This class is a seminar, limited to 15 participants. It involves a lot of reading and discussion!

Starting on February 20, students will take turns (2 per class) in preparing short (3-5 pages) summaries and comments on the readings, to distribute to the class; when it’s your turn, you will also help lead the class discussion. Everyone will do this 3 times during the class. In addition to these 3 short papers, there will be a final paper, due at the last class, exploring a topic related to the course in greater detail. There will be no exams.

How to contact me: email frank_a@mit.edu. Office hours (room 9-330) are by appointment only, preferably on Tuesdays and Thursdays before or after class. (On other days I am often at Synapse Energy Economics in Central Square, about a 10-minute walk.)

Part I: The Big Picture

**Feb 4  Introduction to the class and overview of topics to be covered**

William Steinhurst, “The electric industry at a glance”

**Feb 6  History of electric utilities and regulation**


Nidhi Thakar, “The urge to merge: A look at the repeal of the Public Utility Holding Company Act of 1935”

**Feb 11  Deregulation: economic arguments for and against it; the California crisis.**

Severin Borenstein, “The trouble with electricity markets: Understanding California’s restructuring disaster”

Darren Bush and Carrie Mayne, “In (reluctant) defense of Enron: Why bad regulation is to blame for California’s power woes…”
James Bushnell and Catherine Wolfram, “Ownership change, incentives, and plant efficiency: The divestiture of U.S. electric generation plants”

**Feb 13**  *How the grid works today: ISOs, marginal costs, dispatch, planning, etc. (Guest presentation by Bruce Biewald, CEO of Synapse Energy Economics.)*

**Feb 20**  *Overview of environmental impacts of electricity production*

James Hansen et al., “Assessing ‘Dangerous climate change’…”

Geoff Keith et al., “The hidden costs of electricity”

Melissa Whited et al., “Water constraints on energy production: Altering our current collision course” [read through part 3]

**Part II: Efficiency and Renewables**

**Feb 25**  *Energy efficiency, 1: How much does it cost?*

McKinsey & Company, “Pathways to a low-carbon economy, version 2” [read through Chapter 4]

Rose Murphy and Mark Jaccard, “Energy efficiency and the cost of GHG abatement: A comparison of bottom-up and hybrid models for the US”

Hunt Allcott and Michael Greenstone, “Is there an energy efficiency gap?”

Tom Tietenberg, “Reflections – Energy efficiency policy: Pipe dream or pipeline to the future?”

**Feb 27**  *Energy efficiency, 2: The rebound effect*

William Steinhurst and Vladlena Sabodash, “The Jevons paradox and energy efficiency”

Harry Saunders, “Is what we think of as ‘rebound’ really just income effects in disguise?”

David Goldstein et al., “Are there rebound effects from energy efficiency? An analysis of empirical data, internal consistency, and solutions”

**Mar 4**  *Energy efficiency, 3: Does California do it better?*

Arthur Rosenfeld with Deborah Poskanzer, “A graph is worth a thousand gigawatt-hours”
California Energy Commission, “A comparison of per capita electricity consumption in the United States and California”

Dora Costa and Matthew Kahn, “Why has California’s residential electricity consumption been so flat since the 1980s? A microeconomic approach”

Anant Sudarshan, “Deconstructing the Rosenfeld curve: Making sense of California’s low electricity intensity”

Mar 6 Wind power: case studies of Texas, and a look at offshore wind

Xi Lu et al., “Costs for integrating wind into the future ERCOT system with related costs for savings in CO2 emissions”

Daniel Kaffine et al., “Emissions savings from wind power generation in Texas”

Anya Castillo and Joshua Linn, “Incentives of carbon dioxide regulation for investment in low-carbon electricity technologies in Texas”

Brian Snyder and Mark Kaiser, “Ecological and economic cost-benefit analysis of offshore wind energy”

Mar 11 Solar power: costs, policies, and prospects

Chiara Candelise et al., “The dynamics of solar PV costs and prices as a challenge for technology forecasting”

John Edward Burns and Jin-Su Kang, “Comparative economic analysis of supporting policies for residential solar PV in the United States: Solar Renewable Energy Credit (SREC) potential”

Govinda Timilsina et al., “Solar energy: Markets, economics and politics”

Mar 13 Germany’s “Energiewende” (energy transition), pro and con

Erik Gawel et al., “The German Energiewende under attack – is there an irrational Sonderweg?”

David Buchan, “The Energiewende – Germany’s gamble”

Will Boisvert, “Green Energy Bust in Germany” (and follow links to Davidson’s response and Boisvert’s reply)

Mar 18 Economics of renewable energy: overviews

Severin Borenstein, “The private and public economics of renewable energy generation”
Geoff Keith et al., “Toward a sustainable future for the U.S. power sector: Beyond business as usual 2011”

J.H. Williams et al, “The technology path to deep greenhouse gas emissions cuts by 2050: The pivotal role of electricity”

EPRI, “Estimating the costs and benefits of the smart grid” [read executive summary and introductory chapter]

**Mar 20 Feasibility of all-renewable systems**

Cory Budischak et al., “Cost-minimized combinations of wind power, solar power and electrochemical storage, powering the grid up to 99.9% of the time”

Mark Jacobson and Mark Delucchi, “Providing all global energy with wind, water, and solar power,” Parts I and II

Ted Trainer’s debate with Jacobson and Delucchi (two Trainer critiques, two responses)

**Part III: Fossil and Nuclear Energy**

**Apr 1: Coal, 1: Environmental and economic impacts**

Paul Epstein et al., “Full cost accounting for the life cycle of coal”

The Brattle Group, “Coal plant retirements: Feedback effects on wholesale electricity prices”

Lucy Johnston et al., “Phasing out federal subsidies for coal”

A collection of industry comments on problems caused by cycling power plants on and off

**Apr 3: Coal, 2: CCS and the potential for emission reduction**

Daniel Cohan and Catherine Douglass, “Potential emissions reductions from grandfathered coal power plants in the United States”

Stuart Haszeldine, “Carbon capture and storage: How green can black be?”

Howard Herzog, “Scaling up carbon dioxide capture and storage: From megatons to gigatons”

Stuart Cohen et al., “Turning CO₂ capture on and off in response to electric grid demand: A baseline analysis of emissions and economics”
Apr 8: *Natural gas, 1: The economics of fuel-switching*

Becky Lafrancois, “A lot left over: Reducing CO₂ emissions in the United States’ electric power sector through the use of natural gas”

Joseph Cullen and Erin Mansur, “Will carbon prices reduce emissions in the US electricity industry? Evidence from the shale gas experience”

Xi Lu et al., “Implications of the recent reductions in natural gas prices for emissions of CO₂ from the US power sector”

Apr 10: *Natural gas, 2: Fugitive emissions and life-cycle impacts*

Jeffrey Logan et al., “Natural gas and the transformation of the U.S. energy sector: electricity” [read executive summary and Chapter 1]

Robert Howarth et al., “Methane and the greenhouse-gas footprint of natural gas from shale formations”

Andrew Burnham et al., “Life-cycle greenhouse gas emissions of shale gas, natural gas, coal, and petroleum”

Apr 15: *Nuclear power, 1: Problem or solution?*

Mark Cooper, “The economics of nuclear reactors: Renaissance or relapse?”

Lucas Davis, “Prospects for nuclear power”

Robin Grimes and William Nuttall, “Generating the option of a two-stage nuclear renaissance”

Pushkar Kharecha and James Hansen, “Prevented mortality and greenhouse gas emissions from historical and projected nuclear power”

Apr 17: *Nuclear power, 2: Learning from past mistakes*

Pedro Linares and Adela Conchado, “The economics of new nuclear power plants in liberalized electricity markets”

Masahiko Aoki and Geoffrey Rothwell, “Coordination under uncertain conditions: An analysis of the Fukushima catastrophe”

Arnulf Grubler, “The costs of the French nuclear scale-up: A case of negative learning by doing”

Frank Ackerman et al., “Applying cost-benefit to past decisions: Was environmental protection ever a good idea?” [read at least the Grand Canyon/nuclear power case study]
Part IV: Policy Options and Debates

Apr 24: Policy overview; costs and benefits of environmental policy

Nicholas Muller et al., “Environmental accounting for pollution in the United States economy”

Nancy Pfund and Ben Healey, “What would Jefferson do? The historical role of federal subsidies in shaping America’s energy future”

Johannes Bollen et al., “Local air pollution and global climate change: A combined cost-benefit analysis”

Frank Ackerman and Jeremy Fisher, “Is there a water-energy nexus in electricity generation? Long-term scenarios for the western United States”

Apr 29: Contingent valuation and cost-benefit analysis

Richard Carson, “Contingent valuation: A practical alternative when prices aren’t available”

Catherine Kling et al., “From Exxon to BP: Has some number become better than no number?”

Jerry Hausman, “Contingent valuation: From dubious to hopeless”

Frank Ackerman and Lisa Heinzerling, “Pricing the priceless: Cost-benefit analysis of environmental protection”

May 1: Cap-and-trade vs. tax policies

Lawrence Goulder and Andrew Schein, “Carbon taxes versus cap and trade: A critical review”

Reuven Avi-Yonah and David Uhlmann, “Combating global climate change: Why a carbon tax is a better response to global warming than cap and trade”

Lesley McAllister, “The overallocation problem in cap-and-trade: Moving toward stringency”

Richard Schmalensee and Robert Stavins, “The SO₂ allowance trading system: The ironic history of a grand policy experiment”

May 6: The “regulatory train wreck”: pending regulations and legislation affecting power plants

James McCarthy and Claudia Copeland, “EPA’s regulation of coal-fired power: Is a ‘train wreck’ coming?”
Eric Schaeffer, “Coal and the U.S. economy”

Joshua Linn et al., “Regulating greenhouse gases from coal power plants under the Clean Air Act”

Frank Ackerman et al., “Not-so-smart ALEC: Inside the attacks on renewable energy”

**May 8: Economics of climate policy**

Lawrence Goulder and Roberton Williams, “The choice of discount rate for climate change policy evaluation”

REMI / Committee for a Green Economy, “Modeling the economic, demographic, and climate impact of a carbon tax in Massachusetts”

Harrison Fell et al., “Designing renewable electricity policies to reduce emissions”

Frank Ackerman et al., “Limitations of integrated assessment models of climate change”

**May 13: The “social cost of carbon” debate**


Frank Ackerman and Elizabeth Stanton, “Climate risks and carbon prices: Revising the social cost of carbon”


Frank Ackerman, “Secret climate cost calculations: the sequel” and “As good as a stopped clock: The House does transparency” [two blog posts on the 2013 SCC update]

**May 15: Reserved for discussion and evaluation of course, or for additional topics**