

ECONOMICS OF CLIMATE CHANGE AND ENVIRONMENTAL POLICY
Monday, Wednesdays (& Fridays Optional), 1:30-2:45 pm, Starr Auditorium (HKS Belfer 200)
<https://canvas.harvard.edu/courses/143462>
SYLLABUS

Nature and Purpose of the Course:

This course provides an introduction to the economics of climate change and related public policies, with emphasis on the real-world practical and political context in which policies are developed and implemented. We cover both conceptual and methodological topics, as well as policy options and debates, in the United States and globally. After reviewing the basic science of climate change, we develop key methods for assessing climate change policies, including net present value analysis, cost-effectiveness, and distributional equity (both internationally and in regard to local correlated pollutants and environmental justice). Alternative regional, national, and sub-national climate policy instruments are examined, including performance and technology standards, carbon taxes, subsidies, and emissions trading, with an examination of key emission sectors (electric power, transportation, and buildings). The course includes in-depth analysis of recent domestic and international climate policy developments.

Instructor:

Prof. Robert N. Stavins
A.J. Meyer Professor of Energy & Economic Development
Harvard Kennedy School
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Office Hours: Tuesday, 12:00-1:00 pm

Assistant: Meredith Landry, Room L-307A, 496-8054
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Teaching Fellows:

Andrés de Loera, Ph.D. Student, Economics (Head Teaching Fellow)
E-Mail: adeloerabrust@g.harvard.edu
Office Hours: Thursday 10:00-11:00am ([virtual](#))
Wednesday 3:00-4:00pm ([by appointment](#))

Jun Gao, Ph.D. Student, Public Policy
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Office Hours: Friday 3:00-4:00pm ([virtual](#))
Monday 3:00-4:00pm ([by appointment](#))

Recommended Background: There are no prerequisites for the course, but it is recommended that you have previously taken an introductory course in microeconomic theory (such as ECON 10A, P-125, API-101, or M-221). It will be very helpful to be familiar with basic economic concepts, such as: supply & demand functions, consumers' surplus, opportunity cost, marginal analysis, and time discounting. You may wish to review an introductory microeconomics textbook.

Registration:

IMPORTANT: Unless you are a Kennedy School student, you should register for ECON 1661, not API-135; this applies to Harvard undergraduates and non-Kennedy School graduate students (e.g. HLS, MIT, Tufts, etc).

Reading Material:

There are two textbooks for the course — one text and one volume of selected readings:

Keohane, Nathaniel, and Sheila Olmstead. *Markets and the Environment. Second Edition.* Washington: Island Press, 2016. [TEXT]

Stavins, Robert N., ed. *Economics of the Environment: Selected Readings, Seventh Edition.* Northampton, Massachusetts: Edward Elgar Publishing, Inc., 2019. [EOE]

The Keohane & Olmstead textbook (*Second Edition*) provides a concise yet comprehensive treatment of the environmental economics topics covered in this course. This book is available for purchase at the Harvard Coop ([link](#) to Harvard Coop Bookstore course search tool), and is available for [download](#) from Harvard Library (you will need to sign into Hollis). This textbook is **required**. Students who would like a more detailed treatment of the material may also consider purchasing *Environmental and Natural Resource Economics* (Thomas Tietenberg & Lynne Lewis). A more rigorous mathematical treatment of the material, beyond the level required for the course, is found in *Environmental Economics* (Charles Kolstad).

The second book for the course is the *Seventh* Edition of *Economics of the Environment*, a collection of academic papers. This is available at the Harvard Coop for purchase, and is available for [download](#) from Harvard Library (you will need to sign into Hollis). Students **should not** purchase previous editions, as many required readings were not included in previous editions. The readings found in this textbook can also be accessed through Hollis or academic journal websites, so as long as you obtain and read them, you need not purchase the book.

Slides and other additional materials can be downloaded from the [course website](#). Use of electronic devices in class is discouraged (see the [NYTimes](#) for an explanation). A few additional readings found in the reading list below are available for download at the indicated web sites.

Course Requirements and Grading:

We will meet for a total of 25 class sessions. There will be: five problem sets (due at the beginning of class on February 19, March 3, March 31, April 14, and April 28); an in-class midterm exam (March 12); and a final exam during exam period. The final examination is scheduled by the Faculty of Arts and Sciences; the date and time of the exam will be announced by FAS later in the semester. Problem sets will be graded Check/+/-, and late submissions will be lowered a grade a day. However, you will have three “late days” to use as you wish over the semester.

Classes will be held on **Mondays and Wednesdays, 1:30-2:45 PM**, in Starr Auditorium (Belfer-200) at Harvard Kennedy School. Enrolled students should be available for the class times on all three days each week. The Teaching Fellows will conduct optional review sessions on specific topics on Fridays, from 1:30-2:45 PM. These review sessions will also take place in Starr Auditorium. None of these classes will be recorded.

Course grading is on the following basis:	Problem Sets	15%
	Midterm Exam	35%
	Final Exam	<u>50%</u>
		100%

Academic Integrity: Students are expected to abide by all University policies on academic honesty. While groups may work on problem sets together, each student must write up and submit their own problem set. The use of generative AI on problem sets is not allowed.

Please see the schedule on the next page. The exact schedule of classes, with topics and readings, is found on subsequent pages of the syllabus.

Modules	Lectures	Topic	Professor Stavins Mondays & Wednesdays 1:30-2:45 pm	Teaching Fellows (Optional) Fridays 1:30-2:45 pm
1	1 & 2	Introduction to Basic Science, Economics, & Policy of Climate Change	January 27 & 29	January 31
2	3, 4, & 5	Essential Methodology for Economic Analysis of Climate Change Policy	February 3, 5, & 10	February 7
3	6 & 7	Key Elements of Economic Analysis of Climate Change Policy: Cost and Benefit Concepts, and Measurement <i>Problem Set #1 Due at Beginning of Class on February 19th</i>	February 12 & 19	February 14
4	8 & 9	Benefit-Estimation: Revealed Preference (Hedonic Pricing, Averting Behavior); Stated Preference, Mortality Risk Valuation	February 24 & 26	February 21
5	10 & 11	Policy Instruments: Criteria, Cost Effectiveness, Technology & Performance Standards, Subsidies, Taxes, Emissions Trading <i>Problem Set #2 Due at Beginning of Class on March 3rd</i>	March 3 & 5	February 28
		Midterm Examination	March 12	March 7 Midterm Review
6	12 & 13	Localized Climate Change & Policy: Correlated Air Pollutants, Economics of Local Air Pollution, Adaptation, and Environmental Justice	March 10 & 24	(No Meeting)
		Spring Break: No Course Meetings on March 17, 19, or 21	(No Meeting)	(No Meeting)
7	14	Cross-Boundary Air Pollution: Economics of Acid Rain Control	March 26	March 28
8	15 & 16	National & Regional Climate Policy Options I: Carbon-Pricing Instruments <i>Problem Set #3 Due at Beginning of Class on March 31st</i>	April 2 & 7	April 4
9	17 & 18	National & Regional Climate Policy Options II: Electricity, Transportation, & Building Sectors	April 9 & 11 ¹	(No Meeting)
10	19 & 20	Sub-National Policy & Policy Interactions; Technology Change & Energy Efficiency <i>Problem Set #4 Due at Beginning of Class on April 14th</i>	April 14 & 21	April 18
11	21 & 22	International Climate Change Policy I: Rio Earth Summit to Paris Agreement	April 23 & 25 ²	(No Meeting)
12	23 & 24	International Climate Change Policy II: Implementation of Paris Agreement & Path Ahead <i>Problem Set #5 Due at Beginning of Class on April 28th</i>	April 28 & 30	TBA Final Review

¹ Note that a lecture will take place on Friday April 11th taking the place of the review session.

² Note that a lecture will take place on Friday April 25th taking the place of the review session.

**API-135/ECON 1661: ECONOMICS OF CLIMATE CHANGE AND ENVIRONMENTAL POLICY
READING LIST**

Readings below are required, and should be completed prior to class sessions, with selections read in the order listed. At the end of the list of required readings is a separate list of suggested (optional) readings. If you are particularly interested in a certain week or topic, the optional readings are recommended, but not required.

TEXT refers to Keohane, Nathaniel, and Sheila Olmstead. *Markets and the Environment. Second Edition.* Washington: Island Press, 2016.

EOE refers to Stavins, Robert N., ed. *Economics of the Environment: Selected Readings, Seventh Edition.* Northampton, Massachusetts: Edward Elgar Publishing, Inc., 2019.

MODULE 1, LECTURES 1 & 2 (JANUARY 27 & 29): INTRODUCTION TO BASIC SCIENCE, ECONOMICS, AND POLICY OF CLIMATE CHANGE

Intergovernmental Panel on Climate Change. [*Summary for Policymakers: The Physical Science Basis Contribution of Working Group I to the Sixth Assessment Report of the IPCC.*](#) Cambridge University Press, Cambridge, UK and New York, 2021.

TEXT, pp. 11-34, 80-90: Chapter 2 "Economic Efficiency..." and Chapter 5 "Market Failures...", through the "Public Goods" heading

EOE, pp. 2-7, Chapter 1 (Fullerton and Stavins, "[How Economists See the Environment.](#)" *Nature*, 1998).

MODULE 2, LECTURES 3, 4, & 5 (FEBRUARY 3, 5 & 10): ESSENTIAL METHODOLOGY FOR ECONOMIC ANALYSIS OF CLIMATE CHANGE POLICY

TEXT, pp. 35-68: Chapter 3: "The Benefits and Costs..."

EOE, pp. 145-149, Chapter 8 (Arrow, Cropper, Eads, Hahn, Lave, Noll, Portney, Russell, Schmalensee, Smith, and Stavins, "[Is There a Role for Benefit-Cost Analysis in Environmental, Health, and Safety Regulation?](#)" *Science*, 1996).

EOE, pp. 150-154, Chapter 9 (Goulder and Stavins, "[An Eye on the Future.](#)" *Nature*, 2002).

MODULE 3, LECTURES 6 & 7 (FEBRUARY 12 & 19): KEY ELEMENTS OF ECONOMIC ANALYSIS OF CLIMATE CHANGE POLICY: COST AND BENEFIT CONCEPTS AND MEASUREMENT

NOTE: Problem Set #1 is due at beginning of class on February 19th

TEXT, pp. 69-78: Chapter 4, "The Efficiency of Markets"

EOE, pp. 47-71, Chapter 3 (Dechezlepretre, Antoine and Misato Sato. "[The Impacts of Environmental Regulations on Competitiveness.](#)" *Review of Environmental Economics and Policy* 11(2), 2017).

Aldy, Joseph, Matthew Kotchen, Robert Stavins, and James Stock. "[Keep Climate Policy Focused on the Social Cost of Carbon.](#)" *Science*, Policy Forum Insights, Volume 373, Issue 6557, August 20, 2021.

MODULE 4, LECTURES 8 & 9 (FEBRUARY 24 & 26): BENEFIT-ESTIMATION METHODS: REVEALED PREFERENCE (HEDONIC PRICING, AVERTING BEHAVIOR); STATED PREFERENCE, MORTALITY RISK VALUATION

TEXT, pp. 49-55. "Measuring Benefits," in Chapter 3.

EOE, pp. 92-107, Chapter 5 (Carson, Richard T. "[Contingent Valuation: A Practical Alternative when Prices Aren't Available](#)." *Journal of Economic Perspectives* 26(4) 2012).

EOE, pp. 72-91, Chapter 4 (Cameron, "[Euthanizing the Value of a Statistical Life](#)." *Review of Environmental Economics and Policy* 4(2), 2010).

MODULE 5, LECTURES 10 & 11 (MARCH 3 & 5): GHG POLICY INSTRUMENTS: CRITERIA AND COST EFFECTIVENESS; TECHNOLOGY AND PERFORMANCE STANDARDS, SUBSIDIES, TAXES, EMISSIONS TRADING

NOTE: Problem Set #2 is due at beginning of class on March 3rd

TEXT, pp. 139-198: Chapters 8, "Principles of Market-Based..." and 9, "The Case for Market-Based..."

Revesz, Richard L., and Robert N. Stavins. "[Environmental Law](#)." *Handbook of Law and Economics, Volume I*, eds. A. Mitchell Polinsky and Steven Shavell, pp. 499-589. Amsterdam: Elsevier Science, 2007. [Read pages 534-546]

MARCH 12: MIDTERM EXAMINATION

MODULE 6, LECTURES 12 & 13 (MARCH 10 & 24): LOCALIZED CLIMATE CHANGE & POLICY EFFECTS: CORRELATED AIR POLLUTANTS, ECONOMICS OF LOCAL AIR POLLUTION, ADAPTATION, AND ENVIRONMENTAL JUSTICE

Schmalensee, Richard, and Robert N. Stavins. "[Policy Evolution under the Clean Air Act](#)." *Journal of Economic Perspectives*, Volume 33, Number 4, Fall 2019, pp. 27-50.

Hsiang, S. et al. 2017. "[Estimating economic damage from climate change in the United States](#)." *Science*, 356 (6345): 1362-1369.

Fullerton, Don (2011). "[Six Distributional Effects of Environmental Policy](#)." *Risk Analysis* 3(6): 923-929.

Banzhaf, Spencer, Lala Ma, and Christopher Timmins (2019). "[Environmental Justice: The Economics of Race, Place, and Pollution](#)." *Journal of Economic Perspectives* 33(1): 185-208.

MODULE 7, LECTURE 14 (MARCH 26): LOCALIZED CLIMATE CHANGE & POLICY, PART II; CROSS-BOUNDARY AIR POLLUTION: ECONOMICS OF ACID RAIN CONTROL

TEXT, pp. 200-207: Chapter 10, "Market-Based Instruments ..." through "Compliance and Enforcement"

EOE, pp. 193-210, Chapter 13 (Schmalensee and Stavins. "[The SO₂ Allowance Trading System: The Ironic History of a Grand Policy Experiment](#)." *Journal of Economic Perspectives* 27(1), 2013).

MODULE 8, LECTURES 15 & 16 (APRIL 2 & 7): NATIONAL & REGIONAL CLIMATE POLICY OPTIONS I: CARBON PRICING INSTRUMENTS

NOTE: Problem Set #3 is due on March 31st at 11:59pm.

EOE, pp. 440-468, Chapter 27 (Stavins, "[The Problem of the Commons: Still Unsettled After 100 Years.](#)" *American Economic Review* 101(1), 2011). [Read Pages 96-103]

EOE, pp. 316-350, Chapter 19 (Aldy, Krupnick, Newell, Parry, and Pizer, "[Designing Climate Mitigation Policy.](#)" *Journal of Economic Literature* 48(4), 2010.

EOE, pp. 361-383, Chapter 22 (Newell, Pizer and Raimi. "[Carbon Markets 15 Years after Kyoto: Lessons Learned, New Challenges.](#)" *Journal of Economic Perspectives* 27(1), 2013).

EOE, pp. 171-192, Chapter 12 (Schmalensee, Richard and Robert N. Stavins. "[Lessons Learned from Three Decades of Experience with Cap and Trade.](#)" *Review of Environmental Economics and Policy* 11(1), 2017).

Stavins, Robert N. "[The Future of U.S. Carbon-Pricing Policy.](#)" *Environmental and Energy Policy and the Economy*, volume 1, pp. 8-64. University of Chicago Press, 2020. [Read Pages 8-29, 33-43, 47-52]

MODULE 9, LECTURES 17 & 18 (APRIL 9 & 11): NATIONAL & REGIONAL CLIMATE POLICY OPTIONS II: FOCUS ON ELECTRICITY, TRANSPORTATION, & BUILDING SECTORS

Borenstein, Severin, and James B. Bushnell. 2022. "[Do Two Electricity Pricing Wrongs Make a Right? Cost Recovery, Externalities, and Efficiency.](#)" *American Economic Journal: Economic Policy*, 14 (4): 80-110.

Borenstein, Severin. "[The Economics of Decarbonizing Houses](#)" *Milken Institute Review*. July 25, 2022.

Shaffer, Blake, Auffhammer, Maximilian & Constantine Samaras. "[Make Electric Vehicles Lighter to Maximize Climate and Safety Benefits.](#)" *Nature*, October 14, 2021, Volume 598, pp. 254-256.

MODULE 10, LECTURES 19 & 20 (APRIL 14 & 21): SUB-NATIONAL POLICY & POLICY INTERACTIONS; TECHNOLOGY CHANGE AND ENERGY EFFICIENCY

NOTE: Problem Set #4 is due at beginning of class on April 16th

EOE, pp. 573-618, Chapter 32 (Gerarden, Newell, and Stavins, "[Assessing the Energy-Efficiency Gap.](#)" *Journal of Economic Literature* 55(4), 2017).

Goulder, Lawrence H. and Robert N. Stavins. "[Challenges from State-Federal Interactions in U.S. Climate Change Policy.](#)" *American Economic Review Papers and Proceedings* 101(3), 2011.

MODULE 11, LECTURES 21 & 22 (APRIL 23 & 25): INTERNATIONAL CLIMATE CHANGE POLICY I: RIO EARTH SUMMIT TO PARIS AGREEMENT

Chan, Gabriel, Robert Stavins, and Zou Ji. "[International Climate Change Policy.](#)" *Annual Review of Resource Economics* 10 (2018): 335–360.

Joseph Aldy and Robert Stavins. "[Climate Negotiators Create an Opportunity for Scholars.](#)" *Science*, 2012.

Stavins, Robert N. "[Why Trump Pulled the U.S. Out of the Paris Accord.](#)" *Foreign Affairs* (2017).

MODULE 12, LECTURES 23 & 24 (APRIL 28 & 30): INTERNATIONAL CLIMATE CHANGE POLICY II: IMPLEMENTATION OF PARIS AGREEMENT AND PATH AHEAD

NOTE: Problem Set #5 is due at beginning of class on April 28th

Mehling, Michael A., Gilbert E. Metcalf, and Robert N. Stavins. "[Linking Climate Policies to Advance Global Mitigation](#)." *Science* 359 (2018): 997–998.

Schneider, Lambert, Maosheng Duan, Robert Stavins, Kelley Kizzier, Derik Broekhoff, Frank Jotzo, Harald Winkler, Michael Lazarus, Andrew Howard, and Christina Hood. "[Double Counting and the Paris Agreement Rulebook](#)." *Science* 366, no. 6462 (2019): 180–183.

Stavins, Robert N. "[The Biden Administration and International Climate Change Policy and Action](#)." *LAWFARE*, January 14, 2021

"[Reducing Greenhouse Gases in the United States: A 2030 Emissions Target](#)." The United States of America Nationally Determined Contribution, April 21, 2021.

Powell, Alvin. "[Separating Signal from Noise at COP26](#)." *The Harvard Gazette*, November 17, 2021.

Stavins, Robert N. "[What Happened in Glasgow at COP26?](#)" *An Economic View of the Environment*, November 14, 2021.

Bipartisan Policy Center. "[Inflation Reduction Act Summary: Energy and Climate Provisions](#)".

Jenkins, J.D., Mayfield, E.N., Farbes, J., Jones, R., Patankar, N., Xu, Q., Schivley, G., "Preliminary Report: The Climate and Energy Impacts of the Inflation Reduction Act of 2022," REPEAT Project, Princeton, NJ, August 2022. [REPEAT_IRA_Preliminary_Report_2022-09-21.pdf](#)

Stavins, Robert N. "[What Really Happened at COP27 in Sharm El-Sheikh?](#)", November 22, 2022.

Stavins, Robert N. "[What Really Happened at COP-28 in Dubai](#)," December 15, 2023.

More TBA

OPTIONAL READINGS

- Module 1:** EOE, pp. 8-45, Chapter 2 (Coase, "[The Problem of Social Cost](#)," *Journal of Law and Economics*, 1960).
- Jones, M.W., Peters, G.P., Gasser, T. et al. [National contributions to climate change due to historical emissions of carbon dioxide, methane, and nitrous oxide since 1850](#). *Sci Data* 10, 155 (2023).
- Module 2:** EOE, pp. 155-160, Chapter 10 (Arrow, *et al.*, "[Determining Benefits and Costs for Future Generations](#)," *Science*, 2013).
- EOE, pp. 161-169, Chapter 11 (Gayer and Viscusi, "[Resisting Abuses of Benefit-Cost Analysis](#)," *National Affairs*, 2016).
- Module 3:** Carleton and Greenstone. 2021. "[Updating the United States Government's Social Cost of Carbon](#)." Energy Policy Institute at the University of Chicago Working Paper No. 2021-04.
- Module 4:** EOE, pp. 108-130, Chapter 6 (Kling, Catherine L., Daniel J. Phaneuf and Jinhua Zhao. "[From Exxon to BP: Has Some Number Become Better than No Number?](#)" *Journal of Economic Perspectives*. 26(4) 2012).
- EOE, pp. 131-143, Chapter 7 (Hausman, Jerry A. "[Contingent Valuation: From Dubious to Hopeless](#)." *Journal of Economic Perspectives* 26(4), 2012).
- Module 6:** IPCC, Working Group II. 2014. "[Economics of Adaptation](#)" in *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*.
- EOE, pp. 401-423, Chapter 24 (Tol, "[The Economic Impacts of Climate Change](#)," *Review of Environmental Economics and Policy* 12(1), 2018).
- NPR. [How Federal Disaster Money Favors the Rich](#). 2019.
- Tessum, *et al.* "[Inequity in consumption of goods and services adds to racial–ethnic disparities in air pollution exposure](#)." *PNAS* vol. 116, no. 13, March 26, 2019.
- Kousky, Carolyn. [Managing Flood Risk under Climate Change](#), Resources Radio, 2020.
- EOE, pp. 469-489, Chapter 28 (Reinhardt, Stavins, and Vietor, "[Corporate Social Responsibility Through an Economic Lens](#)," *Review of Environmental Economics and Policy* 2(2), 2008).
- Hahn, R.W. and R.D. Metcalfe. 2021. "[Efficiency and Equity Impacts of Energy Subsidies](#)." *American Economic Review*, 111(5): 1658-1688.
- Currie, Janet, John Voorheis, and Reed Walker. 2023. "[What Caused Racial Disparities in Particulate Exposure to Fall? New Evidence from the Clean Air Act and Satellite-Based Measures of Air Quality](#)." *American Economic Review* 113(1): 71-97
- Hernandez-Cortes, Danae, and Kyle C. Meng. 2023. "[Do Environmental Markets Cause Environmental Injustice? Evidence from California's Carbon Market](#)." *Journal of Public Economics* 217 (January): 104786.
- Module 8:** EOE, pp. 351-355, Chapter 20 (Nordhaus, "[Critical Assumptions in the Stern Review on Climate Change](#)," *Science*, 2007).
- EOE, pp. 356-360, Chapter 21 (Stern and Taylor, "[Climate Change: Risk, Ethics, and the Stern Review](#)," *Science*, 2007).

- Module 11:** Stavins, Robert N. "[The Evolving China-USA Climate Policy Relationship: The Future of All Societies May Depend Upon It.](#)" An Economic View of the Environment, a Blog by Robert Stavins.
- Aldy, Joseph E. "[Evaluating Mitigation Effort: Tools and Institutions for Assessing Nationally Determined Contributions.](#)" Working paper.
- Module 12:** Hahn, R.W. and R.N. Stavins. "[What has the Kyoto Protocol Wrought? The Real Architecture of International Tradeable Permit Markets.](#)" Washington, D.C. The AEI Press, 1999.
- Nordhaus, W. 2015. "[Climate Clubs: Overcoming Free-riding in International Climate Policy.](#)" *American Economic Review*, 105(4): 1339-1370.