

Energy, the Environment, and Society
Spring 2013

MW 3-4:30pm, L1118 ES&T

Prof. Kim Cobb

Email: kcobb@eas.gatech.edu

Phone: 404-894-3895

Office Hours: by appt, 3240 ES&T

Teaching Assistant: Dexter Campbell

Email: dexter.campbell@eas.gatech.edu

Office Hours: by appt, 1108 ES&T

Course Overview

The quest for a sustainable energy future involves balancing a series of oftentimes competing goals. On the one hand, continued population growth, combined with increased energy consumption by citizens in ever-richer developing countries, require energy production to keep pace with growth in demand. Access to cheap energy has fueled the economic development of the richest countries, and there is widespread concern that any increases in energy prices will undermine the global and national economic recovery. At the same time, the scientific consensus on climate change is now clear: carbon dioxide emissions from fossil fuel combustion are altering Earth's climate. The search for affordable, low-carbon, and renewable energies to fuel 21st century economies has become a local, national, and international priority. The energy landscape is currently in rapid flux, with the production of cheap, abundant natural gas providing unique challenges and opportunities that will determine the course of energy infrastructure development, and therefore carbon dioxide emissions, for the next decades.

This interdisciplinary seminar-style course relies on guest speakers from across the Tech campus and beyond, encouraging lively discussion of both current events and past developments relevant to our nation's energy and climate future. The main student activity will be a semester-long "Carbon Reduction Challenge", in which student teams compete to reduce carbon footprints by the end of the semester.

Course objectives

The primary goals of the course are:

- to equip students with the scientific and technical knowledge required to understand America's current energy infrastructure and alternative energy strategies
- to engage students in an interdisciplinary dialogue about one of the most pressing and complex problems facing modern societies
- to inspire students to become active participants in shaping a sustainable energy future

Course Structure

The course will be divided into four parts:

Part I: Overview of current energy use trends and projections

- Part II: Greenhouse emissions and anthropogenic global warming
- Part III: Legislative strategies for reducing greenhouse emissions
- Part IV: Low-carbon energy technologies in America's future

Requirements

Class participation: As much of the course focuses on discussion, students are required to read all assigned materials before class. Instructors will prepare a list of discussion questions, which will be addressed to individual students during group discussions. Mid-term grades for class participation will be distributed so that students can improve their participation if necessary.

Written briefs: Students will be responsible for submitting 300-word (about 1 page double-spaced) briefs that summarize the material covered in class (see assigned dates on class schedule). Please see “Tips for Writing Clearly” on class web-site.

Team research projects and presentations: “*Carbon reduction challenge*”

Teams of 3-4 students will design and implement a strategy for reducing their combined CO₂ footprint. Each team must quantify the CO₂ reductions that are associated with their reduction activities through the investigation of primary literature. The teams will present the results of their efforts and research to the class in the form of oral presentations, and to the EAS and HP communities in the form of poster sessions. The team with the most effective CO₂ reduction strategy (total amount reduced and degree of plan's success) at the end of the semester will accompany the instructor to Capital Hill to meet with Georgia lawmakers.

Please note that late assignments will be penalized 5% per day late, without prior permission from the instructor.

Grading: total = 1000pts

- 200 Participation in discussions/keeping up with reading
- 200 Written briefs (5 briefs x 40 pts each)
- 150 Plan for CO₂ reduction (Rough Draft = 50 pts; Final Plan = 100 pts)
- 150 Execution and evidence of CO₂ reduction: did the plan succeed?
- 150 Oral Presentation
- 150 Final Poster Presentation

Supplementary Text: Tester, J. et al., Sustainable Energy: Choosing Among Options. Cambridge, MA: MIT Press, 2005.

Note that all required readings will be distributed in class or available on the web.

Schedule of topics (subject to change):

- Jan 7 Introduction
- PART I Current energy use and trends**
- Jan 9 Overview of global and national energy usage and trends
- Jan 14 Overview of the transportation sector *Randall Guensler, CEE, GT*
- Jan 16 Electricity: A Southern Company perspective *Ron Shipman, Georgia Power*
- PART II Anthropogenic global warming: causes and consequences**

Jan 23	The Greenhouse effect & Earth's radiative balance	[Brief 1 due]
Jan 28	IPCC Working Group 1: The Physical Science Basis	
Jan 30	Regional climate impacts in the Southeastern US	[Brief 2]
Feb 4	Positive feedbacks on climate change: methane and ice	[Rough Plan Due]
Feb 6	Freshwater resources in the 21 st century	<i>Chuck Huling, GT</i> [Brief 2 due]
PART III	Legislative strategies for reducing emissions	
Feb 11	<i>International:</i> The Kyoto Protocol	
Feb 13	Beyond Kyoto: multi-lateral climate negotiations	<i>Paul Baer, SPP, GT</i>
Feb 18	<i>National:</i> the Clean Air Act and the EPA	<i>Ken Mitchell, EPA</i> [Brief 3]
Feb 20	Climate change/energy bills pending in Congress	[Final Plan due]
Feb 25	<i>Mock floor debate</i>	
Feb 27	<i>Regional:</i> Regional alliances for greenhouse reductions	[Brief 3 due]
PART IV	Alternative energy sources in America's future: science, technology, and economics	
Mar 4	Interface FLOR fieldtrip	
Mar 6	Renewable Portfolio Standards	<i>Marilyn Brown, SPP, GT</i> [Brief 4]
Mar 11	Carbon sequestration technologies	<i>Chris Jones, ChBE, GT</i>
Mar 13	Nuclear	<i>Bojan Petrovic, ME, GT</i> [Brief 4 due]
Mar 25	Solar	<i>Ian Campbell, ECE, GT</i>
Mar 27	Wind	
Apr 1	Energy from landfills - plasma	<i>Lou Circeo, GTRI, GT</i>
Apr 3	The future of electricity in the Southeast; clean coal?	[Brief 5]
Apr 8	<i>Transportation:</i> biofuels	<i>Art Ragauskas, Chemistry, GT</i>
Apr 10	Hybrid/electric car technologies	<i>Tom Fuller, ChBE, GT</i> [Brief 5 due]
Apr 15	Mass transit potentials	
Apr 17	Invited Speaker	
Apr 22	Student presentations (Groups 1 & 2)	
Apr 24	Student presentations (Groups 3 & 4)	
Apr 29	2:50pm – EAS poster session	

The Georgia Tech Honor Code

<http://www.honor.gatech.edu/honorcode/honorcode.html>

The definition of plagiarism (from the GT Honor Code):

“ ‘Plagiarism’ is the act of appropriating the literary composition of another, or parts of passages of his or her writings, or language or ideas of the same, and passing them off as the product of one's own mind. It involves the deliberate use of any outside source without proper acknowledgment. Plagiarism is scholarly misconduct whether it occurs in any work, published or unpublished, or in any application for funding.”