What can we do now to avoid the most serious consequences of climate change, which poses an immediate problem for global society?

SYLLABUS AND SCHEDULE: GENED 1137 Syllab_24Spring.docx

Welcome Video

Meeting Time: MW 12:00-01:15 pm ET

Location: Pierce Hall Room 209

Course Description:

Human induced climate change has the potential to alter the function of natural ecosystems and the lives of people on a global scale. The prospect lies not in the distant future but is imminent. Our choice is either to act immediately to change the nature of our global energy system (abandon our dependence on fossil fuels) or accept the consequences (included among which are increased incidence of violent storms, fires, floods and droughts, changes in the spatial distribution and properties of critical ecosystems, and rising sea level). The course will be designed to provide students with an understanding of relevant physical, technical and social factors including an historical perspective. In the latter half of the course, the plan will be to engage students in an interactive dialogue on possible responses recognizing explicitly differences in motivations for different constituencies - for developed as distinct from developing economies for example. We plan to explore options for a zero carbon future energy system including the challenges involved in implementing the necessary transition. If we fail to abandon our dependence on fossil fuels - and the time scale over which we must do so to realize even the minimal objectives outlined in the recent Paris climate accord is as brief as a couple of decades or even less â€“ might we need to explore possibilities for geoengineering, for purposeful intervention in the global climate system? Arguments for and against such options will be discussed and debated. We will expect students to be actively involved in exploring, researching and debating responses to any and all of these interrelated issues.

Prerequisites: Math requirement is minimal, at most high school algebra

Course Enrollment: **This course does not have an enrollment cap. You may enroll through my.harvard when any advising holds are lifted.**

Teaching Staff:

Professor:
Michael B. McElroy (mbm@seas.harvard.edu)
Harvard School of Engineering and Applied Sciences; Earth and Planetary Sciences
Office: Pierce 100C
Office hours: By appointment (please contact Cecilia McCormack at ctd@seas.harvard.edu)

Teaching Fellows:

Haiyang Lin (haiyanglin@seas.harvard.edu)

Luka Chomich (luka_chomich@hks.harvard.edu)

Course Goals:

By the end of this course, students will be able to:

1. Summarize scientific principles that connect energy and climate.
2. Quantify energy use, costs, efficiency, and other relevant climatic parameters.
3. Compare and contrast the sources, problems, and potential of important energy sources, including

coal, oil, natural gas, nuclear, wind, solar, biomass, geothermal and hydropower.
4. Evaluate the impact of governance, economics, policies, and innovative technologies on energy and climate.
5. Contribute to meaningful, informed dialogue about climate and energy with people in both scientific and non-scientific fields.

Course Format:

Lectures:

Given the collaborative nature of the discussions, all are required to attend the main class sessions in person. If you cannot attend class on a regular basis for some other reason, please contact the instructor by email.

Sections:

Weekly one-hour sections will be staffed by the teaching fellows, allowing opportunities for students to seek help with more difficult components of the course and discuss specific questions as they arise relating to the lectures, readings, and homework. Sections will consist of some lecture review, practice problems, discussion, and work on papers and presentations. Given the collaborative nature of the discussions, section attendance is mandatory.

Required Reading:

The first half of the course is devoted to developing an understanding of the climate system including the impact of human activity. The lectures will cover past and future impacts of climate change not only for the US and Europe but also for China and India, respectively numbers 1 and 3 in terms of emissions of green house gases.

Readings assigned for the first half of the course will emphasize the climate system. Readings will be posted on a weekly basis on Canvas. It will include chapters from a recent book by McElroy and Prem. Other readings will be taken from a number of popular books addressing challenges caused by climate change.

The second half of the course will address options for substitution of zero carbon energy sources for fossil fuels. Readings will be taken from 'Energy and Climate: Vision for the Future' by Michael B. McElroy (1st edition, Oxford University Press, 2016) . This book is accessible through the Harvard Library and can also be purchased on Amazon.

An important component of this course involves critically analyzing the ideas presented in these readings. Each week, students are expected to submit a one-page critique of the assigned reading. This exercise aims to deepen your understanding and engage you actively in the learning process.

Course Requirements and Grade Breakdown:

Group discussion, Section and Lecture Participation (10%)

Each studentâ€™s participation grade will be determined based on attendance and activity during sections and lectures. Attendance may be recorded using sign-in sheets and/or in-class activities. Excused absences (see below) will not count against students. Students with excused absences should contact TFs or Professor McElroy (for lectures) in advance. Students are expected to check the course website regularly and respond in a timely manner to emails from course teaching staff.

Homework (15%) and Short Responses (15%)

Students are expected to complete homework assignments providing practice in handling the quantitative and qualitative aspects of the material. Homework assignments will be posted on the course Canvas site. Due dates are indicated on the course schedule. Students will submit assignments via Canvas. **Late assignments will be docked 10% and an additional 10% per 24 hours after the due date.** Problem sets will cover: (1) climate basics, (2) energy basics, and (3) electricity. Students will be expected to write a brief paper weekly (1 page) on the reading emphasizing questions arising from the material. A portion of

the scheduled class time will be devoted to related discussions including possible small group breakout sessions.

Midterm Exam (20%)

The midterm exam is a written exam (multiple choice, true/false, and short answer) scheduled for **Monday, March 18th**, and will cover material covered in lecture, section, the textbook, and homework up to that point. **A study guide detailing the relevant topics, along with a practice sheet including answers, will be made available**. Please note that the exam is closed book, and there is no need for a calculator.

Final Paper (30%) and Presentations (10%)

In lieu of a final exam, students, working as individuals or in pairs, will complete an in-depth research project pertaining to an aspect of climate or energy. This research will culminate in a paper (due **Sunday, April 28**) and a short presentation (length depends on course enrollment, probably 10 minutes) during lecture (**early April**). The purpose of the final project is to encourage students to dive deeply into a topic of personal interest that is relevant to the course and also provide information that will be relevant to in-class discussion.

Students working in pairs will have twice the suggested lengths for their papers and presentations. More details will be provided. Students will be required to attend all of the presentations and provide feedback to the presenters, which will be incorporated in their final papers.

Policy on missing lectures and assignment due dates:

Students with occasional conflicts (e.g., extracurricular activities, job interviews, religious observances) should inform their TF **in advance** of their absence. Students who will be unavailable on assignment due dates are required to turn in their homework **in advance** remotely (via email or Canvas) on the original due date. Students who experience unexpected or other extenuating circumstances (e.g., illness, family emergency), should contact their TF as soon as possible to arrange for missed work. When circumstances will require more significant accommodations, such as extended illness, a death in the family, etc., the student should inform their resident dean, the course head, and their TF. The resident dean will work with the course head and head TF on an appropriate plan for making up any missed work.