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ECO 414S/3502S: Energy and Regulation

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. A related objective is the development of a framework for understanding the public discourse on energy and the environment. Topics include the theoretical and empirical tools necessary to analyse energy markets, the politics and history of energy, the hydrocarbon economy (oil, natural gas and coal), electricity markets, global warming and other externalities, renewable energy, conservation, carbon taxes and 'cap-and-trade'.

LOCATION AND TIME: Mondays 2-5 SS 2127

EVALUATION:
Evaluation for this course consists of a paper worth 40%, an assignment worth 20% (due Friday March 13, 2020, and two tests worth 20% each (held Monday February 10 and Monday March 30, 2020).

The only generally acceptable reason for missing an exam or term test is illness. A medical certificate is required. We are asked to remind you that plagiarism and cheating are **serious** academic offences with potentially serious penalties. Papers will be processed through plagiarism software, such as Turn-It-In.

RESEARCH PAPER:

a. Undergraduates taking the course may write an overview paper analysing an energy topic of interest.
b. Graduate students taking the course are required to include some empirical analysis in their paper.

Paper Outline is due February 23, 2020 by midnight. This is a hard deadline. Late submissions will be penalized 10% per day on the paper grade. Please submit the outline electronically through Quercus and name the file using your name. For example, my outline would be "YatchewOutline.doc" or "YatchewOutline.pdf". Your two-page outline must contain the following:

a. An abstract not exceeding 200 words
b. A list of key references (be sure to do a citation search)
c. An outline of how your analysis will be conducted,
d. Graduate students who are doing empirical work,
    i. please indicate the anticipated results of your analysis
    ii. a spreadsheet with any data that you will be using.

The Paper is due Friday April 3, 2020, by midnight. This is a hard deadline. Late submissions will be penalized 10% per day. Please submit the paper electronically through Quercus, and name the file using your name. For example, my paper would be "YatchewPaper.pdf" or "YatchewOutline.pdf".

a. Undergraduate papers should be up to 3000 words. Graduate papers should be up to 4000 words. This does not include references, tables and graphics.
b. The structure of the paper should be as follows:

i. Cover Page – Title of paper, name and student number, date submitted, word count
ii. Introduction
iii. Literature Review
iv. Analysis
v. Conclusions
vi. References

c. The "Conclusions" section should discuss policy implications.
d. For graduate students, the "Analysis" section should include a description of the data and an explanation of any empirical work that was conducted.

IN THE NEWS

Students will follow current issues in energy by signing up for news alerts (e.g., through Google Alerts). Subscribe to MIT Energy Initiatives daily updates by visiting http://mitei.mit.edu/about/contact. 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/.

COURSE MATERIALS

Readings [1]

1. Richard Muller, *Energy for Future Presidents*, *The Science Behind the Headlines*, Norton 2012. Hardcopy and Kindle editions available.
2. Jeffrey Sachs, *The Age of Sustainable Development*, Columbia University Press, 2015. Hardcopy and Kindle editions available. Also available electronically through UofT Libraries.
3. 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 versions available.

Additional References and Data Sources:

1. *Encyclopedia of Energy*, ed. Cutler Cleveland. Available electronically through UofT Libraries.
2. Daniel Yergin, *The Quest*, The Penguin Press, 2011.
3. Carol Dahl, *International Energy Markets*, PennWell, 2004, updated edition 2015.
4. Joseph Dukert, *Energy*, Greenwood Press, 2009.
5. Subhes Bhattacharyya, *Energy Economics*, Springer, 2011. Cutler Cleveland. Available electronically through UofT Libraries.
6. International Energy Agency http://www.iea.org *Energy Statistics Manual*, *Electricity Information, IEA Statistics, Key World Energy Statistics*.

[1] In some cases Kindle editions are available and usually less costly than hardcopy. You do not need a Kindle device as Kindle books can be read on Macs and PCs.

7. Canada Energy Regulator: https://www.cer-rec.gc.ca/index-eng.html (formerly the National Energy Board).
8. BP (formerly British Petroleum) www.bp.com/statisticalreview, *Statistical Review of World Energy*, *Statistical Review Workbook* (Excel spreadsheet).
9. Lawrence Livermore Laboratories. Energy and Carbon Flow Charts.
10. World Resources Institute – GHG gas data, slide presentation, papers, annual "Stories to Watch".

LECTURE TOPICS AND READINGS

1. Background and Introduction (2 weeks)
    a. Yatchew, A. 2014: "Economics of Energy: Big Ideas for the Non-Economist", Energy Research and Social Science, 1:1, 74-82.
    b. Yatchew, A. 2016, "Rational vs. 'Feel-Good' Carbon Policy – Transferability, Subsidiarity and Separation" Energy Regulation Quarterly, 4:3, 31-40.
    Available at http://www.energyregulationquarterly.ca/articles/rational-vs-feel-good-carbon-policy-transferability-subsidiarity-and-separation#sthash.u6jtvAJI.dpbs.
    c. Richard Muller, *Energy for Future Presidents*, *The Science Behind the Headlines*, Norton 2012. See also Review of Richard Muller's book by Bill McKibben: "The Scientist Who Made a Total Turnaround", New York Review of Books, October 11, 2012. Reply by Richard Muller: "On Turning Down the Heat", New York Review of Books, November 22, 2012.
    d. Usher, Ch. 1-3.
    e. Sachs – Chapters 1, 2, 3, 6, 14

2. Energy in World History (1 week)
    a. Vaclav Smil, *Energy and Civilization: A History*, 2017, MIT Press. Hardcopy and Kindle versions available.
    b. Vaclav Smil, *Energy: Beginner's Guide*, 2006. Kindle version available.
    c. Daniel Yergin, *The Quest*, The Penguin Press, 2011. Hardcopy and Kindle versions available.

3. Economic Tools: Theory and Empirical Analysis. (1 week)
    a. Theory: 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.
    b. Empirical Work Examples:
        i. David Ryan and Andre Plourde, "Empirical Modeling of Energy Demand", in *International Handbook on the Economics of Energy*, eds. Joanne Evans and Lester Hunt, 2009, Edward Elgar.
        ii. Dimitropoulos, D. and A. Yatchew 2017, "Is Productivity Growth in Electricity Distribution Negative? An Empirical Analysis Using Ontario Data", The Energy Journal, 38:2,175-200.

iii. Dimitropoulos, D. and A. Yatchew 2017, "Discerning Trends in Commodity Prices", Macroeconomic Dynamics, vol.22, Special Issue 3, Dynamics of Oil and Commodity Prices, 683-701, doi:10.1017/S1365100516000511.

4. Global Warming and Other Externalities (2 weeks)
    a. Brander, J. A., and Taylor, M. S. "The Simple Economics of Easter Island: A Ricardo–Malthus model of renewable resource use." Am. Econ. Rev. 1998, 88(1), 119–138.
    b. Brander, J.A.. "Easter Island: Resource Depletion and Collapse", Encyclopedia of Energy, 2005, ed. Cutler Cleveland.
    c. Nordaus, William, "Climate Clubs: Overcoming Free-riding in International Climate Policy", American Economic Review 2015, 105(4): 1339–1370.
    d. Nordhaus, W. "The Pope and the Market", *The New York Review of Books*, issue dated October 15, 2015.
    e. Climate Leadership Council, February 2017, "The Conservative Case for Carbon Dividends", available at https://clcouncil.org/publications/.
    f. *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"
    g. 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*, 305, pp. 968-72, 2004.
    h. Robert Stavins, "The Problem of the Commons: Still Unsettled After 100 Years", *American Economic Review*, 2011, 81-108.`
    i. Robert Rohde, Richard A. Muller, Robert Jacobsen, Elizabeth Muller, Saul Perlmutter, Arthur Rosenfeld, Jonathan Wurtele, Donald Groom, Charlotte Wickham, "A New Estimate of the Average Earth Surface Land Temperature Spanning 1753 to 2011" 2013, Geoinfor Geostat: An Overview 2013, 1:1, http://www.scitechnol.com/2327-4581/2327-4581-1-101.pdf
    j. Sixteen Concerned Scientists, "No Need to Panic About Global Warming", *Wall Street Journal*, Op-Ed, January 27 2012. William Nordaus (response) "Why the Global Warming Skeptics Are Wrong", *New York Review of Books*, March 22 2012. Cohen et al. and Nordaus response, "In the Climate Casino: An Exchange", *New York Review of Books*, April 26 2012. Fred Singer, "The Climate Contrarians", *New York Review of Books*, August 16 2012.
    k. Bill McKibben, Global Warming's Terrifying New Math, *Rolling Stone*, July 19, 2012.

5. Regulation and Government Intervention (2 weeks)
    a. Joseph Aldy, Alan J. Krupnick, Richard G. Newell, Ian W.H. Parry, and William A. Pizer. "Designing Climate Mitigation Policy" *Journal of Economic Literature*, 2010, 48:4, 903-934.
    b. Martin Weitzman, "Prices vs. Quantities", *Review of Economics* Studies, 1974, 41:4, 477-91.
    c. Competition Bureau, "Merger Enforcement Guidelines" https://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/eng/03420.html

d. Competition Bureau, "Abuse of Dominance Enforcement Guidelines: https://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/eng/03420.html

6. Oil, Natural Gas and Coal (2 weeks)
   a. Daniel Yergin, *The Quest*, The Penguin Press, 2011.
   b. Bil McKibben, "Why Not Frack?", *New York Review of Books*, March 8, 2012. Reply by John Deutch, *New York Review of Books,* April 26, 2012.
   c. Alan Riley, "The Geostrategic Implications of the Shale Gas Revolution", NATO Paper 10, 2012.
   d. James Hamilton, "Oil Prices, Exhaustible Resources and Economic Growth", in the *Handbook of Energy and Climate Change*, eds. Roger Fouquet, 2013. Also available on-line as an NBER working paper.
   e. Lutz Killian, "The Economic Effects of Energy Price Shocks", *Journal of Economic Literature*, 2008, 46:4, 871-909.
   f. James Smith, 2009, "World Oil: Market or Mayhem?", *Journal of Economic Perspectives*, 23:3, 145-164.
   g. Henry Jacoby, Francis Sullivan and Sergey Paltsev, 2012, "The Influence of Shale Gas on U.S. Energy and Environmental Policy", *Economics of Energy & Environmental Policy*, 1, 37-51.
   h. *The Future of Natural Gas. An Inter-disciplinary MIT Study*, 2011, Executive Summary, http://web.mit.edu/mitei/research/studies/naturalgas.html

7. Electricity and Renewables (2 weeks)
   a. Usher, Chs. 4-12.
   b. MIT Energy Initiative, "Utility of the Future", 2016, Executive Summary, http://energy.mit.edu/research/utility-future-study/.
   c. *The Future of the Electricity Grid: An Interdisciplinary MIT Study*, 2011, Executive Summary, http://web.mit.edu/mitei/research/studies/the-electric-grid-2011.shtml
   d. Adonis Yatchew and Andrew Baziliauskas 2011, "Ontario Feed-In Tariff Programs", *Energy Policy*, 39, 3885-3893.
   e. Severin Borenstein, "The Private and Public Economics of Renewable Electricity Generation", *Journal of Economic Perspectives*, 2012, 26:1, 67-92.
   f. Yatchew, A. 2019, "How Scalability is Transforming Energy Industries" Energy Regulation Quarterly, 7:2, 35-44.
   g. Lucas Davis, "Prospects for Nuclear Power", *Journal of Economic Perspectives*, 2012, 26:1, 49-66.
   h. Hunt Alcott and Michael Greenstone, "Is There an Energy Efficiency Gap?", *Journal of Economic Perspectives*, 2012, 26:1, 3-28.
   i. Richard Green and Adonis Yatchew 2012: "Support Schemes for Renewable Energy: An Economic Analysis", *Economics of Energy & Environmental Policy*, 1, 83-98.
   j. David Newbery 2012: "Reforming Competitive Electricity Markets to Meet Environmental Targets", *Economics of Energy & Environmental Policy*, 1, 69-82.
   k. Nicholas Stern and James Rydge 2012 "The New Energy-Industrial Revolution and International Agreement on Climate Change", *Economics of Energy & Environmental Policy*, 1, 101-119.

l. Rivard, B. and A. Yatchew 2016, "Integration of Renewables into the Ontario Electricity System", *The Energy Journal,* vol. 37, Special Issue 2, 221-242.

8. Canada – Energy History and Policy
   Source: The Canadian Encyclopedia https://thecanadianencyclopedia.ca/en
   a. Hydroelectricity https://thecanadianencyclopedia.ca/en/article/hydroelectricity
   b. Petroleum Industries https://thecanadianencyclopedia.ca/en/article/petroleum-industries
   c. Natural Gas https://thecanadianencyclopedia.ca/en/article/natural-gas-in-canada
   d. Nuclear https://thecanadianencyclopedia.ca/en/article/nuclear-power-plants
   e. Pipelines in Canada https://thecanadianencyclopedia.ca/en/article/pipeline
   f. Canadian Energy Policy https://thecanadianencyclopedia.ca/en/article/energy-policy