

**AEA Continuing Education Workshop
Climate Change Economics
January 2020**

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Reading List

This is a highly selective list of readings and websites keyed to each of the modules of the workshop. Readings marked with an asterisk are especially useful. Papers that are discussed in multiple modules of the course are listed in multiple sections below.

I. Global Energy Systems and Markets

Burgess, Robin, Olivier Deschenes, Dave Donaldson, and Michael Greenstone. "Weather, Climate Change and Death in India." (2019). Mimeograph.

Covert, Thomas, Michael Greenstone, and Christopher R. Knittel. "Will we ever stop using fossil fuels?." *Journal of Economic Perspectives* 30, no. 1 (2016): 117-38.

*Duflo, Esther, Michael Greenstone, Rohini Pande, and Nicholas Ryan. "Truth-telling by third-party auditors and the response of polluting firms: Experimental evidence from India." *The Quarterly Journal of Economics* 128, no. 4 (2013): 1499-1545.

*Ebenstein, Avraham, Maoyong Fan, Michael Greenstone, Guojun He, and Maigeng Zhou. "New evidence on the impact of sustained exposure to air pollution on life expectancy from China's Huai River Policy." *Proceedings of the National Academy of Sciences* 114, no. 39 (2017): 10384-10389.

Greenstone, Michael, and Claire Qing Fan. "Introducing the Air Quality Life Index." (2018).

Greenstone, Michael. "If We Dig Out All Our Fossil Fuels, Here's How Hot We Can Expect It to Get." *New York Times*, April 8, 2015. <https://www.nytimes.com/2015/04/09/upshot/if-we-dig-out-all-our-fossil-fuels-heres-how-hot-we-can-expect-it-to-get.html>

II. Climate Science Basics¹

Eckaus, Richard. 1992. "Comparing the Effects of Greenhouse Gas Emissions on Global Warming." *The Energy Journal*, 13(1), 25-35.

¹ IPCC reports such as the Assessment Reports or Special Reports provide a Technical Summary (TS) and a Summary for Policy Makers (SPM). The latter are heavily negotiated by politicians and so, while shorter, are less useful than the Technical Summaries.

*IPCC Working Group I, 2013. *The Physical Science Basis*, Fifth Assessment Report.

IPCC Working Group III. 2014. *Glossary*.

*IPCC. 2018. *Global Warming of 1.5 Degrees C*, Special Report

NOAA Climate.gov, *Climate Data Primer*

Schmalensee, Richard. 1993. "Comparing Greenhouse Gases for Policy Purposes." *The Energy Journal*, 14(1), 245-255.

Skeptical Science website summarizes common arguments by climate skeptics along with the scientific evidence to refute those claims.

Prof. Katherine Kayoe's Twitter thread summarizing the evidence backing anthropogenic climate change is excellent and points to a good deal of hard evidence in graphs.

III. Basic Climate Change Economics

*Becker, Gary S., Kevin M. Murphy, and Robert H. Topel. "On the economics of climate policy." *The BE Journal of Economic Analysis & Policy* 10, no. 2 (2011).

Daniel, Kent D., Robert B. Litterman, and Gernot Wagner. "Declining CO2 price paths." *Proceedings of the National Academy of Sciences* 116, no. 42 (2019): 20886-20891.

Deshpande, Manasi, and Michael Greenstone. "Comment on 'On the Economics of Climate Policy': Is Climate Change Mitigation the Ultimate Arbitrage Opportunity?." *The BE Journal of Economic Analysis & Policy* 10 (2011).

Greenstone, Michael. "What Financial Markets Can Teach Us About Managing Climate Risks." *New York Times*, April 4, 2017. <https://www.nytimes.com/2017/04/04/upshot/what-financial-markets-can-teach-us-about-managing-climate-risks.html>

Murphy, Kevin M., and Robert H. Topel. "The value of health and longevity." *Journal of Political Economy* 114, no. 5 (2006): 871-904.

Stern, Nicholas. *The economics of climate change: the Stern review*. Cambridge University Press, 2007.

Weitzman, Martin L. "On modeling and interpreting the economics of catastrophic climate change." *The Review of Economics and Statistics* 91, no. 1 (2009): 1-19.

IV. IAMs and Macro Models

A. *Integrated Assessment and Macro Models of Climate Change*

Anthoff, David, and Richard Tol. "The Climate Framework for Uncertainty, Negotiation, and Distribution (FUND), Technical Description, Version 3.9" (2014).

Barrage, Lint (2014): "Sensitivity Analysis for Golosov, Hassler, Krusell, and Tsyvinski (2014): 'Optimal Taxes on Fossil Fuel in General Equilibrium'," *Econometrica Supplemental Material*, 82 [http://www.econometricsociety.org/ecta/supmat/10217_extensions.pdf]

*Cai, Yongyang, and Thomas S. Lontzek. "The social cost of carbon with economic and climate risks." *Journal of Political Economy* 127, no. 6 (2019): 000-000.

*Golosov, Mikhail, John Hassler, Per Krusell, and Aleh Tsyvinski. "Optimal taxes on fossil fuel in general equilibrium." *Econometrica* 82, no. 1 (2014): 41-88.

Hassler, John, and Per Krusell. "Economics and climate change: integrated assessment in a multi-region world." *Journal of the European Economic Association* 10, no. 5 (2012): 974-1000.

Hope, Chris. 2006. The Marginal Impact of CO2 from PAGE 2002. *Integrated Assessment Journal* 6 (1): 9-56

Knutti, Reto, and Gabriele C. Hegerl. "The equilibrium sensitivity of the Earth's temperature to radiation changes." *Nature Geoscience* 1, no. 11 (2008): 735.

Krusell, Per, and Anthony Smith. "Climate Change Around the World" Slides from ifo Institute Workshop on 'Heterogeneous Agents and the Macroeconomics of Climate Change', Munich, Germany. [<http://www.econ.yale.edu/smith/munich2.pdf>]

Lemoine, Derek. "The Climate Risk Premium: How Uncertainty Affects the Social Cost of Carbon." (2019) Working paper.

Lemoine, Derek, and Ivan Rudik. "Managing climate change under uncertainty: Recursive integrated assessment at an inflection point." *Annual Review of Resource Economics* 9 (2017): 117-142.

Machta, Lester. "The role of the oceans and biosphere in the carbon dioxide cycle. The changing chemistry of the ocean." In *Proceedings of the Twentieth Nobel Symp.*, pp. 121-145. Wiley Interscience, 1972.

Nordhaus, William D., and James Tobin. "Is growth obsolete?." In *Economic Research: Retrospect and prospect*, Volume 5, Economic growth, pp. 1-80. NBER 1972.

Nordhaus, William D. "Resources as a Constraint on Growth." *The American Economic Review* 64, no. 2 (1974): 22-26.

Nordhaus, William D. "Can we control carbon dioxide?" IIASA WP-75--63 (1975a).

Nordhaus, William D. "Economic growth and climate: the carbon dioxide problem." *The American Economic Review* (1977): 341-346.

Nordhaus, William D. "Thinking about Carbon Dioxide: Theoretical and Empirical Aspects of Optimal Control Strategies" Cowles Foundation Discussion Paper No. 565 (1980), Yale University.

Nordhaus, William D. "An optimal transition path for slowing climate change." *Science* 20 (1992): 1315-1319.

*Nordhaus, William D. (2008) *A Question of Balance*, Yale University Press, New Haven, CT.

Nordhaus, William D. (2010a) "Economic aspects of global warming in a post-Copenhagen environment" *Proceedings of the National Academy of Sciences*, 107(26): 11721-11726.

*Nordhaus, William D. "Revisiting the social cost of carbon." *Proceedings of the National Academy of Sciences* 114, no. 7 (2017): 1518-1523.

Nordhaus, William D. "Evolution of modeling of the economics of global warming: Changes in the DICE model, 1992--2017." *Climatic Change* 148, no. 4 (2018a): 623-640.

Nordhaus, William D., and Boyer, Joseph (2000) *Warming the World: Economic Models of Global Warming*, MIT Press, Cambridge, MA.

Nordhaus, William D. and David Popp "What is the Value of Scientific Knowledge? An Application to Global Warming Using the PRICE Model." *Energy Journal* 18 (1997): 1-47.

Nordhaus, William D., and Zili Yang. "RICE: a regional dynamic general equilibrium model of optimal climate-change policy." *American Economic Review* 86, no. 4 (1996): 741-765.

Pizer, William A. "The optimal choice of climate change policy in the presence of uncertainty." *Resource and Energy Economics* 21, no. 3-4 (1999): 255-287.

Toda, Alexis A. and Kieran J. Walsh (2019): "The Equity Premium and the One Percent" Forthcoming, *Review of Financial Studies*.

Traeger, Christian P. "ACE—analytic climate economy (with temperature and uncertainty)." *Working Paper* (2018).

Van den Bremer, Ton S., and Rick van der Ploeg. "The risk-adjusted carbon price." *Working Paper* (2019).

B. What do we know about Climate Change's Impacts?

*Carleton, Tamma, Michael Delgado, Michael Greenstone, Trevor Houser, Solomon Hsiang, Andrew Hultgren, Amir Jina et al. "Valuing the Global Mortality Consequences of Climate Change Accounting for Adaptation Costs and Benefits." (2019).

*Interagency Working Group on Social Cost of Greenhouse Gases. "Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866." Environmental Protection Agency (2016).

National Academies of Sciences, Engineering and Medicine. "Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide." (2017).

C. Climate-Economy Models: Challenges and New Frontiers

Acemoglu, Daron. "Directed technical change." *The Review of Economic Studies* 69, no. 4 (2002): 781-809.

*Acemoglu, Daron, Philippe Aghion, Leonardo Bursztyn, and David Hemous. "The environment and directed technical change." *American economic review* 102, no. 1 (2012): 131-66.

Acemoglu, Daron, Ufuk Akcigit, Douglas Hanley, and William Kerr. "Transition to clean technology." *Journal of Political Economy* 124, no. 1 (2016): 52-104.

Acemoglu, Daron, Philippe Aghion, Lint Barrage, and David Hemous. "Climate Change, Directed Innovation, and Energy Transition: The Long-run Consequences of the Shale Gas Revolution" *WP*.

Aghion, Philippe, Antoine Dechezleprêtre, David Hemous, Ralf Martin, and John Van Reenen. "Carbon taxes, path dependency, and directed technical change: Evidence from the auto industry." *Journal of Political Economy* 124, no. 1 (2016): 1-51.

Calel, Raphael, and Antoine Dechezlepretre. "Environmental policy and directed technological change: evidence from the European carbon market." *Review of economics and statistics* 98, no. 1 (2016): 173-191.

Casey, Gregory. "Energy Efficiency and Directed Technical Change: Implications for Climate Change Mitigation" *WP*.

- Chichilnisky, Graciela, and Geoffrey Heal. "Who should abate carbon emissions?: An international viewpoint." *Economics Letters* 44, no. 4 (1994): 443-449.
- Fried, Stephanie. "Climate policy and innovation: A quantitative macroeconomic analysis." *American Economic Journal: Macroeconomics* 10, no. 1 (2018): 90-118.
- Gillingham, Kenneth, Richard G. Newell, and William A. Pizer. "Modeling endogenous technological change for climate policy analysis." *Energy Economics* 30, no. 6 (2008): 2734-2753.
- Harstad, Bård. "Buy coal! A case for supply-side environmental policy." *Journal of Political Economy* 120, no. 1 (2012): 77-115.
- Hassler, John, and Per Krusell. "Economics and climate change: integrated assessment in a multi-region world." *Journal of the European Economic Association* 10, no. 5 (2012): 974-1000.
- Hémous, David. "The dynamic impact of unilateral environmental policies." *Journal of International Economics* 103 (2016): 80-95.
- Lemoine, Derek. "Innovation-led transitions in energy supply." National Bureau of Economic Research WP No. w23420 (2018).
- Lemoine, Derek, and Christian Traeger. "Watch your step: optimal policy in a tipping climate." *American Economic Journal: Economic Policy* 6, no. 1 (2014): 137-66.
- Lenton, Timothy M., Hermann Held, Elmar Kriegler, Jim W. Hall, Wolfgang Lucht, Stefan Rahmstorf, and Hans Joachim Schellnhuber. "Tipping elements in the Earth's climate system." *Proceedings of the National Academy of Sciences* 105, no. 6 (2008): 1786-1793.
- Millner, Antony. "On welfare frameworks and catastrophic climate risks." *Journal of Environmental Economics and Management* 65, no. 2 (2013): 310-325.
- Newell, R.G., Jaffe, A.B. and Stavins, R.N., 1999. The induced innovation hypothesis and energy-saving technological change. *The Quarterly Journal of Economics*, 114(3), pp.941-975.
- Nordhaus, William. "Economics of the disintegration of the Greenland ice sheet." *Proceedings of the National Academy of Sciences* 116, no. 25 (2019): 12261-12269.
- Nordhaus, William. "Climate clubs: Overcoming free-riding in international climate policy." *American Economic Review* 105, no. 4 (2015): 1339-70.

Nordhaus, William D. "Economic aspects of global warming in a post-Copenhagen environment." *Proceedings of the National Academy of Sciences* 107, no. 26 (2010): 11721-11726.

Nordhaus, William. "An analysis of the dismal theorem." *Cowles Foundation WP 1686*. URL: <https://cowles.yale.edu/sites/default/files/files/pub/d16/d1686.pdf>

Nordhaus, William D. "The economics of an integrated world oil market." In *International Energy Workshop*, pp. 17-19. (2009).

Nordhaus, William D., and Zili Yang. "A regional dynamic general-equilibrium model of alternative climate-change strategies." *The American Economic Review* (1996): 741-765.

Popp, David. "Induced innovation and energy prices." *American economic review* 92, no. 1 (2002): 160-180.

Robinson, Alexander, Reinhard Calov, and Andrey Ganopolski. "Multistability and critical thresholds of the Greenland ice sheet." *Nature Climate Change* 2, no. 6 (2012): 429.

Sinn, Hans-Werner. "Public policies against global warming: a supply side approach." *International Tax and Public Finance* 15, no. 4 (2008): 360-394.

*Weitzman, Martin L. "On modeling and interpreting the economics of catastrophic climate change." *The Review of Economics and Statistics* 91, no. 1 (2009): 1-19.

V. Policy

A. Policy Goals

Daniel, Kent D.; Robert B. Litterman and Gernot Wagner. 2019. "Declining CO₂ Price Paths." *Proceedings of the National Academy of Sciences*, 116(42), 20886-20891.

Klenert, David; Linus Mattauch; Emmanuel Combet; Ottmar Edenhofer; Cameron Hepburn; Ryan Rafaty and Nicholas Stern. 2018. "Making Carbon Pricing Work for Citizens." *Nature Climate Change*, 8(8), 669-677.

Mercator Institute, Carbon Budget Clock. <https://www.mcc-berlin.net/en/research/co2-budget.html>

Riahi, K. et al., 2017. "The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas emissions implications: An overview," *Global Environmental Change* 42, 153-168.

B. *Empirical Evaluations of Climate Mitigation Policies*

*Fowlie, Meredith, Michael Greenstone, and Catherine Wolfram. "Do energy efficiency investments deliver? Evidence from the weatherization assistance program." *The Quarterly Journal of Economics* 133, no. 3 (2018): 1597-1644.

*Gillingham, Kenneth, and James H. Stock. "The cost of reducing greenhouse gas emissions." *Journal of Economic Perspectives* 32, no. 4 (2018): 53-72.

*Greenstone, Michael, and Ishan Nath. "Do Renewable Portfolio Standards Deliver?." University of Chicago, Becker Friedman Institute for Economics Working Paper 2019-62 (2019).

C. *Market Based Policy Approaches*

*Metcalf, Gilbert E. 2019. *Paying for Pollution: Why a Carbon Tax Is Good for America*. New York: Oxford University Press.

*Metcalf, Gilbert E. 2019. "On the Economics of a Carbon Tax for the United States." *Brookings Papers on Economic Activity*, (Spring), 405-458.

*Weitzman, Martin. 1974. "Prices vs. Quantities." *Review of Economic Studies*, 41(4), 477-491.

Weitzman, Martin. 2018. "Prices or Quantities Dominate Banking and Borrowing," National Bureau of Economic Research Working Paper No. 24218, NBER: Cambridge, MA.

D. *Other Policy Approaches*

Aaheim, Asbjørn; Bård Romstad; Taoyuan Wei; Jón Egill Kristjánsson; Helene Muri; Ulrike Niemeier and Hauke Schmidt. 2015. "An Economic Evaluation of Solar Radiation Management." *Science of The Total Environment*, 532, 61-69.

Allcott, Hunt and Judd B. Kessler. 2019. "The Welfare Effects of Nudges: A Case Study of Energy Use Social Comparisons." *American Economic Journal: Applied Economics*, 11(1), 236-276.

Allcott, Hunt and Todd Rogers. 2014. "The Short-Run and Long-Run Effects of Behavioral Interventions: Experimental Evidence from Energy Conservation." *American Economic Review*, 104(10), 3003-3037.

*Barrett, Scott. 2008. "The Incredible Economics of Geoengineering." *Environmental and Resource Economics*, 39(1), 45-54.

- Boomhower, Judson and Lucas W. Davis. 2014. "A Credible Approach for Measuring Inframarginal Participation in Energy Efficiency Programs." *Journal of Public Economics*, 113, 67-79.
- Chandra, Ambarish; Sumeet Gulati and Milind Kandlikar. 2010. "Green Drivers or Free Riders? An Analysis of Tax Rebates for Hybrid Vehicles." *Journal of Environmental Economics and Management*, 60, 78-93.
- Greenstone, Michael and Nathan, Ishan, Do Renewable Portfolio Standards Deliver? (May 9, 2019). University of Chicago, Becker Friedman Institute for Economics Working Paper No. 2019-62. Available at SSRN: <https://ssrn.com/abstract=3374942> or <http://dx.doi.org/10.2139/ssrn.3374942>
- Hagmann, David; Emily H. Ho and George Loewenstein. 2019. "Nudging out Support for a Carbon Tax." *Nature Climate Change*, 9(6), 484-489.
- Holland, Stephen P.; Jonathan E. Hughes and Christopher R. Knittel. 2009. "Greenhouse Gas Reductions under Low Carbon Fuel Standards." *American Economic Journal: Economic Policy*, 1(1), 106-146.
- 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.
- Knittel, Christopher R.; Ben S. Meiselman and James H. Stock. 2017. "The Pass-through of RIN Prices to Wholesale and Retail Fuels under the Renewable Fuel Standard." *Journal of the Association of Environmental and Resource Economists*, 4(4), 1081-1119.
- Moreno-Cruz, Juan B. 2015. "Mitigation and the Geoengineering Threat." *Resource and Energy Economics*, 41, 248-263.
- Soden, Brian J.; Richard T. Wetherald; Georgiy L. Stenchikov and Alan Robock. 2002. "Global Cooling after the Eruption of Mount Pinatubo: A Test of Climate Feedback by Water Vapor." *Science*, 296(5568), 727-730.
- E. Distributional Impacts*
- Borenstein, Severin and Lucas W. Davis. 2016. "The Distributional Effects of U.S. Clean Energy Tax Credits." *Tax Policy and the Economy*, 30, 191-234.
- Cronin, Julie-Anne; Don Fullerton and Steven E. Sexton. 2019. "Vertical and Horizontal Redistributions from a Carbon Tax and Rebate." *Journal of the Association of Environmental and Resource Economists*, 6(S1), S169-208.

Davis, Lucas W. and Christopher R. Knittel. 2019. "Are Fuel Economy Standards Regressive?" *Journal of the Association of Environmental and Resource Economists*, 6(S1), S37-S63.

Fullerton, Don; Garth Heutel and Gilbert E. Metcalf. 2011. "Does the Indexing of Government Transfers Make Carbon Pricing Progressive?" *American Journal of Agricultural Economics*, 94(2), 347-353.

*Goulder, Lawrence H.; Marc A. C. Hafstead; GyuRim Kim and Xianling Long. 2019. "Impacts of a Carbon Tax across US Household Income Groups: What Are the Equity-Efficiency Trade-Offs?" *Journal of Public Economics*, 175, 44-64.

Hassett, Kevin A.; Aparna Mathur and Gilbert E. Metcalf. 2009. "The Incidence of a U.S. Carbon Tax: A Lifetime and Regional Analysis." *The Energy Journal*, 30(2), 157-179.

Jacobsen, Mark R. 2013. "Evaluating U.S. Fuel Economy Standards in a Model with Producer and Household Heterogeneity." *American Economic Journal: Economic Policy*, 5(2), 148-187.

Rausch, Sebastian; Gilbert E. Metcalf and John M. Reilly. 2011. "Distributional Impacts of Carbon Pricing: A General Equilibrium Approach with Micro-Data for Households." *Energy Economics*, 33, S20-S33.

F. *Economic Impacts*

Andersson, Julius J. 2019. "Carbon Taxes and CO₂ Emissions: Sweden as a Case Study." *American Economic Journal: Economic Policy*, 11(4), 1-30.

Bernard, Jean-Thomas; Maral Kichian and Misbahul Islam. 2018. "Effects of B.C.'S Carbon Tax on GDP," USAEE, Research Paper Series No. 18-329.

Elgie, Stewart and Jessica McClay. 2013. "BC's Carbon Tax Shift after Five Years: Results," Sustainable Prosperity, Ottawa.

Meng, Kyle C. and Ashwin Rode. 2019. "The Social Cost of Lobbying over Climate Policy." *Nature Climate Change*, 9(6), 472-476.

Metcalf, Gilbert E. 2016. "A Conceptual Framework for Measuring the Effectiveness of Green Fiscal Reforms." *International Journal on Green Growth and Development*, 2(2), 87-126.

*Metcalf, Gilbert E. and James H. Stock. 2020. "Measuring the Macroeconomic Impacts of Carbon Taxes." *American Economic Review: Papers and Proceedings*.

World Bank Group. 2019. "States and Trends of Carbon Pricing 2019," World Bank Group, Washington DC.

Yamazaki, Akio. 2017. "Jobs and Climate Policy: Evidence from British Columbia's Revenue-Neutral Carbon Tax." *Journal of Environmental Economics and Management*, 83, 197-216.

G. *Political Economy and Second Best*

Acemoglu, Daron; Philippe Aghion; Leonardo Bursztyn and David Hemous. 2012. "The Environment and Directed Technical Change." *American Economic Review*, 102(1), 131-166.

Berkouwer, Susanna B. and Joshua T. Dean. 2019. "Credit and Attention in the Adoption of Profitable Energy Efficient Technologies in Kenya," Department of Agricultural and Resource Economics, UC Berkeley.

*Bovenberg, A. Lans and Ruud A. de Mooij. 1994. "Environmental Levies and Distortionary Taxation." *American Economic Review*, 84, 1085-.

Klenert, David; Linus Mattauch; Emmanuel Combet; Ottmar Edenhofer; Cameron Hepburn; Ryan Rafaty and Nicholas Stern. 2018. "Making Carbon Pricing Work for Citizens." *Nature Climate Change*, 8(8), 669-677.

Meng, Kyle C. and Ashwin Rode. 2019. "The Social Cost of Lobbying over Climate Policy." *Nature Climate Change*, 9(6), 472-476.