

ISEN-410/EARTH-342: TOPICS IN CONTEMPORARY ENERGY AND CLIMATE CHANGE

Fall Quarter 2014 –DRAFT-
T/Th 11 am-12:20 pm, Tech F-285

Instructor: Dr. Yarrow Axford, Earth and Planetary Sciences

COURSE SUMMARY & OBJECTIVES

The increasing worldwide demand for energy creates complex and interwoven problems, from oil price volatility to climate change. This class will challenge students to answer the question, *How shall we power the world in the 21st century?* Students will:

- Acquire a broad understanding of national and global patterns of energy use by source and sector
- Consider the history of energy use and industrialization, and how this shapes the modern world
- Quantify aspects of their own energy consumption and energy embodied in products and services
- Learn some fundamentals of climate science, especially Earth's energy balance
- Evaluate the scientific evidence regarding human-caused climate change
- Survey practical aspects, including technical feasibility and sustainability, of major energy sources
- Conduct independent research on a pressing present-day energy or climate topic

CLASS SCHEDULE

Date Topic

Energy history: How did we get here?

Sept 23 Introduction to course.
Reading: Kolbert "Age of man;" Langmuir & Broecker "The rise of Homo sapiens;" Kerr "Do we have the energy?;" Economist "Can China clean up fast enough?"

Sept 25 A brief history of energy use.
Reading: Wolfson Ch 1-4

Energy challenges: Reasons to change course?

Sept 30 Fossil fuels: Patterns of use and production. Costs and benefits.
Reading: Wolfson Ch 5-6; Murray and Hansen "Peak oil and energy independence;" Gregg et al. "China: emissions patterns"
HOMEWORK 1 DUE

Oct 2 Climate change I: Climate fundamentals. Greenhouse gases and Earth's energy balance.
Reading: Wolfson Ch 12-13

| <u>Date</u> | <u>Topic</u> |
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| Oct 7 | Climate change II: Observations of recent climate change. <i>Reading: Wolfson Ch 14; IPCC AR5 WG1 Summary for Policymakers (on Blackboard/online); Dessler Ch 7 “Why is the climate changing?”</i> HOMEWORK 2 DUE |
| Oct 9 | Climate change III: Forecasting climate. Impacts of climate change. <i>Reading: Wolfson Ch 15; Dessler Ch 8 & 9 “The future of our climate” and “Impacts;” Folger “Rising seas;” Kaufman “City prepares for a warm long-term forecast”</i> |
| Oct 14 | Uncertainty in climate science <i>Reading: Doran and Zimmerman “Examining the scientific consensus;” Schiermeier “The real holes in climate science;” Mann “False hope”</i> |
| Oct 16 | Energy & human evolution <i>Reading: TBD</i> HOMEWORK 3 DUE |

Energy options: Where can we go from here?

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| Oct 21 | Future energy options, challenges; Part I <i>Reading: Pacala and Socolow “Stabilization wedges;” Fridley “Nine challenges of alternative energy;”</i> |
| Oct 23 | Future energy options, challenges; Part II <i>Reading: Wolfson Ch 16; Chu & Majumdar “Opportunities and challenges;” Van Noorden “Two plants to put ‘clean coal’ to the test;” Liu et al. “Low-carbon road map for China”</i> |
| Oct 28 | <u>EXAM</u> (in class) |
| Oct 30 | Energy storage. <i>Reading: TBD</i> |
| Nov 4 | CO ₂ policy. <i>Reading: President’s Climate Action Plan; U.S. Congressional Budget Office re: Policy Options for Reducing CO₂ Emissions</i> |
| Nov 6 | Wind energy. <i>Reading: Wolfson Ch 10; Gillis “Sun and wind alter global landscape;” others TBA</i> |

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| Nov 11 | Nuclear energy. <i>Reading: Wolfson Ch 7; others TBA</i> |
| Nov 13 | STUDENT PRESENTATIONS <i>Reading: TBD</i> |
| Nov 18 | STUDENT PRESENTATIONS <i>Reading: TBD</i> |
| Nov 20 | STUDENT PRESENTATIONS <i>Reading: TBD</i> |
| Nov 25 | TBD. Last day of class. Final Project DUE BEFORE CLASS [post to Blackboard] |
| Nov 27 | NO CLASS: Happy Thanksgiving! |
| Dec 2 & 4 | Weinberg CAS Reading Period: NO CLASS per WCAS policy. |

REQUIRED READING

1. Wolfson, R. 2012. *Energy, Environment, and Climate. Second Edition.* W.W. Norton & Company (available at the University bookstore or online used and new, e.g. at Amazon.com).
2. Coursepack.
3. Additional readings will be posted on Blackboard or emailed to the class.

IMPORTANT ONLINE RESOURCES

1. Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5):
<http://www.ipcc.ch/report/ar5/>
2. U.S. Energy Information Administration: <http://www.eia.doe.gov/>
3. Additional useful resources will be linked from Blackboard.