

Earth System Science 178 – *Solving the Energy-Carbon-Climate Problem*

Syllabus

Class Information

Lectures: Tues Thurs, 11:00am-12:20pm, Location: RH 184

Instructor: Steven J. Davis, sjdavis@uci.edu

Office Hours: Tues Thurs, 1-2pm, Location: Croul Hall 3232

Course Description

This course will address the question of what we can do about the problem of climate change. We will discuss how climate change is essentially an energy problem, introduce the global politics of energy and climate, and work in small groups to assess the potential of and barriers to reducing energy demand, generating low-carbon energy, sequestering carbon, intervening in the climate system, and adapting to climate change.

Textbook (required): *Sustainable Energy – Without the Hot Air* by David JC MacKay, published by UIT Cambridge Ltd., ISBN 978-0954452933. Available through the UCI Bookstore and Amazon, but the easiest and cheapest option is to download a .pdf of the book for free from the author's website at <http://www.withouthotair.com>.

Student Learning Outcomes

After completing this course students should be able to:

- 1) explain the carbon-climate-energy problem, including the primary options humanity has available for avoiding or contending with dangerous climatic changes.
- 2) identify key limits and barriers related to specific low-carbon energy technologies and be able to critically evaluate unfamiliar energy technologies
- 3) discuss social, economic and political issues surrounding climate change mitigation, intervention and adaptation

Course Requirements

Required Reading: Reading assignments from *Without the Hot Air* are listed in the Class Schedule and may occasionally be supplemented by material distributed in class.

Participation (25%): Attending lecture-discussions is the best way to learn the material and to maximize your overall performance and attendance is mandatory. Exam questions may be drawn from the topics discussed in class or laboratories but not covered in the readings. Your questions are encouraged, so please do not hesitate to ask. Participation will be evaluated by attendance (iClickers) and active contributions to in-class discussions.

Final Project (25%): Working in pairs (i.e. 2 students), you will choose a specific, cutting-edge technology (e.g., new materials, 3D-printing, nanotechnology, robotics, artificial intelligence, etc.) that you think could dramatically alter the energy market and prospects for decarbonizing our society. You will research the technology and develop one or more scenarios (i.e. possible futures) where your chosen technology is deployed. **Your final report (at least 2000 words) must include calculations of the impact of your technology on global carbon emissions.** Groups will present a summary of their work during the last week of class. Further details on the projects will be provided in class during Week 5.

Examinations - Mid-term (25%) and Final (25%): There will be two "closed book" exams, i.e., books, notes, calculators, cell phones and other forms of assistance are not permitted. No early exams will be given. If you miss an exam, a make-up oral exam will only be permitted a) within 1 week following that exam b) if you first provide authentic documentation of a genuine emergency excusing you from the exam and c) you personally request an appointment with the instructor. If you miss one exam, a make-up exam will not be permitted for the other exam.

Summary: The value of each assignment (exams and final project) and associated percentage of total points possible this quarter is presented below.

Table 1: Point values of assignments

Assignment	points total	% total
Participation	25	25%
Midterm	25	25%
Final Project	25	25%
Final	25	25%
Total	100	100%

Class Schedule

Week			Topic	Reading
1	Thurs	24- Sept	Introduction, the energy-carbon-climate problem	Ch. 1, 29
2	Tues	29- Sept	Why is this so hard? Part I: Fossil Fuels are Great	Ch. 2, Ch. 19
	Thurs	1- Oct	Why is this so hard? Part II: The Human Element	
3	Tues	6- Oct	<i>Conservation/Efficiency</i> : Transport + Buildings	Ch. 3, 5, 7, 9, 20, and 21
	Thurs	8- Oct	<i>Conservation/Efficiency</i> : Goods and Services (incl. Agriculture)	Ch. 11, 13, 15, and 22
4	Tues	13- Oct	<i>Energy supply</i> : Wind	Ch. 4
	Thurs	15- Oct	<i>Energy supply</i> : Solar	Ch. 6 pp. 38 - 42
5	Tues	20- Oct	<i>Energy supply</i> : Hydroelectric, wave and tidal	Ch. 16
	Thurs	22- Oct	<i>Energy supply</i> : Geothermal / Midterm Review	
6	Tues	27- Oct	MIDTERM	
	Thurs	29- Oct	FIELD TRIP : Port of LA	
7	Tues	3- Nov	<i>Energy supply</i> : Biomass	Ch. 13, 6 pp. 42-44
	Thurs	5- Nov	<i>Energy supply</i> : Nuclear	Ch. 24
8	Tues	10- Nov	<i>Energy supply</i> : Storage + Transmission	Ch. 26
	Thurs	12- Nov	<i>Intervention</i> : Carbon dioxide removal (CDM), carbon capture and storage (CCS) and solar radiation management (SRM)	Ch. 23 and 31
9	Tues	17- Nov	FIELD TRIP : UCI Advanced Power and Energy Program 1-3p	
	Thurs	19- Nov	<i>Adaptation</i> : Agriculture	
10	Tues	24- Nov	Final Project Presentations	
	Thurs	26- Nov	Final Project Presentations	
11	Tues	1- Dec	Final Project Presentations	
	Thurs	3- Dec	FINAL (11am – 12:20pm)	

Academic Honesty & Civility

Cheating and disruptive behavior in any form are never allowed. Guidelines established by the UCI Academic Senate will be followed if a student is caught cheating or disrupting the educational process. These policies are available [available online](#) and highlighted below. You have a responsibility to refrain from any form of academic dishonesty and to treat your fellow students, teaching assistants, and instructors with courtesy, civility, and respect.

Consulting on assignments is acceptable and encouraged as a potentially valuable learning practice. Study together, discuss methods, and check your answers against each other. You must do the work yourself and write your answers in your own words. It is your responsibility to make it clear to the grader that you worked through the entire problem yourself. Plagiarism (e.g., copying another student's answer, submitting others' work without attribution) results in an automatic score of zero on the assignment/exam and possible additional penalties, beginning with loss of whole grades. Ask the instructor or a TA if you have any questions about what this means. One way to be safe is to never show your written work to others or ask your study partners to see their answers. Focus instead on discussing the correct methods or principles. It is also academic dishonesty to operate another person's iClicker!

Highlights from the UCI Academic Senate Policies on Academic Honesty:

Types of Academic Dishonesty:

Cheating

Copying from other students (or staring inappropriately at their work) during an exam.

Telling answers to another student during an exam.

Taking an exam for another student or having another student take an exam for you.

Making changes to a corrected exam and then returning it for more credit.

Using hidden notes.

Dishonest conduct (e.g., stealing an exam from an instructor)

Plagiarism

Collusion (i.e., helping another student to cheat such as operating their iClicker)

Students have a responsibility to:

Refrain from cheating and plagiarism.

Refuse to aid or abet any form of academic dishonesty.

Notify professors and/or appropriate administrative officials about observed incidents of academic misconduct. The anonymity of a student reporting an incident of academic dishonesty will be protected.

Refrain from cheating and plagiarism.