Stanford University School of Engineering
Syllabus, Summer 2017, CEE 107s/207s
Energy Resources: Fuels and Tools

Lecture: Tuesdays, 4:30pm – 7:20pm, 27 June – 15 August
Location: TBD
Address: 473 Via Ortega, Stanford, CA 94305

Discussion section: TBD (once/week for 50 minutes)

Instructor:
Emily Grubert
Office: Y2E2 226 (shared) / Office Hours: TBD and by appointment
Email: gruberte@stanford.edu

Teaching Assistant:
TBD

Quick References
Course website: TBD

Important dates:

Field trip:	TBD (attendance required to pass the class; talk to instructor ASAP about possible alternatives if you have an unavoidable conflict)
Midterm:	In-class portion, 18 July; Take-home, distributed 18 July, due 25 July on Canvas by the beginning of class
Final exam:	Take-home, distributed 15 August; due 19 August on Canvas by 10 pm

Course add/drop deadline: 7 July
Note: after 3 July, contact instructor before adding course; high school and undergraduate students enroll in 107s, graduate students enroll in 207s
Course withdrawal and change of grading basis deadline: 4 August

Texts and other resources: There is no required textbook for this class (see page 7). Readings are optional and will be posted to the course website.

Prerequisites: Algebra. Students may not receive credit for both CEE 107s/207s and CEE 107a/207a (formerly CEE 173a/207 & Earthsys 103).

Expected workload: 3 units, or roughly 12 hours of in- and out-of-class work each week (due to equivalence with 3 units in the longer academic year quarters). The exact time commitment might vary from week to week. Grading is on a letter or credit/no credit basis; CEE 107s (undergraduates) and CEE 207s (graduate students) will be graded separately using a curve.

About the Class

Energy Resources: Fuels and Tools is an introductory survey class focused on the fuels that power the energy systems we interact with most: transportation and electricity. The course presents a comprehensive overview of the following energy resources commonly used in transportation and electricity systems: oil, biomass, natural gas, coal, nuclear fission, hydroelectricity, solar, wind, geothermal, efficiency, and demand side management.

Lectures and readings will provide a basic understanding of the following for each resource: significance, abundance, technologies for production and use, and the political, economic, regulatory, environmental, and technical factors that affect supply and demand. To supplement readings and lectures there will be a required field trip to Stanford's new energy center. Additional field trips might be offered depending on demand.

Emily Grubert, the course instructor, studies energy systems, particularly focused on how communities experience social and environmental outcomes. Her research uses life cycle assessment, social science methods like surveys and interviews, and computational methods. She is excited to be teaching this class for the eleventh time in Summer 2017.

Who Should Take This Class?

Anyone with an interest in energy or environmental issues! In other words, there are no prerequisites for this course other than comfort with algebra. Energy systems are a major part of the human experience, but many seemingly basic facts about energy are not intuitive until you have learned them – so don't be worried that you might not have enough background. Alternatively, if you have a lot of background in some topics but not all, this course will help you think about the systems you do not yet understand, and we welcome your expertise and experience as part of our learning community. **Please note** that if you have taken or are planning to take Understanding Energy, which is offered at Stanford each fall and spring as CEE 107a/207a (formerly CEE173a, CEE 207, and Earthsys 103), you cannot receive credit for both this class and Understanding Energy due to substantial overlap in the topics covered.

What Will You Learn in This Class?

Your teaching team is passionate about energy and energy education in particular, and we have designed this class with the goal of helping you become engaged participants in energy conversations at local through global levels. Specifically, we have three main learning objectives:

1) We hope you will leave this class with basic **energy literacy**, in particular an understanding of where energy comes from, what we do with it, and why all energy decisions involve tradeoffs. We hope to expose you to the major advantages and disadvantages of each of the world's major existing and emerging fuels and to help guide you to resources that will help you find relevant information on your own.
    a. We will ask you to memorize some information, like terms and acronyms that are critical in the language of energy. We find that having certain information in your head allows you to really engage in energy conversations.
    b. We will ask you to become comfortable with certain types of calculations that are common in the energy world so that you can develop intuition for what kinds of numbers are reasonable for different energy systems and feel that you understand how the numbers are calculated.

c. We want you to have a sense for what energy systems look like so that you can draw on your own experience of how big a power plant is, what it sounds like, etc. when you think about energy, so we have a mandatory field trip. This experience is meant to give you a physical understanding of the concepts we will discuss in class.

2) We hope you will leave this class feeling qualified to **have and defend opinions on energy**, in particular that you will be able to think critically about energy-related statements and decisions. We will discuss all of the major fuels currently in use or under serious consideration for use and challenge you to think critically about how these fuels affect people and the environment in our homeworks and exams, with the goal of enabling you to take what you read in a newspaper, hear in conversation, or learn in class and feel qualified to agree with, challenge, or build on it.
3) We hope you will leave this class **knowing where to go for more information**. With that goal in mind, we will offer many more references than you can look at over the course of eight weeks, and we will not try to lecture on every important detail in class. Instead, we will cover key themes and important basic facts in lecture and evaluations and show you how to uncover additional information on your own.

What Do We Expect from You?

CEE 107s/207s is an engineering class, so we will be using some math. Please don't let that discourage you – we expect anyone who is comfortable with basic algebra can succeed in this course, and we encourage you to seek assistance from peers, the TA, and the instructor as needed. Come talk to the instructors or send us a private Piazza message or email if you have concerns. Graduate students should enroll in 207s; all others should enroll in 107s. The graduate and non-graduate sections will be graded separately, and graduate students will sometimes be assigned more difficult homework and exam problems.

The class will cover a lot of material; therefore, we will emphasize qualitative and holistic understanding of energy systems. This will be reflected in the homework and tests, which will be primarily take-home assignments that will allow you to think deeply about the problems. We are more interested in your thought process than your answer and will grade accordingly, though we will ask many questions that have a "right" answer. Also, there are some terms and key facts that one must know to be literate in energy, so we will ask you to do some traditional memorization that we will test with in-class components of the exams. Past students consistently report how useful this is after the class, so we think the effort is worth your time. We will not, however, ask you to memorize huge amounts of numerical data – what we focus on is your ability to engage with the energy world, develop intuition, and synthesize issues and analyze decisions in the energy industry.

We will suggest readings and other resources (including videos) that will help you access information about topics we will discuss in class and make them accessible to you online and in the libraries.

We are strongly committed to returning your assignments and exams in a timely fashion (within a week of the due date). So that we can grade everything and provide you with feedback as quickly as possible, late assignments and exams will not be accepted without official approval from the instructors. We understand emergencies happen – we just ask that you keep us informed of your needs so that we can make the class work for everyone. In particular, if you know that you cannot attend the field trip to Stanford's energy center (date and time TBD), please let us know ASAP so that we can discuss a make-up assignment.

If you want to make audio or video recordings of the class, please get permission from the instructor before doing so.

Detailed Class Processes, Assessment, and Evaluation

Assignments are due at the beginning of lecture on the day that they are due. No late assignments will be accepted without instructor approval. The teaching team works hard to return assignments quickly, but it is your responsibility to make sure that assignments have been received and graded. You must report any ungraded/missing assignments no later than ten days after the assignments are returned to students.

As noted above, graduate students (enrolled in CEE 207s) and non-graduate students (enrolled in CEE 107s) will be graded separately and will be asked to complete slightly different assignments.

Final Exams: 30%

The final exam will be comprehensive and will be take-home, open book. No collaboration is allowed. The exam is due online at the end of the university-designated exam slot (10 pm on Saturday, 19 August), and you will not need to be on campus for the designated exam time.

Midterm Exam: 15%

The midterm exam will cover energy extraction and capture and will be take-home, open book, with an in-class portion covering acronyms and definitions. No collaboration is allowed.

Problem sets: 50%

You will have five problem sets (assigned in weeks without an exam). The problem sets will be similar in format to the midterm exam, and you are encouraged to collaborate with peers. However, each student is expected to turn in an individual assignment in your own words: plagiarism or copying is a serious violation of the Honor Code. Honor Code violations will be reported to SEWSS.

Field trip attendance and worksheet: MANDATORY, and 5%

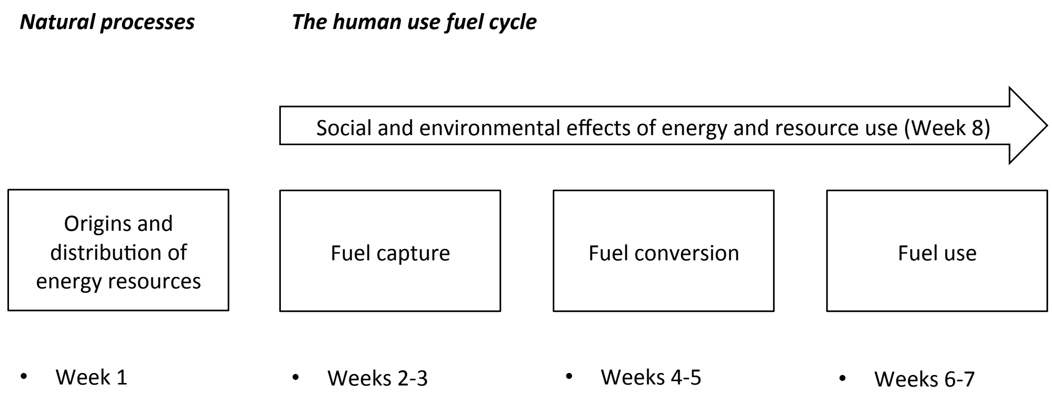
You must attend the class field trip to Stanford's energy center to pass this class, and you will receive 5% credit for your attendance when you complete a short worksheet that will be handed out at the field trip. If you must miss the field trip, please contact the instructors immediately to arrange an alternative. The field trip is an important contributor to your energy literacy, and we take it very seriously.

Class participation, enthusiasm, and preparedness: Intangible

While attendance is not strictly required, consistent positive participation, enthusiasm, and preparedness will be taken into consideration if your final numerical grade is near a letter-grade border. Similarly, disruptiveness, rudeness, and disregard for your peers and instructors will be taken into consideration if necessary.

Lectures and Course Map

This course focuses on the human use fuel cycle – that is, how natural resources like coal or the wind are harnessed, processed, and controlled for human use. A basic concept map for the course shows that we will be looking at many different energy resources at the stages of fuel capture, fuel conversion, and fuel use that we see with human systems. Throughout, we will be talking about how different fuels affect people and the environment, and we will spend some extra time on those topics at the end of the class once you have background on all of our major fuels.



The likely lecture schedule is below, but we might spend more or less time on a topic based on your interests. Note that each of the topics we will be discussing could be the topic of its own course – so we want to hear what you want to learn! Even if we cannot fit everyone's deeper interests into lecture, we can point you to resources that will help you go deeper on your own.

Lecture Schedule

Week 1: Introduction to Energy Systems
- Why study energy?
- What are energy systems?
- Origins and distribution of energy resources
- Student introductions

Week 2: Fuel capture: extraction
- Drilling: Oil, natural gas, and geothermal
- Mining: Coal and uranium

Week 3: Fuel capture: harnessing
- **Problem set 1 due on Canvas at start of class**
- Cultivation: biomass
- Reservoirs: hydropower and solar
- Turbines: wind and ocean
- Technical capture: efficiency and demand side management

Week 4: Fuel conversion: electricity
- **Problem set 2 due on Canvas at start of class**
- **In-class portion of midterm begins at start of class; take-home portion released at end of class**
- Thermal power plants
- Nonthermal power plants
- Transmission and distribution

Week 5: Fuel conversion: transportation
- **Midterm due on Canvas at start of class**
- Refining
- Batteries
- Fuel cells

Week 6: Fuel use: developed world
- **Problem set 3 due on Canvas at start of class**
- Electricity end uses in the developed world
- Transportation end uses in the developed world
- Efficiency opportunities in the developed world
- Energy regulation and politics in the developed world

Week 7: Fuel use: developing world and international considerations
- **Problem set 4 due on Canvas at start of class**
- Energy poverty
- Electricity in the developing world
- Transportation in the developing world
- Energy trade

Week 8: Social and environmental implications of energy systems
- **Problem set 5 due on Canvas at start of class**
- Land use and air pollution
- Climate change
- Water use and drought
- Energy access
- **Final released at end of class, due on Canvas by 10 pm on 19 August**

Texts and Other Resources

The optional class textbook is a digital book based on Energy 101, a successful Massively Open Online Course from The University of Texas at Austin. We will also be publishing selected readings and other resources like videos on the course website. While you might find them helpful, the readings are not required. You are encouraged to look through the resources and allocate your time as you choose.

The course website is your source for all resources and other information about the class and is found at **TBD**. Embedded in that website is an online discussion forum (Piazza) where you are encouraged to share interesting articles and questions with your peers. Rather than emailing questions to the teaching staff, I encourage you to post your questions and anything you might like to share with the class on Piazza. You are not required to join Piazza. Direct link to Piazza: https://piazza.com/stanford/summer2017/cee107s207s/.

This course requires access to a computer and the Internet for accessing course resources and completing assignments: 24-hour access to Windows and Macintosh computers is available at the LaIR in Tresidder Union (https://acomp.stanford.edu/tresidder) and Lathrop library (https://library.stanford.edu/libraries/lathrop/24-hour-study-room) in addition to other locations with more limited hours (http://library.stanford.edu/using/study).

Accessibility

Students who may need an academic accommodation based on the impact of a disability must initiate the request with the Office of Accessible Education (OAE). Professional staff will evaluate the request with required documentation, recommend reasonable accommodations, and prepare an Accommodation Letter for faculty dated in the current quarter in which the request is being made. Students should contact the OAE as soon as possible since timely notice is needed to coordinate accommodations. The OAE is located at 563 Salvatierra Walk; phone: 650-723-1066; web site: http://studentaffairs.stanford.edu/oae.

Honor Code

The Honor Code applies to both instructors and students. The text is reproduced below; for more information, see http://studentaffairs.stanford.edu/communitystandards/policy/honor-code. Violations of the Honor Code will be taken extremely seriously in this class.

1. The Honor Code is an undertaking of the students, individually and collectively:
    1. that they will not give or receive aid in examinations; that they will not give or receive unpermitted aid in class work, in the preparation of reports, or in any other work that is to be used by the instructor as the basis of grading;
    2. that they will do their share and take an active part in seeing to it that others as well as themselves uphold the spirit and letter of the Honor Code.
2. The faculty on its part manifests its confidence in the honor of its students by refraining from proctoring examinations and from taking unusual and unreasonable precautions to prevent the forms of dishonesty mentioned above. The faculty will also avoid, as far as practicable, academic procedures that create temptations to violate the Honor Code.
3. While the faculty alone has the right and obligation to set academic requirements, the students and faculty will work together to establish optimal conditions for honorable academic work.