HSP 288 - Energy in the Modern World
Syllabus - Fall 2010

Instructor
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Meeting times and place
Monday and Wednesday, 3:35 pm to 4:50 pm; room 304 of the Nielsen Physics Building
No class on November 3 and 24

Course description
This course will focus on the energy technology solutions for the future as the country and the
world face the problems of expanding population, increasing need for energy, eventual peak in
the world production of petroleum, and the increasing realization that sustainable forms of
energy supply must receive more emphasis in the future. It is becoming clearer each year that
climate change is resulting from the increasing use of fossil fuels as the world’s primary source
of energy, and so a consideration of future energy technologies must include a discussion not
only of the cost of the construction and supply of fuel but also the handling of waste that results
and the impact on the environment including buildup of greenhouse gases. Traditional sources
of energy and electricity will be covered, in addition to future sustainable energy sources, near or
far term. The important role of efficient use of energy will also be discussed.

Course objectives
The primary objective is to educate the students about the details of the energy choices for the
future. Each of the past, present, and future energy technologies will be discussed with some
emphasis on how the technology works and what effect it has on the environment. Many careers
in the future will be shaped at least in part by some aspect of energy supply, use, pricing, control,
policy, and impact on climate. It is therefore important for students in many disciplines to study
the various energy technologies available for the next 50 years. Discussion of fuel, supply,
siting, waste, pricing, and policy concerning each energy technology considered will flow
naturally from the consideration of the basic technology. This course is meant to be
interdisciplinary in nature and will not have technical prerequisites. The timing for this course is
appropriate, as sustainability is increasingly important to institutions in construction, energy use,
and research. The public is beginning to accept the fact that climate change as real and
increasingly seems poised to move to new energy solutions that emphasize sustainability. UT
enjoys a close relationship with Oak Ridge National Laboratory, which contributes to energy
emphasies and expertise in many areas. ORNL expertise, facilities, and programs will be
available as complementary resources for this course.

Textbook
Roger A. Hinrichs and Merlin H. Kleinbach
Course structure
This course will have the following components:
1. Sustainable energy basics
2. Climate change
3. Fossil fuels
4. Nuclear power
5. Renewable energy
6. Biomass energy
7. Solar energy
8. Wind energy
9. Storage, transportation, and distribution
10. Transportation

Guest lecturers from ORNL and UT will be used in a few relevant areas of discussion. Tours of ORNL energy-research facilities will be arranged.

News Notes
It is important for everyone to be aware of current news items that pertain to the many energy issues that are constantly in front of our society. Each student should be watching for these news items and is expected to e-mail the instructor a short summary of a new item in the news. This should be done on the frequency of roughly one every two weeks. The instructor will occasionally ask a student to give an informal five-minute summary of a news item in class.

Technology summaries
Each student is expected to submit a Technology Summary for each of the energy technologies discussed in the course: conservation, fossil fuels, air pollution/climate change, batteries/fuel cells, electrical grid, solar, wind/hydro, nuclear, and biomass. Each of the nine summaries should be submitted by the class following the discussion of that particular technology. Each report should be roughly two pages in length and should include a brief discussion of some of the following topics concerning the particular energy technology:
1. Source of fuel
2. Abundance of fuel; preparation of fuel
3. Status of the technology
4. Typical size of a plant
5. Efficiency of the process
6. Disposal of waste
7. Environmental impact
8. Approximate cost of a plant
9. Social, political, and other considerations relative to this technology

This set of technology summaries has several purposes. One is to help each student become at least somewhat familiar with each energy technology discussed. Another is to prepare the student with an outline for the major project he/she is expected to do on one of the energy technologies, to be submitted towards the end of the semester.
Energy technology project
Each student is expected to prepare and present a detailed project analyzing the status of a particular energy technology. Possible topics include the following:
- Coal, e.g., closed cycle coal plants
- Biofuels
- Solar
- Nuclear
- Wind
- Geothermal
- Hydrogen
- Fusion
- Efficiency
- Batteries/storage
- Transmission of electricity
- Oil shale
- Far-out options

The ground rules for this process include the following.
- Each student should propose a possible detailed topic midway in the semester. The topic should be more specific than the broad categories listed above. For example, rather than nuclear energy the project topic could be the role of high-temperature gas-cooled reactors in the future or nuclear fuel reprocessing.
- The instructor will work with the students to ensure that each student has a different project topic.
- Each student must submit a one-page outline of their project by a date to be determined, to be sure that everyone is headed in the right direction.
- The final project report follows from the outline and is entirely Powerpoint based. It must be submitted by the end of the semester.
- The final project must be given to the class in a 15 to 20 minute presentation sometime in the final two weeks of class.
- The project Powerpoint should include a discussion of the topics listed above in the Technology Summaries section, as appropriate.

In addition, each student must submit along with their Powerpoint presentation a summary paper discussing the set of solutions they suggest for the energy/environment problems of our country over the next few decades. This set of solution builds on the nine technology summaries submitted throughout the semester, and requires each student to integrate all that was learned and to lay out a broad program to address our energy issues. The particular subject of the presentation should be one of the list of solutions for the future.

Final grade. The final grade for the course will be based on the following components:
- Class participation and news notes - 10%
- Mid-term test – 30%
- Technology summaries - 30%
- Energy technology project - 30%.