-95.](#)
- [Graff Zivin, J., Hsiang, S. M., and Neidell, M. 2018. Temperature and human capital in the short and long run. *Journal of the Association of Environmental and Resource Economists* 5\(1\): 77-105.](#)
- [Heal, G., and Park, J. 2016. Reflections—temperature stress and the direct impact of climate change: a review of an emerging literature. *Review of Environmental Economics and Policy* 10\(2\): 347-362.](#)

February 25: Externalities: Catastrophic Risk

- * [Weitzman, Martin. 2009. On Modeling and Interpreting the Economics of Catastrophic Climate Change. *Review of Economics and Statistics*, February 2009.](#)
- [Nordhaus, W. D. 2012. Economic policy in the face of severe tail events. *Journal of Public Economic Theory* 14\(2\): 197-219.](#)
- [Barrett, Scott. 2013. Climate Treaties and Approaching Catastrophes. *Journal of Environmental Economics and Management* 66\(2\): 235-250.](#)
- [Zeckhauser, 1995. Economics of Catastrophes. *Journal of Risk and Uncertainty*, 12\(2-3\).](#)
- [Weitzman, Martin L. 2014. Fat Tails and the Social Cost of Carbon. *American Economic Review* 104\(5\): 544-546.](#)

February 27: Public Goods: International Environmental Agreements

- * [Barrett, Scott and Astrid Dannenberg. 2016. An Experimental Investigation into "Pledge and Review" in Climate Negotiations. *Climatic Change* 138: 339-351.](#)
- [Samuelson, P.A. 1954. The Pure Theory of Public Expenditure. *Review of Economics and Statistics* 36\(4\): 387-389.](#)
- [Barrett, S. 1994. Self-enforcing international environmental agreements. *Oxford Economic Papers* 46: 878-894.](#)
- [Aldy, Joseph E. 2014. The Crucial Role of Policy Surveillance in International Climate Policy. *Climatic Change* 126\(3-4\): 279-292.](#)
- [Ostrom, Elinor. 2010. Beyond Markets and States: Polycentric Governance of Complex Economic Systems. *American Economic Review* 100\(3\): 641-672.](#)

March 4: Macroeconomics of Energy Shocks

- * [Newell, Richard G. and Brian C. Prest. 2017. Informing SPR Policy through Oil Futures and Inventory Dynamics. NBER Working Paper 23974.](#)
- [Kilian, Lutz. 2008. The Economic Effects of Energy Price Shocks, *Journal of Economic Literature* 46\(4\).](#)
- [Considine, T. 2006. "Is the Strategic Petroleum Reserve Our Ace in the Hole?" *The Energy Journal* 27\(3\).](#)
- [Stock, James H. and Mark W. Watson. 2012. Disentangling the Channels of the 2007-2009 Recession. NBER Working Paper No. 18094, May.](#)

Term paper precis due

March 6: Distributional Issues

- * [Levinson, Arik. 2018. Energy Efficiency Standards Are More Regressive than Energy Taxes: Theory and Evidence. *Journal of the Association of Environmental and Resource Economists*, forthcoming.](#)
- [Borenstein, S. and L.W. Davis. 2015. The Distributional Effects of U.S. Clean Energy Tax Credits. NBER Working Paper 21437, July.](#)
- [Lucas W. Davis and Lutz Kilian. 2011. The Allocative Cost of Price Ceilings in the U.S. Residential Market for Natural Gas. *Journal of Political Economy* 119\(2\).](#)
- [Borenstein, Severin and Lucas W. Davis. 2012. The Equity and Efficiency of Two-Part Tariffs in U.S. Natural Gas Markets. *Journal of Law & Economics* 55\(1\): 75-128.](#)
- [Bento, Antonio, Lawrence Goulder, Mark Jacobsen, and Roger von Haefen. 2009. Distributional and Efficiency Impacts of Increased U.S. Gasoline Taxes. *American Economic Review* 99\(3\).](#)

March 11: Libertarian Paternalism

- * [Allcott, Hunt \(2011\), Social Norms and Energy Conservation, *Journal of Public Economics* 95\(9-10\).](#)
- [Glaeser, E.L. 2006. Paternalism and Psychology. *Regulation Summer*: 32-38.](#)
- [Thaler, R.H. and C.R. Sunstein. 2003. Libertarian Paternalism. *American Economic Review* 93\(2\): 175-179.](#)
- [Allcott, Hunt. 2011. Consumers' Perceptions and Misperceptions of Energy Costs. *American Economic Review, Papers and Proceedings* 97\(2\): 80-85.](#)
- [Gerarden, T., Newell, R.G., Stavins, R.N., and R.C. Stowe. 2015. An Assessment of the Energy-Efficiency Gap and Its Implications for Climate-Change Policy. NBER Working Paper 20905, January.](#)
- [Hunt, Allcott and Kessler, Judd B. 2015. The Welfare Effects of Nudges: A Case Study of Energy Use Social Comparisons. NBER Working Paper 21671, October.](#)

March 13: Energy Prices and Fossil Fuel Subsidies

- * [Davis, Lucas W. 2014. The Economic Cost of Global Fuel Subsidies. *American Economic Review* 104\(5\): 581-585.](#)
- [Metcalf, Gilbert. E. 2017. The Impact of Removing Tax Preferences for U.S. Oil and Natural Gas Production: Measuring Tax Subsidies by an Equivalent Price Approach. *Journal of the Association of Environmental and Resource Economists*, forthcoming.](#)
- [Davis, Lucas W. 2017. The Environmental Cost of Global Fuel Subsidies. *The Energy Journal* 38: KAPSARC Special Issue.](#)
- [Metcalf, G.E., 2010. Investment in Energy Infrastructure and the Tax Code. *Tax Policy and the Economy* 24\(1\):1-34.](#)
- [Coady, David et al. 2015. How Large Are Global Energy Subsidies? IMF Working Paper 15/105.](#)

March 18-20: No Class: Spring Break

March 25: Fuel Economy Standards

- * [Anderson, Soren T., and James M. Sallee. 2011. Using loopholes to reveal the marginal cost of regulation: The case of fuel-economy standards. *American Economic Review* 101\(4\): 1375-1409.](#)
- [Bento, A. M., Gillingham, K., Jacobsen, M. R., Knittel, C. R., Leard, B., Linn, J., ... and Whitefoot, K. S. \(2018\). Flawed analyses of US auto fuel economy standards. *Science* 362\(6419\): 1119-1121.](#)
- [Anderson, S., C. Fischer, I. Parry, and J. Sallee. 2011. Automobile Fuel Economy Standards: Impacts, Efficiency, and Alternatives. *Review of Environmental Economics and Policy* req 021.](#)
- [Jacobsen, Mark R. and Arthur A. van Bentham. 2015. Vehicle Scrappage and Gasoline Policy. *American Economic Review* 105\(3\): 1312-1338.](#)
- [Hunt Allcott and Nathan Wozny. 2014. Gasoline Prices, Fuel Economy, and the Energy Paradox. *The Review of Economics and Statistics* 96\(5\): 779-795.](#)
- [Busse, Meghan R., Christopher R. Knittel, and Florian Zettelmeyer. 2013. Are consumers myopic? Evidence from new and used car purchases. *American Economic Review* 103\(1\): 220-256.](#)

March 27: Quantity Instruments: Introduction

- * [Stavins, R. N. 2008. A meaningful US cap-and-trade system to address climate change. *Harv. Envtl. L. Rev.*, 32: 293-371.](#)
- [Schmalensee, R., and Stavins, R. N. 2017. The design of environmental markets: What have we learned from experience with cap and trade?. *Oxford Review of Economic Policy* 33\(4\): 572-588.](#)
- [Goulder, L. H. 2013. Markets for Pollution Allowances: What Are the \(New\) Lessons?. *The Journal of Economic Perspectives* 27\(1\), 87–102.](#)
- [Aldy, Joseph E., Alan J. Krupnick, Richard G. Newell, Ian W.H. Parry, and William A. Pizer. 2010. Designing Climate Mitigation Policy. *Journal of Economic Literature* 48\(4\).](#)
- [Montgomery, W. D. 1972. Markets in licenses and efficient pollution control programs. *Journal of economic theory* 5\(3\): 395-418.](#)

Policy analysis exercise assigned

April 1: Quantity Instruments: EU ETS

- * [Fabra, N., & Reguant, M. \(2014\). Pass-through of emissions costs in electricity markets. *American Economic Review* 104\(9\): 2872-99.](#)
- [Martin, Ralf, Mirabelle Muûls, Laure B. de Preux, and Ulrich J. Wagner. 2014. Industry Compensation under Relocation Risk: A Firm-Level Analysis of the EU Emissions Trading Scheme. *American Economic Review* 104 \(8\): 2482-2508.](#)
- [Calel, R. and Dechezlepretre, A. 2016. Environmental policy and directed technological change: evidence from the European carbon market. *Review of economics and statistics* 98\(1\): 173-191.](#)
- [Martin, R., Muûls, M., and Wagner, U. J. 2015. The impact of the European Union Emissions Trading Scheme on regulated firms: What is the evidence after ten years?. *Review of environmental economics and policy* 10\(1\): 129-148.](#)
- [Holt, C.A. and Shobe, W.M., 2016. Price and quantity collars for stabilizing emission allowance prices: Laboratory experiments on the EU ETS market stability reserve. *Journal of Environmental Economics and Management* 76:32-50.](#)

April 3: Quantity Instruments: SO2 Cap-and-Trade Program

- * [Chan, H. R., Chupp, B. A., Cropper, M. L., and Muller, N. Z. 2018. The impact of trading on the costs and benefits of the Acid Rain Program. *Journal of Environmental Economics and Management* 88: 180-209.](#)
- [Schmalensee, R. and Stavins, R. N. 2013. The SO2 allowance trading system: the ironic history of a grand policy experiment. *Journal of Economic Perspectives* 27\(1\): 103-122.](#)
- [Ferris, A. E., Shadbegian, R. J., and Wolverton, A. 2014. The effect of environmental regulation on power sector employment: Phase I of the title IV SO2 trading program. *Journal of the Association of Environmental and Resource Economists* 1\(4\): 521-553.](#)
- [Montero, J.P. 1999. Voluntary Compliance with Market-Based Environmental Policy: Evidence from the U. S. Acid Rain Program. *Journal of Political Economy* 107\(5\): 998-1033.](#)

April 8: Quantity Instruments: NOX Cap-and-Trade Programs

- * [Deschênes, O., Greenstone, M., and Shapiro, J. S. 2017. Defensive investments and the demand for air quality: Evidence from the NOx budget program. *American Economic Review* 107\(10\): 2958-89.](#)
- [Fowlie, M., Holland, S. P., and Mansur, E. T. 2012. What do emissions markets deliver and to whom? Evidence from Southern California's NOx trading program. *American Economic Review* 102\(2\): 965-93.](#)
- [Fowlie, M. 2010. Emissions trading, electricity restructuring, and investment in pollution abatement. *American Economic Review* 100\(3\): 837-69.](#)
- [Curtis, E. M. 2018. Who loses under cap-and-trade programs? the labor market effects of the nox budget trading program. *Review of Economics and Statistics* 100\(1\): 151-166.](#)
- [Linn, J. 2010. The effect of cap-and-trade programs on firms' profits: Evidence from the Nitrogen Oxides Budget Trading Program. *Journal of Environmental Economics and management* 59\(1\): 1-14.](#)
- [Popp, D. 2006. International innovation and diffusion of air pollution control technologies: the effects of NOX and SO2 regulation in the US, Japan, and Germany. *Journal of Environmental Economics and Management* 51\(1\): 46-71.](#)

April 10: Price Instruments: Introduction

- * [Aldy, Joseph E. 2016. Long-term Carbon Policy: The Great Swap. Report published by the Progressive Policy Institute.](#)
- [Metcalfe, G. 2009. Market-Based Policy Options to Control U.S. Greenhouse Gas Emissions. *Journal of Economic Perspectives* 23\(2\): 5-27.](#)
- [Parry, Ian W H and Kenneth A. Small. 2005. Does Britain or the United States Have the Right Gasoline Tax? *American Economic Review* 95\(4\).](#)
- [Goulder, Lawrence H. 2013. Climate change policy's interactions with the tax system. *Energy Economics* 40: S3-S11.](#)
- [Murray, B. and Rivers, N., 2015. British Columbia's revenue-neutral carbon tax: A review of the latest "grand experiment" in environmental policy. *Energy Policy* 86, pp.674-683.](#)
- [Aldy, Joseph E. 2017. Designing and Updating a U.S. Carbon Tax in an Uncertain World. *Harvard Environmental Law Review* 41: 28-40.](#)

Policy analysis exercise due

April 15: Price Instruments: Renewable Subsidies

- * [Gerarden, Todd. 2017. Demanding Innovation: The Impact of Consumer Subsidies on Solar Panel Production Costs. Working Paper, November 15 Draft.](#)
- [Aldy, J.E., Gerarden, T.D. and Sweeney, R.L. 2018. Investment versus Output Subsidies: Implications of Alternative Incentives for Wind Investment. Working Paper.](#)
- [Aldy, Joseph E. 2012. A Preliminary Review of the American Recovery and Reinvestment Act's Clean Energy Package. *Review of Environmental Economics and Policy*.](#)
- [Murray, Brian C., Maureen L. Cropper, Francisco C. de la Chesnaye, and John M. Reilly. 2014. How Effective Are US Renewable Energy Subsidies in Cutting Greenhouse Gases? *American Economic Review*, 104\(5\): 569-74.](#)
- [Metcalf, Gilbert E. 2009. Tax Policies for Low-Carbon Technologies. *National Tax Journal* 62\(3\).](#)
- [Browner, Carol, Ron Klain, and Larry Summers. October 25, 2010. "Briefing Memo: Renewable Energy Loan Guarantees and Grants," The White House.](#)
- [Aldy, Joseph E., Matthew J. Kotchen, and Anthony A. Leiserowitz. 2012. Willingness to Pay and Political Support for a U.S. National Clean Energy Standard. *Nature Climate Change* 2: 596-599.](#)

April 17: Price Instruments: Energy Efficiency Subsidies

- * [Houde, Sebastien and Joseph E. Aldy. 2017. Consumers' Response to State Energy Efficient Appliance Rebate Programs. *American Economic Journal: Economic Policy* 9\(4\): 227-255.](#)
- [Holland, S. P., Mansur, E. T., Muller, N. Z., & Yates, A. J. 2018. Distributional effects of air pollution from electric vehicle adoption. *Journal of the Association of Environmental and Resource Economists*, forthcoming.](#)
- [Auffhammer, M., Blumstein, C., & Fowlie, M. \(2008\). Demand-side management and energy efficiency revisited. *The Energy Journal*, 91-104.](#)
- [Allcott, Hunt, Christopher Knittel, and Dmitry Taubinsky. 2015. Tagging and targeting of energy efficiency subsidies. *American Economic Review* 105\(5\): 187-91.](#)

April 22: Instrument Choice

- * [Pizer, William A. 2002. Combining Price and Quantity Controls to Mitigate Global Climate Change. *Journal of Public Economics* 85\(3\): 409-434.](#)
- [Weitzman, M.L. 1974. Prices vs. Quantities. *Review of Economic Studies* 41\(4\): 477-491.](#)
- [Stavins, Robert N. 1995. Correlated Uncertainty and Policy Instrument Choice. *Journal of Environmental Economics and Management* 30\(2\): 218-232.](#)
- [Newell, Richard G. and William A. Pizer. 2003. Regulating Stock Externalities Under Uncertainty. *Journal of Environmental Economics and Management* 45\(2 Supplement 1\): 416-432.](#)
- [Aldy, Joseph E. and Robert N. Stavins. 2012. The Promise and Problems of Pricing Carbon: Theory and Experience. *The Journal of Environment & Development*, 21\(2\): 152-180.](#)
- [Murray, Brian, Richard G. Newell, and William A. Pizer. 2009. Balancing Cost and Emissions Certainty: An Allowance Reserve for Cap-and-Trade. *Review of Environmental Economics and Policy* 3\(1\): 84-103.](#)

April 24: No Class

April 29: Competitiveness

- * [Aldy, J.E. and W.A. Pizer. 2015. Competitiveness Impacts of Climate Change Mitigation Policies. *Journal of the Association of Environmental and Resource Economists* 2\(4\): 565-595.](#)
- [Fowlie, M., and Reguant, M. 2018. Challenges in the Measurement of Leakage Risk. *AER/AEA Papers and Proceedings* 108: 124-29\).](#)
- [Aldy, J. 2017. Frameworks for Evaluating Policy Approaches to Address the Competitiveness Concerns of Mitigating Greenhouse Gas Emissions. *National Tax Journal* 70\(2\): 395-420.](#)
- [Böhringer, C., Balistreri, E. J., and Rutherford, T. F. 2012. The role of border carbon adjustment in unilateral climate policy: Overview of an Energy Modeling Forum study \(EMF 29\). *Energy Economics*, 34, S97-S110.](#)
- [Jaffe, Adam, Steven Peterson, Paul Portney, and Robert Stavins. 1995. Environmental Regulation and the Competitiveness of U.S. Manufacturing: What Does the Evidence Tell Us? *Journal of Economic Literature* 33:132-163.](#)

May 1: Innovation, Technological Change, and R&D Policy

- * [Howell, S. T. 2017. Financing innovation: evidence from R&D grants. *American Economic Review* 107\(4\): 1136-64.](#)
- [Henderson, Rebecca and Richard G. Newell. 2010. Accelerating Innovation in Energy: Insights from Multiple Sectors. Harvard Business School Working Paper 10-067.](#)
- [Nordhaus, W.D., 2014. The Perils of the Learning Model for Modeling Endogenous Technological Change. *The Energy journal* 35\(1\): 1-13.](#)
- [Newell, Richard G., Adam B. Jaffe, and Robert Stavins. 1999. The Induced Innovation Hypothesis and Energy-Saving Technological Change. *Quarterly Journal of Economics* 114\(3\).](#)
- [Popp, D., 2010. Innovation and Climate Policy. *Annual Review of Resource Economics* 2\(1\), pp.275-298.](#)
- [Acemoglu, Daron, Philippe Aghion, Leonardo Bursztyn, and David Hemous. 2012. The Environment and Directed Technical Change. *The American Economic Review* 102 \(1\).](#)

May 3: Final Papers

Final papers are due by 5pm in electronic and hard copy