

Topics in Management 298D

Ivo Welch with

Winter Quarter 2020, Part II

Bradford Cornell

This half-course will be co-taught with Bradford Cornell, Professor Emeritus at UCLA.

Energy, Climate Change, and Finance

The preeminent issues of our time may well be the need to reduce carbon emissions planet-wide. Greenhouse gases lead to global warming and a host of associated collateral damage, such as ocean acidification. The possibility of a tipping point could lead to disaster on a global scale never before experienced by humankind. If this is to be avoided, it will require moving the world economy from dirty to clean sources of energy. Although such a transformation is ultimately inevitable (when fossil fuels become scarce), the evidence suggests that it may be more urgent.

Getting off fossil fuels will not be easy. Fossil fuels account for more than 80% of [primary energy](#) both in the United States and world-wide. They offer great advantages, such as high energy concentration, ease of transport, low-cost access, and an already established massive infrastructure. Moreover, there is a strong interest lobby that supports their continued use. Transitioning to renewable sources will likely be a long, complex, arduous and extraordinarily expensive undertaking.

This half-course focuses on the financial cost of such a transition. Over the envelope calculations suggest that it will reach **tens of trillions of dollars**. It will require not just great changes in energy generation, storage, and distribution, but also in manufacturing, construction, transportation, and office and residential life.

The key questions for this course is:

How, if at all, can an effective and efficient transition from polluting to clean technologies be promoted and financed?

Administrative Basics

Time: Saturday, 3-Hour Afternoon Block

Office hours: Saturday after class, as long as it takes.

Grading: The majority of the grade will be based on the final student team presentations dealing with specific issues related to energy provision, climate change, and related financing:

Project Report (Group)	33%
Project Presentation (Group)	33%
Class Participation / Attendance (Individual)	16%
2-Page Summaries of Previous Class Session	16%
Total	100%

Reading Assignments and Course Schedule

The main text will be [MacKay, David JC, 2009, *Sustainable Energy – without the hot air*, UIT, Cambridge, UK.](#) Read it before the class begins.

Further texts for interest are [Smil, Vaclav, 2017, *Energy and Civilization*, MIT Press, Cambridge, MA;](#) and [Weitzman, Martin L. and Gernot Wagner, 2015, *Climate Shock: Economic Consequences of a Hotter Planet*, Princeton University Press, Princeton, NJ.](#)

Useful Websites:

- IPCC: <https://www.ipcc.ch/> . Warning: The IPCC has recently veered sideways, tackling issues such as gender and diversity. Regardless of merit, this politicizes and detracts from the science of climate change.
- EIA: <https://eia-global.org/campaigns/Climate> .
- NASA: <https://climate.nasa.gov/> .
- United Nations: <https://www.un.org/en/climatechange/> .
- EPA: <https://www.epa.gov/climate-research> .
- Rocky Mountain Institute: <https://rmi.org/impact/climate/> .
- Bloomberg New Energy Finance: <https://about.bnef.com/> .
- Cumulative emissions: <https://www.youtube.com/watch?v=qNhHTFAcnog>

Sessions

*Note: Reading should be done **prior** to the week under which it is listed.*

Session 1: Review of the physics of energy and energy usage. Analysis of data on energy usage both historical and projected in the U.S. and worldwide. Introduction to the discount issue and trade-offs.

- [British Petroleum, 2018, *BP Statistical Review of World Energy for 2019*.](#)
- [Energy Information Administration, *Annual Energy Outlook 2019*.](#)
- [The New Energy Economy: An Exercise in Magical Thinking](#)

Session 2: The tradeoffs involved in the movement to renewables. The costs of climate change. Integrated economic models of climate and economics. Proposals for dealing with the public “bad” aspect of climate change.

- Nordhaus, William D., 2017, [Integrated assessment models of climate change](#), NBER Reporter, <https://www.nber.org/reporter/2017number3/nordhaus.html>. If you want to play with the model, download [nordhaus.xlsm](#) (password provided in class).
- Nordhaus, William D., [Revisiting the social cost of carbon, *Proceedings of the National Academy of Sciences 2017*, 114: 1518-1523.](#)
- David K Levine, [Global Warming: What Mess We Have Made](#) Oct 2019.
- Nicholas Stern, [The Economics of Climate Change](#)
- Nordhaus, William D., [Climate change: The ultimate challenge for economics, *American Economic Review 2019*, 109 \(6\): 1991-2014.](#)
- Optional: Pindyck, Robert, [Climate Change Policy: What Do the Models Tell Us?, *Journal of Economic Literature* 2013, 51\(3\), 860–872.](#)
- Optional: [Wallace-Wells, David, 2019, *The Uninhabitable Earth*, Random House.](#)

Sessions 3: The transition to renewables. The costs of transition to renewables as a function of the speed and extent of the transition.

- Cornell, Some Green New Deal Financial Arithmetic.
- Sivaram, Varun, 2018, [Taming the Sun, MIT Press, Cambridge, MA](#). Chapter 4.
- Gillingham, Kenneth and James H. Stock, 2019, [The Cost of Reducing Greenhouse Gas Emissions, *Journal of Economic Perspectives* 32=4 \(Fall 2018\), 53-72.](#)

Session 4: A deeper look at specific issues including presentation of student projects.

Readings to be determined.

Session 5: A deeper look at specific issues including presentation of student projects.

Readings to be determined.

Potential Presentation Projects

(It is not required that students choose from this list. Depending on class enrollment, projects could be individual or group-based.)

- Economists almost universally endorse a carbon tax. Explain why it has been so difficult to adopt one in this country. What alternatives have been tried? How would you compare them with a carbon tax?
- What is a fair discount rate for making intergenerational comparisons? Can you suggest a social mechanism by which the discount rate decision could be made?
- Can Western democracies cope with a problem so large? Can the world? Compare Chinese and Indian problems and solutions.
- If the government fails to properly price the costs of carbon related pollution, what responsibilities do firms like Exxon have? How should the conflict between shareholders and other stakeholders be managed?
- Present a detailed capital budgeting analysis of the development of a wind farm or solar farm in comparison to a gas-fired power plant. Include the cost of the land and all other environmental impacts. Consider different locales.
- What role does agriculture play? What role could forestation play? How expensive would such solutions be?
- Offer an evaluation of California's current green energy plans. Suggest any modifications that you conclude would be appropriate.
- What utility-scale energy storage solutions exist or could become viable in the foreseeable future? why can we not simply lift up and release giant weights?
- What are the regulatory and legal obstacles to using natural gas plants to cover intermittent insufficient supply for renewable energy plants? How does the economics compare to batteries?

- What is the state of nuclear power for baseline load? Is the technical problem the human agency issue (i.e., quality control and running) or the nuclear power itself? How long before we can have some small-scale but mass-producible solutions? Why do we still produce reactors that can melt down and/or produce waste that must be stored for millenia?
- Why is coal still competitive in India and China? Will it remain competitive?
- How scalable is solar/wind? That is, if you believe that one plant is economical today, why would one-hundred plants not be?
- Discuss base, natural, and peak load mix issues looming in the future. Would it make a difference if each household drove an electric car that became a household battery while not in use?
- What should be the cost to charging carbon that was produced over the last three centuries? How should we hold population today accountable for the pollution of their ancestors, given migration?
- Describe the regulatory and energy transmission frameworks in the world and/or in the US. Where do you see opportunities for private arbitrage? Where do you see opportunities for social (government) arbitrage?
- What are the most profitable clean energy opportunities today at small scale? At large scale?
- What are the best angel/VC investment opportunities for clean energy in the Los Angeles area? Does UCLA R&D have a role to play?
- What is the best US state and/or country to place a solar, wind, or nuclear power plant today?
- Reanalyze the David MacKay section on the (high) cost of solar photovoltaic cells. Have prices come down a lot faster than he thought they would? Can they now profitably cover the world?
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