

**NYU****ROBERT F. WAGNER GRADUATE
SCHOOL OF PUBLIC SERVICE**

PADM-GP 2472

Climate Economics

Spring 2021

Instructor Information

- [Gernot Wagner](#)
- Email: gwagner@nyu.edu
- Office Address: Department of Environmental Studies, 285 Mercer Street.
- (Currently Virtual) Office Hours: Wednesdays, 2:30-4:30 p.m. Please [sign up here](#). Alternatively, join me on a (masked, 6 feet apart) ~40-minute [morning run](#). If none of these times work, please [email me](#).

Course Information

- Class Meeting Times: Wednesdays, 6:45-8:25 p.m.
- Class Location: Class meets via Zoom and other online tools (e.g. we'll make use of shared online workspaces). Please see Zoom links via NYU Classes website.

Course Prerequisites

Formally, the prerequisites are [CORE-GP 1018 Microeconomics](#) and (concurrently) [CORE-GP 1011 Statistical Methods](#) — or the equivalent classes.

Informally, the main prerequisite is that we need to speak the same language. Please contact me after the first class, if you don't meet the formal requirements, or if you have other questions or concerns.

Course Description

Economics—misguided market forces—is at the core of most environmental problems.
Economics—guiding market forces in the right direction—is also fundamental to the solution.

In this course we develop some of the fundamental economic tools for environmental policy analysis and management: Economics 101 applied to environmental problems—often, though not exclusively, focused on climate change.

We will also go well beyond that initial Econ 101 take, narrowly defined. In fact, focusing exclusively on Econ 101 may sometimes be positively misleading.

For example, Econ 101 traditionally tells us to price each ton of carbon dioxide (CO₂) emitted into the atmosphere, and to get out of the way. Markets will take of the rest.

Not so fast.

Econ 102 tells us that not only is there a negative carbon spillover of economic activity, but also a positive learning-by-doing one. Installing the first rooftop solar panel is costly. The one hundredth is already cheaper. The millionth is a breeze. That goes for any individual roofer. It also goes for entire countries, and it is at the heart of policies from California's Solar Initiative (formerly, its Million Solar Roofs Initiative) to Germany's *Energiewende* (energy transition).

Then there's Political Economy 101. Shouting "carbon tax" all day long will not make it so. In fact, subsidizing clean technologies may even be a necessary step to get a price on CO₂ passed in the first place.

We will discuss this and similar examples, applying Econ 101 (and 102) to the real world, keeping Political Economy 101—and real-world politics—in mind every step along the way.

Course and Learning Objectives

The course has three goals:

- #1 build our environmental economic policy toolkit and know when to apply which tool;
- #2 communicate the results of our analyses in plain English;
- #3 make better-informed environmental policy decision, all while distinguishing between *positive* analyses and *normative* judgements.

Three problem sets and three brief (800-word) op-eds or policy memos will reinforce class discussions. The latter will also ask you to pick a side. Think *Economist* leader: crisp, logical, and always with a well-justified point of view.

Learning Assessment Table

Course Objective Covered	Corresponding Assignment
#1	Three problem sets
#2 and #3	Three policy memos
#1, #2, and #3	In-class midterm exam
#1, #2, and #3	Final exam

Required Readings

There are two required texts for the class: Nathaniel Keohane and Sheila Olmstead's [*Markets and the Environment, Second Edition*](#) (Island Press, 2016). As the book description says, "The authors provide a concise yet thorough introduction to the economic theory of environmental policy and natural resource management." It is not a textbook, but it is a comprehensive, logical presentation we will use throughout the semester—and it does have graphs and tables. We will refer to it as "TEXT" throughout this syllabus.

The second is my own, [*But will the planet notice? How Smart Economics Can Save the World*](#) (Farrar, Strauss & Giroux/Hill & Wang, 2011). It also is decidedly not a textbook. It is a comprehensive introduction to fundamental economic thinking applied to environmental problems. And it tries to do so in a readable, fun way. Where TEXT has graphs and tables, it has cartoons. We will refer to it as "PLANET" throughout this syllabus.

There will be several other materials, ranging from lecture notes/slides to peer-reviewed academic papers to news articles, to brief excerpts from another book of mine, [*Climate Shock*](#) (Princeton, 2015), joint with the late Martin Weitzman. All of those will be available online via the course website.

Beginning with week 2 of the course, come prepared to class having done the readings for the day, including any lecture notes/slides. We will use class times to (briefly) review the most important concepts and then spend the bulk of the time discussing the merits and demerits of the tools and applying them to real-world situations.

Some might call that a "flipped classroom": go through the fundamentals at home on your own time, then spend class time with hands-on exercises. We don't quite go all the way. There will be problem sets and essays to do on your own. But we will generally focus class time on the *how* and *why*—including the *why not*—rather than just the *what*.

Assessment Assignments and Evaluation

Type	Description	%
Problem sets	Three problem sets, 5% each.	15%
Short essays	Three short essays, 5% each. You might call them "policy memos." You might call them "op-eds." Either way, these three short essays have a point of view, they are well argued, and they come in at just around 800 words (sans bibliography). Make sure to use proper citations of materials, including those from the syllabus.	15%
Midterm exam	Exam with numerical problems and (brief) essay questions,	20%

	mimicking the structure of the course—including problem sets and short essays.	
Final exam	Exam with numerical problems and (brief) essay questions, mimicking the structure of the course—including problem sets and short essays.	40%
Participation	Actively engage with the readings and participate in class discussions. Bonus points for anyone able to point to recent news stories or other readings relevant to the topic at hand. Please post them, by 9:00 p.m. the night before each class, on NYU Classes.	10%
Total		100%

All written assessments are individual. Discuss the topic with each other; join up in reading groups; come to office hours alone or in groups (yes, group Zoom sessions!) to discuss details; but submit your own, individual problem sets and essays.

Problem sets are due, electronically via NYU Courses, by the beginning of class on February 24th, March 10th, and April 7th. Essays are due via NYU Classes by the beginning of class on March 3rd, April 28th, and May 5th.

If you need more time, you will need to optimize in light of the following time-grade tradeoff: You will lose ½ point (out of a possible 5 for each assignment, problem set or essay) immediately, and another ½ point for each additional 24 hours the assignment is late.

To request a regrade on any assignment, send me an email with your full assignment attached, explaining your request within 1 week of receiving the graded assignment. I will re-grade the entire assignment—grades may increase or decrease as a result.

Overview of the Semester

- Week 1
 - *Date*: 3 February 2021
 - *Topic*: How costly is climate change, and why does it matter? Aka How to think like a climate/environmental economist
 - *Tools/concepts*: Introduction to “the mother of all benefit-cost analyses”
- Week 2
 - *Date*: 10 February 2021
 - *Topic*: Why benefit-cost analysis (*should*) reign(s) supreme
 - *Tools/concepts*: Negative externalities, net-present value (NPV) analysis, BCA, and some alternative decision criteria

- Week 3
 - *Date:* 17 February 2021
 - *Topic:* How to calculate the benefits of environmental protection
 - *Tools/concepts:* Revealed preference methods, stated preference (contingent valuation), benefit transfer, Value of a Statistical Life (VSL)
- Week 4
 - *Date:* 24 February 2021
 - *Topic:* How far how fast on climate? Aka what's the "optimal" carbon price?
 - *Tools/concepts:* Economic optimality, the limits of BCA
 - *Deliverable:* Problem set 1 due by 6:45 p.m. via NYU Classes
- Week 5
 - *Date:* 3 March 2021
 - *Topic:* Optimal extraction of non-renewable resources
 - *Tool/concept:* Hotelling Rule
 - *Deliverable:* Essay 1 due by 6:45 p.m. via NYU Classes
- Week 6
 - *Date:* 10 March 2021
 - *Topic:* Renewable resources & common property problems
 - *Tools/concepts:* Public goods, tragedy of the commons
 - *Deliverable:* Problem set 2 due by 6:45 p.m. via NYU Classes
- Week 7: in-class MIDTERM EXAM
 - *Date:* 17 March 2021
- Week 8
 - *Date:* 24 March 2021
 - *Topic:* Economics of pollution control
 - *Tools/concepts:* Negative externalities, efficiency, cost-effectiveness, domestic instrument choice (under certainty)
- Week 9
 - *Date:* 31 March 2021
 - *Topic:* Prices vs. Quantities
 - *Tool/concept:* Instrument choice under uncertainty; experience with economic policy instruments
- Week 10
 - *Date:* 7 April 2021
 - *Topic:* Prices vs. Subsidies
 - *Tool/concept:* Positive learning-by-doing externalities
 - *Deliverable:* Problem set 3 due 6:45 p.m. via NYU Classes
- Week 11
 - *Date:* 14 April 2021
 - *Topic:* Global (warming) problem, global solution
 - *Tool/concept:* International policy choice, game theory of climate negotiations
- Week 12
 - *Date:* 21 April 2021
 - *Topic:* Limits to growth? Aka Mind versus Matter

- *Tool/concept*: Sustainability, green accounting, technology progress
- Week 13
 - *Date*: 28 April 2021
 - *Topic*: What could possibly go wrong? Aka The Three Horsemen of the Climate Policy Apocalypse: Rebound, Spatial & Temporal Leakage
 - *Tool/concept*: Rebound effect, spatial leakage, Green Paradox (temporal leakage)
 - *Deliverable*: Essay 2 due by 6:45 p.m. via NYU Classes
- Week 14
 - *Date*: 5 May 2021
 - *Topic*: How to make the planet notice Aka Economic thinking applied to environmental problems
 - *Tools/concepts*: Review & wrap-up
 - *Deliverable*: Essay 3 due by 6:45 p.m. via NYU Classes
- Week 15: FINAL EXAM (exact date to be announced via Albert)

Detailed Course Overview

“TEXT” here will refer to: Keohane, Nathaniel and Sheila Olmstead, [*Markets and the Environment, Second Edition*](#), Island Press, 2016. (Not this is the second edition, considerably updated from the first.)

“PLANET” here will refer to: Wagner, Gernot, [*But will the planet notice? How Smart Economics Can Save the World*](#), Farrar, Strauss & Giroux/Hill & Wang, 2011. (Page number are equal across hardcover, paperback, and electronic editions.)

WEEK 1: How costly is climate change, and why does it matter? Aka How to think like a climate/environmental economist

Readings

1. Wagner, Gernot and Martin L. Weitzman, [*Climate Shock: the economic consequences of a hotter planet*](#), Princeton University Press, 2015: Preface, pp. ix-xi.
2. TEXT, pp. 11-34, 80-90: Chapter 2 "Economic Efficiency and Environmental Protection" and Chapter 5 "Market Failures in the Environmental Realm", the first two subsections: "Externalities" and "Public Goods."
3. PLANET, pp. 3-14: Preface "Doing Good."
4. Wagner, Gernot. ["Why Oil Giants Figured Out Carbon Costs First."](#) *Bloomberg Green Risky Climate* column, 22 January 2020.

Recommended Reading¹

1. Coase, Ronald. "[The Problem of Social Cost](#)," *Journal of Law and Economics* 3, 1960: pp. 1-44.

WEEK 2: Why benefit-cost analysis (should) reign(s) supreme

Readings

1. Please make sure you review last week's readings, especially if you didn't do so already before the first class.
2. TEXT, pp. 35-68: Chapter 3 "The Benefits and Costs of Environmental Protection."
3. Arrow *et al*, "[Is There a Role for Benefit-Cost Analysis in Environmental, Health, and Safety Regulation?](#)" *Science* 272(5259), 1996: pp. 221-222.

Recommended Readings

1. Arrow *et al.*, "[Determining Benefits and Costs for Future Generations](#)," *Science* 341(6144), 2013: pp. 349-350.
2. Gayer and Viscusi, "[Resisting Abuses of Benefit-Cost Analysis](#)," *National Affairs*, Spring 2016

WEEK 3: How to calculate the benefits of environmental protection

Readings

1. TEXT, pp. 48-53: (re-read) Chapter 3's subsection on "Evaluating the Benefits"
2. Slides for lectures 5, 6, and 7 from Rob Stavins's introductory environmental economics class²

Recommended Readings

1. 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: pp. 2-26.
2. Carson, Richard T. "Contingent Valuation: A Practical Alternative when Prices Aren't Available." *Journal of Economic Perspectives* 26(4), 2012: pp. 27-42.
3. Hausman, Jerry A. "Contingent Valuation: From Dubious to Hopeless." *Journal of Economic Perspectives* 26(4), 2012: pp. 43-56.

¹ Recommended readings are typically academic, oft-technical papers that aren't required but good to have taken a look at. Coase's essay is not, in fact, technical. It surely is a classic, though.

² See Acknowledgments section below.

WEEK 4: How far how fast on climate? Aka what's the “optimal” carbon price?

Readings

1. William D. Nordhaus, “[Why the global warming skeptics are wrong](#),” *New York Review of Books* (March 22, 2012).
2. Wagner, Gernot and Martin L. Weitzman, [Climate Shock: the economic consequences of a hotter planet](#), Princeton University Press, 2015: chapter 3, “Fat Tails.”
3. [Re-read:] Wagner, Gernot. “[Why Oil Giants Figured Out Carbon Costs First](#).” *Bloomberg Green Risky Climate* column, 22 January 2020.

Recommended Readings

1. U.S. Office of Management and Budget, [Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis](#), August 2016 update. [Don't read in detail. Look at the gist, and the summary tables.]
2. Ricke, Katharine, Laurent Drouet, Ken Caldeira and Massimo Tavoni, “[Country-level social cost of carbon](#),” *Nature Climate Change* (24 September 2018).

WEEK 5: Optimal extraction of non-renewable resources

Readings

1. TEXT, pp. 99-112: Chapter 6, “Managing Stocks: Natural Resources as Capital Assets”
2. Covert, Thomas, Michael Greenstone and Christopher R. Knittel. “[Will We Ever Stop Using Fossil Fuels?](#)” *Journal of Economic Perspectives* 30(1), 2016:

Recommended Reading

1. Solow, Robert M. “[The Economics of Resources or the Resources of Economics](#).” *American Economic Review* 64(2), 1974: pp. 1-14.

WEEK 6: Renewable resources & common property problems

Readings

1. TEXT, pp. 114-137: Chapter 7, “Stocks that Grow: The Economics of Renewable Resource Management”
2. PLANET, pp. 79-101: “Fewer Fish, More Dough”
3. Stavins, “[The Problem of the Commons: Still Unsettled After 100 Years](#).” *American Economic Review* 101(1), 2011: pp. 81-108. [Focus especially on Part I]

Recommended Reading

1. TEXT, pp. 184-189: Chapter 9's subsection on “Market-based instruments for managing natural resources.”

WEEK 7: in-class MIDTERM EXAM

WEEK 8: Economics of pollution control

Readings

1. TEXT, pp. 138-161 and 166: Chapter 8, "Principles of Market-Based Environmental Policy," except for subsection on "Setting Prices versus Setting Quantities"
2. TEXT, pp. 167-198: Chapter 9, "The Case for Market-Based Instruments in the Real World" (Note that pp. 184-189, "Market-based instruments for managing natural resources" covers renewable resources, from week 6.)

Recommended Reading

1. Aldy, Joseph E., Maximilian Auffhammer, Maureen L. Cropper, Arthur G. Fraas, Richard Morgenstern, "[Looking Back at Fifty Years of the Clean Air Act](#)," NBER Working Paper No. 26687, January 2020.

WEEK 9: Prices vs. Quantities

Readings

1. TEXT, pp. 162-166: Chapter 8's subsection on "Setting Prices versus Setting Quantities"
2. PLANET, pp. 102-125: Chapter 5, "Curious Company Kept"

Recommended Readings

1. Weitzman, M.L., "[Prices vs. quantities](#)," *The Review of Economic Studies* 41(4), 1974: pp.477-491.
2. Wagner, Gernot, "[Marty Weitzman, In Memoriam](#)," *Resources*, 29 August 2019.
3. Schmalensee, Richard and Robert N. Stavins. "[The SO₂ Allowance Trading System: The Ironic History of a Grand Policy Experiment](#)," *Journal of Economic Perspectives* 27(1), 2013: pp. 103-22.

WEEK 10: Prices vs. Subsidies

Readings

1. PLANET, pp. 174-183: Chapter 8, "Bright Idea"
1. Jaffe, Adam, Richard Newell and Robert Stavins. "[A tale of two market failures: technology and environmental policy](#)," *Ecological Economics* 54, 2005: pp. 164-74.
2. Wagner, Gernot, Tomas Kåberger, Susanna Olai, Michael Oppenheimer, Katherine Rittenhouse, and Thomas Sterner. "[Push renewables to spur carbon pricing](#)" *Nature* 525: 27–29 (3 September 2015).

Recommended Readings

1. van Benthem, Arthur, Kenneth Gillingham and James Sweeney. "[Learning-by doing and the optimal solar policy in California](#)," *The Energy Journal* 29, 2008: pp. 131-51.
2. Borenstein, Severin. "[The Private and Public Economics of Renewable Electricity Generation](#)," *Journal of Economic Perspectives* 26(1), Winter 2012.
3. Acemoglu, Daron, Philippe Aghion, Leonardo Bursztyn, and David Hemous. "[The Environment and Directed Technical Change](#)," *American Economic Review*, 102(1), 2012: pp. 131-66. [skim abstract and introduction]

WEEK 11: Global (warming) problem, global solution

Readings

1. Stavins, "[The Problem of the Commons: Still Unsettled After 100 Years](#)," *American Economic Review* 101(1), 2011: pp. 81-108. [Part II]
2. Victor, David, "[Why Paris Worked: A Different Approach to Climate Diplomacy](#)," *Yale Environment* 360, (December 15, 2015).
3. Fabre, Adrien and Gernot Wagner, "[Risky geoengineering option can make ambitious climate mitigation agreement more likely](#)," *NYU Wagner Research paper* (9 December 2019).

Recommended Readings

1. Barrett, Scott, "[The problem of global environmental protection](#)," *Oxford Review of Economic Policy* 6(1), 1990: pp. 68-79.
2. Green, Jessica F., Thomas Sterner, and Gernot Wagner. "[A balance of bottom-up and top-down in linking climate policies](#)," *Nature Climate Change* 4.12 (2014): pp. 1064-7.

WEEK 12: Limits to growth? Aka Mind versus Matter

Readings

1. TEXT, pp. 231-253: Chapter 11: "Sustainability and Economic Growth"
2. PLANET, pp. 125-150: Chapter 6, "Mind versus Matter"
3. En-ROADS Climate Change Solutions Simulator, www.en-roads.org [Explore the tool]
4. Stavins, Robert N., Alexander F. Wagner, and Gernot Wagner. "[Interpreting sustainability in economic terms: dynamic efficiency plus intergenerational equity](#)," *Economics Letters* 79(3), 2003: pp. 339-343.

Recommended Reading

1. Nordhaus, William D., Robert N. Stavins, and Martin L. Weitzman. "[Lethal model 2: the limits to growth revisited](#)," *Brookings papers on economic activity* 1992(2), 1992: 1-59.

WEEK 13: What could possibly go wrong? Aka The Three Horsemen of the Climate Policy Apocalypse: Rebound, Spatial & Temporal Leakage

Readings

1. Gillingham, Ken, David Rapson, and Gernot Wagner. "[The Rebound Effect and Energy Efficiency Policy](#)," *Review of Environmental Economics and Policy* 10(1), 2016: pp. 66-88.
2. Jensen, Sverre, Kristina Mohlin, Karen Pittel, and Thomas Sterner, "[An Introduction to the Green Paradox: The Unintended Consequences of Climate Policies](#)," *Review of Environmental Economics and Policy* 9(2), 2015: pp. 246-265.
3. Dechezleprêtre, Antoine, and Misato Sato. "[The impacts of environmental regulations on competitiveness](#)." *Review of Environmental Economics and Policy* 11(2), 2017: pp. 183-206.

Recommended Reading

1. Revkin, Andrew C. "[Another Round on Energy Rebound](#)." *New York Times DotEarth* blog, 24 October 2014.

WEEK 14: How to make the planet notice Aka Economic thinking applied to environmental problems

Readings

1. TEXT, pp. 199-230 and 254-258: Chapters 10, "Market-Based Instruments in Practice," and 12: "Conclusion."
2. PLANET, pp. 59-78 and 205-216: Chapters 3, "All-or-nothing Conservation," and 10, "Market morals."

NYU Classes

All announcements, resources, and assignments will be delivered through the NYU Classes site.

Academic Integrity

Academic integrity is a vital component of Wagner and NYU. All students enrolled in this class are required to read and abide by [Wagner's Academic Code](#). All Wagner students have already read and signed the [Wagner Academic Oath](#). Plagiarism of any form will not be tolerated and students in this class are expected to report violations to me. If any student in this class is unsure about what is expected of you and how to abide by the academic code, you should consult with me.

Henry and Lucy Moses Center for Students with Disabilities at NYU

Academic accommodations are available for students with disabilities. Please visit the [Moses Center for Students with Disabilities \(CSD\) website](#) and click on the Reasonable Accommodations and How to Register tab, or call or email CSD at (212) 998-4980 or mosescsd@nyu.edu for information. Students who are requesting academic accommodations are strongly advised to reach out to the Moses Center as early as possible in the semester for assistance.

NYU's Calendar Policy on Religious Holidays

[NYU's Calendar Policy on Religious Holidays](#) states that members of any religious group may, without penalty, absent themselves from classes when required in compliance with their religious obligations. Please notify me in advance of religious holidays that might coincide with exams to schedule mutually acceptable alternatives.

Acknowledgments

This syllabus is primarily based on the structure and content of three sets of classes:

First, [Rob Stavins](#)'s introductory environmental economics class, now titled "economics of climate change and environmental policy," a version of which he has taught at Harvard Kennedy School for over two decades. His class is extremely well-structured, logical, and comprehensive. It's based around building the tools—the hammer.

Second, the late, great [Marty Weitzman](#)'s various advanced environmental economics classes. His classes jumped from topic to topic, building tools along the way—sometimes literally right then and there during lecture. Where Rob's class introduced structure and predictability, Marty focused on teaching nimbleness, flexibility, and creativity in approaching various topics. His primary focus was always the question and problem itself—the tool came later. His focus: the nail.

Third, parts of this class have evolved from climate and energy economics and policy classes I have taught at various institutions, including Columbia, NYU Stern, and Harvard. Its first incarnation was largely based on Snorre Kverndokk and Knut Einar Rosendahl's Energy Economics class taught at Johns Hopkins in Spring 2009 and has benefited greatly from Richard Zeckhauser's Analytic Frameworks for Policy class at Harvard, as well as from his mentorship and guidance over the years. Prior iterations have also taken some cues from Bill Hogan's Energy Policy Analysis class at Harvard, Paul Joskow's former Energy Economics class at MIT, Erin Mansur's former Energy Economics & the Environment class at Yale, and Jim Stock's U.S. Energy Revolution and its Implications seminar at Harvard, and valuable feedback from, among others, Joe Aldy, Ken Gillingham, Matt Kahn, Katherine Rittenhouse, Steve Salant, Rob Stavins, Thomas Sterner, Marty Weitzman, Matthew Zaragoza-Watkins, participants in an [OurEnergyPolicy.org](#) discussion forum, and students at Columbia, Harvard, and NYU who have taken versions of this course in the past. Thank you to all.

Anything seems off? Please [let me know](#).