**THE ENERGY CRISIS (ESCI/PHYS 385)**

 FALL SEMESTER 2008

**Lectures:** Tuesday and Thursday at 9:30‑10:45 a.m. in Akeley‑Lawrence Science Center 313

**Text:** *Energy: Its Use and the Environment*, 4th ed., by Roger A. Hinrichs and Merlin Kleinbach

**Instructor:** Dr. Timothy H. Heaton, Chair and Professor of Earth Sciences

 Office: Science Center 201E (inside the Earth Sciences department office)

 Office hours: Monday through Friday at 1:00-2:00 p.m. or whenever available

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 Dept. phone: 677‑5649 Home page: http://www.usd.edu/esci/energy/

**Catalog description:**
Survey of energy resources and usage. The physics and geology of fossil fuels, hydroelectric, nuclear, solar and geothermal energy and environmental effects.

**Course description:**
This course deals with the technical and political aspects of energy in our society. We will discuss the sources, generation, transportation/distribution, and use of energy as well as the efficiency, side-effects, and dangers that are involved. Modern technology, from transportation to lighting, from industry to individual homes, is completely dependent upon energy to function, yet most of the energy currently being used is non-renewable and will be gone in a few decades. For this reason the course will not only cover the energy resources in use today, but will explore many potential renewable resources that may provide for society's needs in the future.

We will also take a brief side trip into the history of nuclear energy since this plays an important political role in the history of the past century. We will look at the discoveries that led to the making of the atomic bomb during World War II and the subsequent use of atomic power for peaceful purposes.

**Prerequisites:**
This course has no prerequisites and can be taken by anyone. We will use algebra and chemical formulas to illustrate simple energy conversions, but these will be explained in detail and should not pose a problem. Please see the instructor if you need special help in this area.

**Course requirements:**
Class attendance is of the utmost importance because some course material is not covered in the textbook. There will also be several field trips, and attendance is required unless there are extenuating circumstances. Field trip reports and a few assignments will be required. There will be three hour exams (dates to be announced) and a comprehensive final exam (December 16th at 3:00 p.m.). The exact coverage and format will be discussed before each exam. Study questions at the end of the chapters (and study question handouts) will be helpful in studying for the exams.

Each student will be expected to write a term paper on a topic related to energy of his/her choice. A list of possible topics and some helpful guidelines will be provided. A topic is to be submitted for approval by October 3rd. The paper is to be written in two drafts, due on November 14th and December 12th. The first draft is to be a completed, typed paper, and the instructor will carefully review it and offer suggestions for improvement on the second and final draft.

Since energy issues are constantly flooding us from the media, one objective of the course is to evaluate media claims for accuracy and significance. During the semester each student is to select at least three articles from news outlets, do a little research on them, and present them to the class along with an explanation (and any questions they raise) so the class can discuss them. Each class will begin with an opportunity make these presentations. The student is not required to be an expert on the subject of the article, but only to have given the content some critical thought.

**Grading:** Hour Exams: 300 points Term Paper 1st Draft: 50 points

 Final Exam: 150 points Term Paper 2nd Draft: 100 points

 Class exercises: 50 points Field trip notes: 100 points

 News events: 50 points

**Course Evaluation:** You will have an opportunity to evaluate the course and the instructor using the IDEA Diagnostic Form at the end of the semester.

**Cell Phones:** Please turn off cell phones and pagers and put them away during class.

**USD Cheating Policy**: “No credit can be given for a dishonest assignment. At the discretion of the instructor, a student caught engaging in any form of academic dishonesty may be: a. given a zero for that assignment, b. allowed to rewrite and resubmit the assignment for credit, c. assigned a reduced grade for the course, d. dropped from the course, or e. failed in the course.”

**Disabilities**: If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the director of the Office of Disability Services (Service Center 119, 677-6389) as early as possible in the semester.

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 **TOPICS TO BE COVERED**

Introduction

Energy Shortages in an Energetic World (Chapter 1)

Forms of Energy and how they are Related (Chapter 2)

Electricity and Energy Transportation (Chapters 10 & 11)

Gravitational Potential Energy

Hydroelectric Power (Chapter 12, pp. 413-417)

*Field trip to Gavin's Point Powerhouse (west of Yankton)*

Chemical Potential Energy

Chemical Reactions and combustion

Engines, Thermodynamics, Heat Transfer (Chapters 3 & 4)

Fossil Fuels (Coal, Oil, Natural Gas) (Chapter 7)

Air and Water Pollution (Chapter 8)

Global Warming and the Ozone Layer (Chapter 9)

*Field Trip to Port Neal Coal Plant (south of Sioux City)*

Nuclear Potential Energy

Atomic Structure and Nuclear Reactions (13)

History of Physics, Fission and Fusion Bombs, Film: *The Day After Trinity*

Nuclear Fission Energy, Breeder Reactors (Chapter 14)

Risk of Nuclear Accidents (Chapter 15)

Nuclear Fusion: Hot and Cold (Chapter 16)

*Field Trip to Cooper Nuclear Power Plant (south of Omaha)*

Renewable Resources for the Future

Solar Heating: Passive and Active (Chapter 6)

Solar Energy: Thermal and Photovoltaic (Chapter 12)

Wind Energy (Chapter 12)

*Field Trip to Iowa Wind Farm*

Hydroelectric Energy (Chapter 12)

Tidal Hydroelectric Energy

Biomass Energy (Chapter 17)

*Field Trip to Poet Ethanol Plant (south of Sioux Falls)*

Geothermal Energy (Chapter 18)

Ocean Energy: Waves and Currents

Ocean Thermal Energy Conversion [OTEC] (Chapter 1, pp. 117‑118)

Other Energy Issues

Energy Transportation and Storage

Air Conditioners and Heat Pumps (Chapter 5)

Energy Efficiency and Conservation (Chapter 5)

Recycling and Energy Savings

*Field Trip to Clay County Recycling Center (Vermillion)*