Topics in Finance, Mgmt. 495
Spring Quarter 2020

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Climate Change, Energy and Finance

A preeminent issue of our time is the impact of fossil fuel related emissions on human economic activity and wellbeing. Greenhouse gases lead to global warming and associate collateral damage. The problem is attempting to estimate the costs of emissions as a function of the scale of emissions. This problem is complicated by a host of potential feedback effects and by the need to assess how the economy might adapt. Although a transformation to renewables is inevitable in the not-too-distant future (when fossil fuels become sufficiently scarce), the critical question is by how much should the transformation to renewables be accelerated in light of the external costs of fossil fuel usage.

Getting off fossil fuels will not be easy. In 2018, fossil fuels accounted for 83% of primary energy in the United States and 84% percent world-wide. Fossil fuels offer great benefits, such as high energy concentration, ease of transport, relatively low-cost access, along with an already established massive infrastructure. Transitioning to renewable sources will be a long, complex, arduous, and extraordinarily expensive undertaking. It will require financial as well as technological innovation.

This half-course has three objectives. First, to introduce students to data on energy usage and its impact. Second, to examine the tradeoffs associated with continued use of fossil fuels. Third, to assess the costs and benefits of a transition to a much greater reliance on renewable sources of energy. This includes exploring options for financing what can be called the great transformation.

Time: Thursday 6:30 to 9:30 pm

Office hours: By appointment

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

Reading Assignments and Course Schedule

Two books you should buy are **MacKay, David JC, 2009, *Sustainable Energy – without the hot air*, and Bill Gates, 2021, *How to avoid a climate disaster***. Further general interest books include Smil, Vaclav, 2017, *Energy and Civilization*, MIT Press, Cambridge, MA; Weitzman, Martin L. and Gernot Wagner, 2015, *Climate Shock: Economic Consequences of a Hotter Planet*, Princeton University Press, Princeton, NJ; Alex Epstein, 2014, *The Moral Case for Fossil Fuels*, Penguin; Sivaram, Varun, 2018, *Taming the Sun*, MIT Press; Wallace-Wells, David, 2019, *The Uninhabitable Earth*, Tim Duggan Books; Dozens of new books and hundreds of new articles are appearing on a continuing basis. If you find something you think is particularly relevant, please bring it to my attention.

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

Various universities, such as Stanford and Columbia, have energy centers. More are coming all the time.

Session 1 (May 7): 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, 2020, *BP Statistical Review of World Energy for 2019*.
- Energy Information Administration, *Annual Energy Outlook 2019*.
- Bill Gates, 2021, *How to avoid a climate disaster.*
- MacKay, David JC, 2009, *Sustainable Energy – without the hot air*, UIT, Cambridge, UK. A general review of these first three documents is all that is required.
- *The New Energy Economy: An Exercise in Magical Thinking*

Session 2 (May 14): The tradeoffs involved in the movement to renewals. The costs of climate change. Integrated economic models of climate and economics. Proposals for dealing with the public "bad" aspect of climate change.

- Levine, David K., Global warming: What sort of mess have we made? October 2018.
- Nordhaus, William D., 2019, Climate change: The ultimate challenge for economics, *American Economic Review*, 109 (6): 1991-2014
- Nordhaus, William D., 2017b, Integrated assessment models of climate change, NBER Reporter, https://www.nber.org/reporter/2017number3/nordhaus.html.
- Nordhaus, William D., 2017a, Revisiting the social cost of carbon, *Proceedings of the National Academy of Sciences*, 114: 1518-1523.
- Pindyck, Robert, 2015, Climate Change Policy: What Do the Models Tell Us., NBER working paper 19244, http://www.nber.org/papers/w19244.
- Global Commission on Adaptation, https://gca.org/global-commission-on-adaptation/report.
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Sessions 3 (May 21): The transition to renewables. The costs of transition to renewables as a function of the speed and extent of the transition.

- Larry Fink letter to CEOs, January 2020.
- Green New Deal Financial Arithmetic
- Baker and Shultz on the Carbon Dividend
- McKinsey, Financing change: How to mobilize private-sector financing for sustainable infrastructure.
- Gillingham, Kenneth and James H. Stock, 2019, The Cost of Reducing Greenhouse Gas Emissions, *Journal of Economic Perspectives*, Fall 2018.
- Morgan Stanley $50 trillion cost of transition.
- McKinsey, Climate Risk and Response, January 2020.

Session 4 (May 28): ESG Investing. A deeper look at specific issues including presentation of student projects and a detailed analysis of major solar and wind projects at Goat Mountain in Texas.

- Cornell and Damodaran Valuing ESG: Doing Good or Sounding Good
- Sobieski materials on Goat Mountain project.
- Project research

Session 5 (June 4): Student project presentations and discussion.

- Project research.

Potential Presentation Projects

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

- Some activists argue that University endowment funds should not hold stock of carbon-based businesses such as Exxon. Is this an effective and efficient policy?
- 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 or is a directed economy such as that in China required?
- 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.