

ECO 314S: Energy and the Environment

CALENDAR DESCRIPTION:

This course surveys important features of energy markets and related environmental challenges. One of the central objectives is to provide an understanding of the key economic tools needed to analyse these markets and to develop an appreciation for the political and geopolitical centrality of energy issues. A related objective is the development of a framework for understanding the public discourse on energy and the environment. Topics include the hydrocarbon economy (oil, natural gas and coal), electricity markets, global warming and other externalities, renewable energy, conservation, carbon taxes and 'cap-and-trade', sustainability, and the geopolitics of energy.

Prerequisite:

ECO200Y1/ ECO204Y1/ ECO206Y1, ECO220Y1/ ECO227Y1/ (STA220H1, STA255H1)/(STA257H1, STA261H1)

Distribution Requirements: Social Science

Breadth Requirements: Society and its Institutions (3)

TIME and LOCATION: M 2-5, Georg Ignatieff Theater. **You must be available during the three-hour period 2-5.**

EVALUATION:

Midterm 30% Monday October 21, 2019, in-class, 2-4.

Final Exam 50% Exam period.

Assignments 20% Due dates are as follows: Assignment 1 September 27; Assignment 2 October 18; Assignment 3 November 8; Assignment 4 November 29. Assignments are submitted electronically and must arrive by midnight. Late assignments will be penalized 10% per day. Each assignment must be submitted as a single pdf document with questions in the original order.

There will be four assignments. You are required to submit solutions to all questions. However, only a subset will be graded. The list of questions that are to be graded will not be revealed in advance.

The only generally acceptable reason for missing a term test is illness. A medical certificate is required under such circumstances. We are asked to remind you that plagiarism and cheating are **serious** academic offences with potentially serious penalties. Programs such as "turnitin" may be used to ensure that the submitted work is original.

RELATED COURSES: ECO 414S Energy and Regulation; ENV462H1: Energy and Environment: Economics, Politics, and Sustainability. ECO 314F is not an exclusion to either of these courses.

COURSE OBJECTIVES

1. Broad overview of major areas of energy economics and related environmental issues.
2. Brief review of important economic tools used to analyse energy markets.
3. Understanding public discourse on energy and environmental debates, (e.g., decarbonization, fracking, renewable energy, markets v. regulation, geopolitics ...).
4. Facility with data resources on energy and related environmental issues.

COURSE MATERIALS

Required:

1. Richard Muller, *Energy for Future Presidents*, Norton, 2012. Hardcopy and Kindle versions available.
2. Bruce Usher, *Renewable Energy: A Primer for the Twenty-First Century*, Columbia University Press, 2019. Available electronically through University of Toronto libraries. Also, hardcopy and Kindle version available.

Recommended Readings:

1. Peter M. Schwarz, *Energy Economics*, Routledge, 2018. Hardcopy and Kindle versions available.
2. Daniel Yergin, *The Quest*, The Penguin Press, 2011. Hardcopy, Kindle and Audible versions available.

Additional References

1. Joseph Dukert, *Energy*, Greenwood Press, 2009.
2. Carol Dahl, *International Energy Markets*, PennWell, 2015.
3. Roy Nersesian, *Energy Economics: Markets, History and Policy*, Routledge, 2016.

IN THE NEWS

Students are required to follow current issues in energy by signing up for alerts (e.g., through Google Alerts <https://www.google.com/alerts>, Bloomberg New Energy Finance <https://about.bnef.com/>, Utility Dive <https://www.utilitydive.com/>, or other such sources). Each class will begin with a brief discussion of the week's developments in energy. Students should regularly visit MIT Technology Review <http://www.technologyreview.com/> to review advances in energy. For insightful commentary on a range of issues, some related to energy, please sign up for the weekly briefing from Project Syndicate <http://www.project-syndicate.org/>.

LECTURE TOPICS

1. Background and Introduction
 - a. Yatchew, A. 2014: "Economics of Energy: Big Ideas for the Non-Economist", Energy Research and Social Science, available electronically through University of Toronto libraries.
 - b. Muller, Part I, Ch. 1 Fukushima, Ch. 2 The Gulf Oil Spill.
 - c. Usher, Ch. 1-3.
 - d. Muller, Part IV What is Energy?
 - e. Lawrence Livermore Laboratories, energy and carbon flow charts <https://energy.llnl.gov/>
 - f. International Energy Agency, energy flow charts <https://www.iea.org/Sankey/>
 - g. U.S. Energy Information Administration, "Canada Country Analysis Brief". Updated periodically on the EIA web-site.
2. Milestones in Energy History
 - a. Smil, Vaclav "World History and Energy" in *Encyclopedia of Energy*, Volume 6, 2004 Elsevier Inc. Available electronically through University of Toronto Libraries.
3. Economic Tools: Theory and Empirical Analysis.

Refer to your texts in microeconomics to review the following subject areas: supply/demand analysis; consumer and producer theory; industry structures – monopoly, oligopoly, monopolistic competition, perfect competition; game theory; externalities; public goods; taxes and deadweight loss; regulation and competition policy. See in particular: Competition Bureau Merger Enforcement Guidelines [http://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/vwapj/cb-meg-2011-e.pdf/\\$FILE/cb-meg-2011-e.pdf](http://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/vwapj/cb-meg-2011-e.pdf/$FILE/cb-meg-2011-e.pdf)

4. Environmental Issues

- a. Muller, Part I, Ch. 3 Global Warming and Climate Change.
- b. Economists' Voice, The Berkeley Economic Press.
 - i. Stiglitz, J. 2006, "A New Agenda for Global Warming"
 - ii. Arrow, K. 2007, "Global Climate Change: A Challenge to Policy"
 - iii. Schelling, T. 2007, "Climate Change: The Uncertainties, the Certainties, and What They Imply About Action"
- c. Socolow, R. and S. Pacala
 - i. "A Plan to Keep Carbon in Check", Scientific American, pp. 50-57. September 2006.
 - ii. "Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies", Science, Vol. 305, pp. 968-72, 2004.
- d. "Easter Island: Resource Depletion and Collapse", James Brander, *Encyclopedia of Energy*, 2004 edited by Cutler Cleveland.
- e. "The Pope & the Market" William D. Nordhaus, New York Review of Books, October 8 2015. <http://www.nybooks.com/articles/archives/2015/oct/08/pope-and-market/>

5. Regulation and Government Intervention

- a. Yatchew, A. 2014: "Economics of Energy: Big Ideas for the Non-Economist", Energy Research and Social Science, available electronically through University of Toronto libraries.
- b. Yatchew, A. 2016: "Rational vs 'Feel-Good' Carbon Policy", Energy Regulation Quarterly, Vol. 4, Issue 3, <http://www.energyregulationquarterly.ca/articles/rational-vs-feel-good-carbon-policy-transferability-subsidiarity-and-separation#sthash.GBtFuIOG.dpbs>
- c. Ontario's Five Year Climate Change Action Plan, 2016-2020, Government of Ontario, <https://www.ontario.ca/page/climate-change-action-plan>.
- d. Ontario's (Four Year) Environment Plan, 2018: <https://prod-environmental-registry.s3.amazonaws.com/2018-11/EnvironmentPlan.pdf>

6. Electricity

- a. Muller, Part III, Ch. 16 Electric Automobiles.
- b. The Future of the Electricity Grid: An Interdisciplinary MIT Study, 2011
- c. Utility of the Future, MIT Energy Initiative, 2016

7. Renewables, Alternative Energy and Conservation

- a. Usher, Ch. 4-12.
- b. Muller, Part II, Ch. 7, Energy Productivity.
- c. Muller, Part III, Ch. 8 Solar Surge, Ch. 9 Wind, Ch. 10 Energy Storage, Ch. 11 The Coming Explosion of Nuclear Power, Ch. 13 Biofuels, Ch. 15 Alternative Alternatives: Hydrogen, Geothermal, Tidal and Wave Power.

- d. Yatchew, A. and A. Baziliauskas 2011: “Ontario Feed-In Tariff Programs”, *Energy Policy*, 39, 3885-3893.
 - e. Green, R. and A. Yatchew 2012: “Support Schemes for Renewable Energy: An Economic Analysis”, *Economics of Energy & Environmental Policy*, 1, 83-98.
 - f. *The Future of Solar Energy. An Interdisciplinary MIT Study led by the MIT Energy Initiative*, 2015, <http://mitei.mit.edu/futureofsolar>
 - g. *The Future of Nuclear Energy in a Carbon-Constrained World An Interdisciplinary MIT Study*, 2018, <http://energy.mit.edu/research/future-nuclear-energy-carbon-constrained-world/>.
8. Hydrocarbons – Oil, Natural Gas, Coal
- Oil
- a. Muller, Part II, Ch. 5 Liquid Energy Security, Ch. 6 Shale Oil.
 - b. Muller Part III, Ch. 14 Synfuels and High-Tech Fossil Fuels.
- Natural Gas
- c. Muller, Part II, Ch. 4 The Natural Gas Windfall
 - d. *The Future of Natural Gas. An Inter-Disciplinary MIT Study*, 2011
- Coal
- e. *The Future of Coal. An Inter-disciplinary MIT Study*, 2007,
9. Politics, Finance and the Energy Future
- a. Muller, Part V Advice for Future Presidents.

ADDITIONAL SOURCES

1. International Energy Agency, most recent documents are available electronically through the University of Toronto Libraries. See also <http://www.iea.org/>
 - a. *World Energy Outlook (most recent edition)*
 - b. *Electricity Information (most recent edition)*
2. Canada Energy Regulator: <https://www.cer-rec.gc.ca/index-eng.html> (formerly the National Energy Board)
3. BP <http://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html> which publishes the annual *BP Statistical Review of World Energy* and provides data in spreadsheet format.