

GEOS 24705/34705, ENST 24705 (2015)

Energy: Science, Technology, and Human Usage

Professor: Liz Moyer (moyer@uchicago.edu, Hinds 405)

Teaching assistant: likely Andrew Malone (amalone@uchicago.edu, Hinds 425)

Field trip coordinator: TBD

Website: <http://geosci.uchicago.edu/~moyer/GEOS24705/2015>

For 2014 course website see <http://geosci.uchicago.edu/~moyer/GEOS24705/2014>

Description

This course covers the technologies by which humans appropriate energy for industrial and societal use, from steam turbines to internal combustion engines to photovoltaics. We will discuss the physics and economics of the resulting human energy system: fuel sources and relationship to energy flows in the Earth system, the history of human appropriation of energy, costs and feasibility of alternative technologies. The course is intended to provide a technical foundation for students interested in careers in the energy industry or in energy policy.

Besides lectures and problem sets, the course involves experiences with energy technology in labs and field trips. Both labs and field trips are intended to be enriching opportunities to explore technology in a hands-on way: visiting, touching, using, dis-assembling. Neither labs nor field trips involve write-ups, only participation. Students are required to participate in a minimum of 3 field trips and 4 labs during the quarter, but in practice many students attend nearly all field trips and labs. Enrollment is limited to 35 students to make trips and labs possible.

Past field trips have included Fisk and Crawford power plants (coal-fired, but now shut down), Grand Ridge wind farm, Dresden Nuclear Plant, BP Whiting oil refinery, Argonne Advanced Automobile Laboratory (and solar photovoltaic research facilities), the Gas Technology Institute (research facility developing gasification technologies), an Arcelor Mittal steel mill, and building sites in downtown Chicago, as well as local options: the U. Chicago's own steam and chilled water plants, building sites on campus, and the Museum of Science and Industry for cogeneration, solar panels, and steam locomotives. Labs include human power, electric motors, internal combustion engines, radiation and lighting, and solar photovoltaics.

The course grade is determined by bi-weekly problem sets and by a final group project. Typical group projects are research papers involving some investigation of feasibility or cost-effectiveness of an energy system, but groups are also permitted to opt for design-and-build projects. In 2010 one group built a wind turbine and another a bicycle-powered electrical generating system. Some funding is provided for materials in the case of build projects.

Prerequisites

The course is intended for students with some background in physics, or with strong motivation to learn. A year of undergraduate-level physics is the recommended preparation, but students with less science preparation can take the course and do well - the teaching assistants are committed to working with each student as needed to bring them to the same level - though those coming from thinner science backgrounds should plan their schedules appropriately to manage the time commitment. In practice, course enrollment tends to be split between students from the sciences, from public policy, and from economics or the business school. Problem sets have a base of questions that require no calculus, but there are additional optional problems for science majors and those wishing to go deeper into the material.

Course components summary

- Class T, Th 3-4:30 PM (Office hours TBD)
- Labs (TBD depending on student schedules, requirement 4 or more labs)
- Field trips (requirement to attend 3 or more field trips, max one local)
- Problem sets (2/week, quick problem on Tuesdays, real PS on Thursdays)
- Final group research project & paper (each group must include both science and non-science students)

Field trip notes: Most field trips are scheduled for 8 AM Fridays, to return before lunchtime. (Only Dresden Nuclear tends to run long, because of all the security involved). We do accommodate students before who have unbreakable Friday conflicts. When possible we will arrange additional alternate "unofficial" trips, and students can also develop new substitutes for field trips. There will also be at least one trip during reading week. U. Chicago will provide free transportation (bus + driver) for all "official" trips (Fridays plus alternate trips with large attendance). Signing up for field trips several weeks in advance may be required for those trips that are space-limited. (Facilities cannot always accommodate large groups.) Suggestions of additional field trips are welcome and I'd like to expand our list, and it's fun to generate trips that respond to particular student interests.

How to request consent to enroll

Enrollment is consent-only for several reasons:

- to force people to read this instruction sheet so that people know what the class entails
- to let students avoid bidding for the class
- to ensure that preference goes to students who most need or want the class, if it is oversubscribed
- to get a balanced class with students of different backgrounds who complement each other and produce good discussions
- to ensure that everyone has the necessary preparation

To request enrollment, send a paragraph or two describing your background, reasons for interest in the class, and what you think you'll get from the class, to Liz Moyer at moyer@uchicago.edu. Put "GEOS24705" in the subject line, and include your student ID# in the email. In general I would reply on the morning of the last day of 8th week (Feb. 28), because students bid for classes on that day. If you need an answer quickly on enrollment consent, include that in your email. As it works out, the number of students turned down is generally very low, but the act of requiring this paragraph seems to be a useful filter that ensures a prepared, active, and engaged class.