

Earth System Science 70A – Sustainable Energy Systems

Syllabus

Class Information

Lectures:	<i>Tues Thurs</i> , Time: 12:30pm – 1:50pm, Location: ALP 2500
Discussions (optional):	<i>Fri</i> , Time: 1:00pm – 1:50pm, Location: DBH 1429 or <i>Fri</i> , Time: 2:00pm – 2:50pm, Location: DBH 1429
Instructor:	Steven J. Davis, sjdavis@uci.edu Office Hours: <i>Tues Thurs</i> , Time: 4pm – 5pm, Location: Croul 3232 (and by appointment: https://calendly.com/sjdavis/15min/)
TA:	Robert Fofrich, rfofrich@uci.edu Office Hours: <i>tbd</i> , Location: <i>tbd</i>

Course Description

This course will address the question of how modern energy services can be provided sustainably and the challenges and barriers that must be overcome in order to do so. We will discuss the major environmental issues surrounding fossil energy: climate change, air pollution, and resource demands, introduce the global politics of energy and climate, and assess the potential of and barriers to reducing energy demand, generating low-carbon/clean energy, reducing air pollution, sequestering carbon, and intervening in the climate system.

Textbook (required): *Sustainable Energy – Without the Hot Air* by David JC MacKay, published by UIT Cambridge Ltd., ISBN 978-0954452933. Available on Amazon, but the easiest and cheapest option is to download a .PDF of the book for free from its website: <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 advantages, disadvantages, limits and barriers related to specific energy sources and technologies and be able to critically evaluate unfamiliar energy technologies
- 3) discuss social, economic and political issues surrounding energy innovation and energy system transitions

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 (10%): 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 but not covered in the readings. Your questions are encouraged, so please do not hesitate to ask. Participation will be evaluated by attendance (iClickers).

Re: iClickers, you may need answers to the following questions when registering your clicker:

Which software will your instructor use in class? Answer = iClicker classic

Which Learning Management System does your institution use? Answer = None

Assignments (15%): There will be a few short assignments during the quarter, including some “back-of-envelope” questions that will be completed *during class*, and possibly some *homework* as well.

Final Project (25%): As we will discuss in this course, there are lots of challenges to getting all the energy we want cheaply and sustainably. Working in pairs, identify one such challenge and make a short video (no more than 5 minutes in duration) to explain the opportunities, barriers and issues of a specific energy source or technology to a non-scientist member of the public. Your video should include some ideas for ways such challenges might be overcome, e.g. by research and development that targets certain processes or decreases costs to certain levels.

Your video will be shown in class during Week 10, and graded according to both its content (e.g., is the information informative and correct?) and communication (e.g., is the explanation understandable and the presentation engaging and persuasive?). With your permission, videos may be shared on social media by Professor Davis and UCI.

Further details on the projects will be provided in class during Week 6.

Examinations - Mid-term (25%) and Final (25%): There will be two "closed book" exams, i.e., books, notes, calculators, 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	10	10%
Assignments	15	15%
Midterm	25	25%
Final Project	25	25%
Final	25	25%
Total	100	100%

Class Schedule

Week			Topic	Reading
1	Tues	7- Jan	Introduction to the concept of sustainability and the unsustainable aspects of the modern energy system: resource depletion, climate change, air pollution, water demand	Chapters 1 and 29
	Thurs	9- Jan	<i>Energy Demand: Transportation</i>	Chapters 3, 5, and 19
2	Tues	14- Jan	<i>Energy Demand: Electricity, Materials and Heat</i>	Chapters 7, 9, 11, 13, and 15 Technical Chapter H
	Thurs	16- Jan	<i>Conservation, Efficiency and Demand Management</i>	Chapters 20, 21, and 22 Technical Chapters A and C
3	Tues	21- Jan	<i>Energy Supply: Fossil fuels</i>	Technical Chapter K
	Thurs	23- Jan	FIELD TRIP: UCI Central Plant	
4	Tues	28- Jan	<i>Energy supply: Wind</i>	Ch. 4
	Thurs	30- Jan	<i>Energy supply: Solar</i>	Ch. 6 pp. 38 – 42, Part B
5	Tues	4- Feb	<i>Energy supply: Geothermal / Midterm Review</i>	Ch. 16,
	Thurs	6- Feb	MIDTERM	
6	Tues	11- Feb	<i>Energy supply: Hydroelectricity, Tidal, Wave</i>	Chapters 8, 12 and 14 Technical Chapters F and G
	Thurs	13- Feb	<i>Energy supply: Biomass</i>	pp. 42-44 of Chapter 6 Technical Chapter D
7	Tues	18- Feb	<i>Energy supply: Nuclear</i>	Ch. 24
	Thurs	20- Feb	<i>End Use Options: Electrification of transport and difficult-to-electrify energy services</i>	Davis et al., 2018
8	Tues	25- Feb	<i>End Use Options: Renewable fuels, low-carbon fuels</i>	Davis et al., 2018
	Thurs	27- Feb	<i>Cross-cutting: Energy Storage + Transmission</i>	Ch. 25 and 26
9	Tues	3- Mar	<i>Cross-cutting: Political dimensions, international relations</i>	Excerpt from Barrett, 2003
	Thurs	5- Mar	<i>Intervention: Carbon dioxide removal, carbon capture and storage, and solar radiation management</i>	Chapters 23 and 31
10	Tues	10- Mar	Final Project Presentations	
	Thurs	12- Mar	Final Project Presentations	
Finals Week	Tues	17- Mar	FINAL (10:30am - 12:30pm)	

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.