ECONOMICS 132 – WINTER 2021
ENERGY ECONOMICS

Instructor: Richard Carson
Class Meeting Room: Zoom [Link in Canvas]
Class Time: TTh 5:00-6:20pm
Course Website: https://canvas.ucsd.edu
Office: Zoom [Link in Canvas]
Office Hours: Tuesday 3:00-4:30pm and by appointment
Email: rcarson@ucsd.edu

Teaching Assistants:

Michael Chua Office hours 10-11am MW [Canvas Zoom Link] Email: mchua@ucsd.edu

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COURSE DESCRIPTION

In this class, you will be introduced to the way that economists view energy choices by reading peer-reviewed journal articles written by economists actively working on energy issues. Each week we will address specific questions about energy supplies, energy demand, and the structure of energy markets by examining how different economists have looked at these questions and identify any important aspects of these questions that have not yet been answered.

PREREQUISITES

Econ 1A-B, Econ 2 or Econ 100A AND Math 10C or Math 20C.

COURSE READINGS

Required readings (listed below) are on the course website (https://canvas.ucsd.edu). To provide an extra incentive for students to read the listed articles before lecture, regular reading quizzes will be given in class during the quarter.

STATEMENT OF ACADEMIC INTEGRITY

Students are expected to do their own work, as outlined in the UCSD policy on Academic Integrity. Cheating will not be tolerated. Any student engaging in suspicious conduct will be subjected to the disciplinary process. Students found guilty of academic misconduct will receive a failing grade in the entire course and may be suspended from UCSD.

QUIZZES AND EXAMINATIONS

Six quizzes will be given.

- Quizzes will be given randomly at the start of class.
- The top five quiz scores will be used to determine your quiz grade (lowest quiz score is dropped).

Two midterm exams and one final exam will be given.

- The midterm exams will be given in class: **Thursday April 22 & Thursday May 13.**
- The final exam will be given on **Thursday, June 10 from 7-10pm**

All quizzes and exams must be taken at the scheduled time and place. Students who arrive late will not receive extra time to complete their quiz/exam.

EXAMINATIONS

There will be three examinations all given equal weight. None of the exams are explicitly cumulative but it is important to note that the course builds on topics learned earlier so conceptual material learned earlier should not be forgotten. Specific factual material from earlier parts of the course will not be asked on subsequent exams. This is true for the final. **BRING CALCULATORS** to exams. Blue books are **NOT** needed.

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SHORT REPORT

You will need to write a two-page single-spaced report addressed to a policymaker (of your choice; examples include but not limited to Secretary of Energy/EPA, Member of Congress, Head of Energy Company/Environmental Group, Equivalent of Secretary of Energy/EPA in foreign country, Head of World Bank). Topic: pick any policy issue related to an emerging energy economics topic that you think will be important in the future to policymakers. Assume your policymaker knows little about the issue, but needs to make a decision. Note who is likely to favor and oppose the decision you recommend to the policymaker and why. Readings under the first two lectures may be a good starting point for a topic as are websites listed under Energy Links in class Canvas.ucsd.edu site. **Due April 8 via Canvas.**

QUIZZES

Short multiple-choice questions on assigned reading for that day. Basic concepts/facts emphasized with no computational questions. A template that may be potentially helpful in thinking about the key points of an article is provided on the course website under the first lecture.

MISSED QUIZZES AND EXAMINATIONS

(1) No make-up quizzes/exams will be given. Missed quizzes for any reason will receive a grade of zero.
(2) Students who miss a midterm exam without an acceptable reason will receive a grade of zero (0) for that exam. Students who miss the midterm with an acceptable reason will have the weight of the other exam increased accordingly. You must take the final exam to receive a grade in this course.
(3) Reasons for missed midterm exams must be **pre-approved** by the instructor (except when this is not possible in an emergency situation). Students who make initial contact after the exam will have to document why they could not make contact prior to the exam. In addition, any student who misses an exam due to physical illness will be required to provide documentation from a health care professional indicating why the student was physically unable to take the exam. All documentation and an additional signed written statement explaining the relevant circumstances of the absence must be provided to the instructor within two working days of the student's return to campus. Failure to comply with any of the above in the specified manner will result in a grade of zero (0) for the exam.

PROBLEM SETS

There will be three problems sets. Each emphasizes the types of quantitative questions needed for the next exam. Students are encouraged to work together in groups, but each student must turn in a separate fully worked problem set. Problem sets will be submitted via Canvas.

READINGS

Students are responsible for all class readings unless clearly noted as optional. Optional readings may be covered in class, but you are only responsible for the material gone over in class. Some additional optional readings not on this syllabus are provided on the course website in case you want to look at specific issues in more depth.

GRADING

Grades will be curved with the final letter grade determined by distribution of class raw numerical scores. Your raw numerical score will be determined as follows:

Quizzes	= 5% (5 quizzes @ 1 percent each)
Short Report	= 5%
Problem Sets	= 15% (3 problem sets @ 5 percent each)
Midterm Exam 1	= 25%
Midterm Exam 2	= 25%
Final Exam	= 25%
Total Raw Score	= 100%

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DATE: TOPIC

March 30: Overview of Course/Current Policy Issues/Challenge of Climate Change

April 1 & April 6: Role of Energy in U.S./World Economies: Micro & Macro Perspectives
(Note: you are responsible for reviewing basic economic concepts and energy facts lecture notes)

April 8 & 13: Theory of Exhaustible Resources
Short Report due April 8th

April 15: Oil Supply; OPEC and Energy Cartels; & Search for New Supplies—Hubbert's Curve, fracking and offshore drilling
Problem Set I due April 15

April 20: International Trade and Security Issues Related to Energy

April 22: **Midterm Exam 1**

April 27: Electricity: Generation, Load Profiles, and Distribution

April 29: Electricity: Regulation and Deregulation, California Energy Crisis

May 4: Traditional Power Sources: Coal, Natural Gas, Hydro, Nuclear

May 6: Alternative Sources Energy (Biofuels, Geothermal, Solar, Wind) & Transmission

May 11: The Electric Grid and Transmission issues/Texas Energy Crises

Problem Set II due May11

May 13: **Midterm Exam 2**

May18: End-User Programs: Home/Commercial Energy Conservation & Solar Installations

May 20 & May 22: Automobiles: Regulation, Mass Transit, and the Structure of Urban Areas

May 27: Local/Regional Environmental Externalities Related to Burning Fossil Fuels

May 29: Global Climate Change: The Underlying Science and Technical Solutions

June 1: Global Climate Change: The Economic Perspective
Problem Set III due June 1

June 3: Global Climate Change: International, National, State & Local Action

June 10: **Final Exam** (Thursday, 7:00pm-10:00pm)

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READINGS

March 30: Course Overview

Economist Magazine (2020; 2018; 2016a,b; 2015a,b; 2013; 2012) Special Reports: "Business and Climate Change", "Toward Zero Carbon", "Global Decarbonization", "Breaking the [Oil] Habit", "Climate Change", "Energy & Technology", "Cars", and "Natural Gas".

Welch (2015), "How to Fix It," *National Geographic*. Longer/older version: Jacobson and Delucchi (2009), "A Path to Sustainable Energy by 2030," *Scientific American*, November: 58-65, and Mirsky (2008), "The Need to Lead Clean Tech: A Conversation with Thomas Friedman," *Scientific American Earth* 3.0.

April 1& 6: Role of Energy in U.S./World Economies: Micro & Macro Perspectives

Fouquet and Pearson (1998), **"**A Thousand Years of Energy Use in the United Kingdom," *The Energy Journal*, 19: 1-41.

Hamilton (2013), "Historical Oil Price Shocks" in *Routledge Handbook of Major Events in Economic History*, pp. 239-265, edited by Randall E. Parker and Robert Whaples, New York: Routledge..

BP (2020), "Energy Outlook" & "Statistical Review of World Energy". Peters (2009), "Energy Measurement Units", Handout for UCSD Econ 132. These documents & U.S. Energy Information Agency (EIA) site http://www.eia.doe.gov/ are good sources for energy information.

April 8 & 13: Theory of Exhaustible Resources

Hartwick and Olewiler (1998), "Non-Renewable Resource Use: The Theory of Depletion," [Chapter 8] and "Nonrewable Resource Use: Departures from the Competitive Case and from Fixed Stock Size," [Chapter 9] from The Economics of Natural Resource Use, 2nd ed. (Addison-Wesley).

April 15: OPEC and Energy Cartels; Search for New Supplies Including Hubbert's Curve, Fracking

Miller and Sorrell (2013) "The Future of Oil Supply," *Transactions of the Royal Philosophical Society*, A372, 1-27. And Mason and Polasky (2005), "What Motivates Membership in Non-Renewable Resource Cartels: The Case of OPEC," *Resource and Energy Economics*, 27: 321-342.

Econ 132 Handouts**:** "Hubbert Curve Theory", "Estimates of the U.S. Hubbert Curve", "U.S. Geological Service (2000 and 2012) "World Oil Resource Estimates"

Optional: Atkins and MacFadyen (2008), "A Resource Whose Time Has Come? The Alberta Oil Sands as an Economic Resource," *The Energy Journal,* 29: 77-98. Alhajji and Huettner (2000), "OPEC and World Crude Oil Markets from 1973 to 1994: Cartel, Oligopoly, or Competitive," *Energy Journal*, 21: 31-60.

April 20: International Trade and Security Issues Related to Energy

Nordhaus (2009), "The Economics of an Integrated World Oil Market," keynote address, International Energy Workshop, Venice, July. And, U.S. Energy Information Agency, "2006 Estimates of Oil Exports, Consumption and Net Imports".

Delucchi and Murphy (2008), "U.S. Military Expenditures to Protect the Use of Persian Gulf Oil for Motor Vehicles," *Energy Policy*, 36: 2253-2264.

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April 27 & April 29: Electricity: Generation, Load Profiles, Distribution, Regulation, California/Texas Crises

Viscusi, Harrington and Vernon (2005), "Natural Monopoly Regulation and Electric Power," [Chapter 5] MIT Press: *Economics of Regulation and Antitrust, 4th Edition*.

Shaten (2008), "Capacity and Demand," Energy & Resource Economics Workbook, (Internal Energy). and Econ 132 Handout: Peters "The Cournot Model".

Brennan, Palmer, Martinez (2002), "Implementing Electricity Restructuring, *ERE* 22: 99-132.

Borenstein (2002), "The Trouble with Electricity Markets: Understanding California's Restructuring Disaster," *J. of Economic Perspectives* 16: 191-211.

May 4: Traditional Power Sources: Coal, Hydro, Natural Gas, and Nuclear

Victor and Morse, 2009, "Living with Coal: Climate Policy's Most Inconvenient Truth," *Boston Review*, September, 7-14. Edenhofer (2015) "King Coal and the Queen of Subsidies." *Science* 1286-1287.

Economist (2012), "Natural Gas," [see January 5th], Stevens (2012), "The 'Shale Gas Revolution': Developments and Changes," Chatham House. Wang and Krupnick (2013), "A Retrospective Review of Shale Gas Development in the United States: What Led to the Boom?," Resources for the Future.

Davis (2012), "Prospects for Nuclear Power," *Journal of Economic Perspectives*, 26, 49-66.

Optional: Lake, et al. (2013), "A Primer on the Economics of Shale Gas Production Just How Cheap is Shale Gas?," *Journal of Applied Corporate Finance*. Krupnick, Gordon, and Olmstead (2013), "Pathways to Dialogue: What the Experts Say about the Environmental Risks of Shale Gas Development," RFF.

May 6: Alternative sources of energy (Solar, Wind, Geothermal, Wave)

Bistline &Young (2019), "Economic drivers of wind and solar penetration in the US,"; Baker, et al. "The Economics of Solar Electricity" (2013); Li et al. (2015) "Comparison of Geothermal with Solar and Wind Power Generation Systems," *Renewable and Sustainable Energy Reviews*; Wald (2009), "The Power of Renewables," *Scientific American*.

May 11: The Electric Grid and Transmission issues

Joskow (2020) "Transmission Capacity Expansion is Needed to Decarbonize the Electricity Sector Efficiently," *Joule*; Schwartz et al. (2021), "Power Companies Get Exactly What They Want: How Texas Repeatedly Failed to Protect its Power Grid Against Extreme Weather" *Texas Tribune*; Charles (2009), "Renewables Test IQ of Grid," *Science.*

Optional: Joskow (2019), "Challenges for Wholesale Electricity Markets with Intermittent Renewable Generation at Scale: the US experience," *Oxford Review of Economic Policy*; Moretti et al. (2017) "A Systematic Review of Environmental and Economic Impacts of Smart Grids," *Renewable and Sustainable Energy Reviews*; Carson and Novan (2013), "The Economics of Bulk Electricity Storage with Intermittent Renewables," *Journal of Environmental Economics and Management*.

May 18: End-User Programs: Home/Commercial Energy Conservation & Solar Installations

Gillingham, Newell and Palmer (2006), "Energy Efficiency Policies: A Retrospective Examination," *Annual Review of Environmental and Resource Economics*.

Baker, *et al.* (2013), "The Economics of Solar Electricity,"*Annual Review of Resource Economics*.

Optional: Borenstein (2008), "The Market Value and Cost of Solar Photovoltaic Electric Production," CSEM paper 176, UC, Berkeley. & Brooks (2008), "MisLEEDING," *Scientific American Earth 3.0*, 54-58.

May 20 & 22: Automobiles, Mass Transit and the Structure of Urban Areas

Li, et al. (2020), "Transportation and the Environment in Developing Countries," Annual Review of Resource Economics. Parry, Walls, and Harrington (2007), "Automobile Externalities and Policies," *Journal of Economic Literature*, 45: 373-399. Bento, et al. (2018), "Flawed Analyses of U.S. Auto Fuel Standards," *Science*.

Optional: Parry and Small (2009), "Should Urban Transit Subsidies Be Reduced," *American Economic Review*, 99: 700-724. "Future of Cars," Scientific American (2009). Bento, *et al.* (2005), Distributional and Efficiency Impacts of Gasoline Taxes," *American Economic Review*, 95: 282-287.

May 27: Environmental Externalities Related to Fossil Fuels

Dewees (2008), "Pollution and the Price of Power," *The Energy Journal*, 29: 81-100. and Carlin (1995) "Environmental Externalities in Electric Power Markets," *Renewable Energy Annual*.

Carson (2010), "Environmental Kuznets Curve," *Review of Environmental Economics and Policy*, 4, 3-23. and Webber (2008), "Catch 22: Water vs. Energy," *Scientific American 3.0*, 18: 34-41.

Optional: Komey and Krause (1997), "Introduction to Environmental Externalities," and Carson, et al. (2003), "Contingent Valuation and Lost Passive Use: Damages from the Exxon Valdez Oil Spill," *Environmental and Resource Economics*, 25: 257-283.

May 29: Global Climate Change: Underlying Science and Technical Solutions

Le Treut and Somerville (2007), "Historical Overview of Climate Change Science," in *Climate Change 2007: The Physical Basis*, Intergovernmental Panel on Climate Change (IPCC).

Pacala and Socolow (2004), "Stabalization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies," *Science*, 305: 968-972.

Optional: Auffhammer and Carson (2008), "Forecasting the Path of China's CO2 Emissions Using Provincial Level Information," *Journal of Environmental Economics and Management*, 55: 229-247.Victor, Morgan, Apt, Steinbruner, Ricke (2009), "The Geoengineering Option: A Last Resort Against Climate Change," *Foreign Affairs*, 88: 64-76.

June 1: Global Climate Change: The Economic Perspective

Stern (2008), "The Economics of Climate Change," *American Economic Review*, 98: 1-37. and Nordhaus, (2007), "A Review of the Stern Review on the Economics of Climate Change," *Journal of Economic Literature*, 45: 686-702.

Optional: Nordhuas (2007), "To Tax or Not: Alternative Approaches to Slowing Global Warming," *Review of Environmental Economics and Policy*, 1: 26-44. Greenstone, Kopits and Wolverton (2013) "Developing a Social Cost of Carbon for US Regulatory Analysis: A Methodology and Interpretation," *REEP*

June 3: International, National, State & Local Action on Climate Change

Gillingham (2019), Carbon Calculus" *Finance and Development*. Perry (2019), "Putting a Price on Pollution, Finance and Development.

Optional: Aldy, Krupnick, Newell, Parry, and Pizer (2010), "Designing Climate Mitigation Policy," *Journal of Economic Literature*. Kenneth Gillingham and James H. Stock (2018), "The Cost of Reducing Greenhouse Gas Emissions," *Journal of Economic Perspectives*. Newell, Pizer, and Raimi (2013), "Carbon Markets 15 Years after Kyoto: Lessons Learned, New Challenges," *Journal of Economic Perspectives*. Morrison, et al. (2015), "Comparison of Low-Carbon Pathways for California," *Climatic Change*. Carson, et al. (2010), "Alternative Australian Climate Change Plans: The Public's View," *Energy Policy*.