

Mixed

Proposal for a Mixed Cluster General Education Learning Community:

Energy and the Environment

1. Theme: Perhaps no issues facing our global society right now are more pressing than the looming energy crisis and the serious environmental consequences of global warming. Due to modern society's heavy reliance on fossil fuels, these two problems are directly linked, and require all of us to become informed enough to play a role in local, national, and global strategies for developing sound environmental policies and finding sustainable ways to meet energy needs. The impending exhaustion of fossil fuels coupled with the serious shift in the earth's climate due to global warming is having and will continue to have dramatic social, political, and economic consequences for the entire world. For modern society to continue, scientific and technological development of new energy sources, as well as dramatic social, political, and economic measures, are required.

Achieving sustainability and thus meeting human energy needs while protecting our environment is a complex, interdisciplinary problem that cannot be solved without a basic understanding of the laws of nature that constrain our scientific options and the moral, cultural, economic, and political principles that govern how humanity can and should respond to these issues.

The core theme of our proposed learning community is examining issues related to energy and the environment the perspectives of science, policy, and ethics. Students will emerge from the learning community as informed citizens who understand the basic scientific and ethical problems related to energy and the environment.

Importance of Issues to First Year Students: People in America live a particularly energy-intensive lifestyle, and it is rapidly becoming clear that the collective impact of our behavior is having dramatic consequences for the world. There is certainly a connection between the rising price of gasoline and electricity of which first year students are acutely aware and the wars and instability in the Middle East, pollution, climate change, political upheaval in many parts of the world, and global economic trends. In a sense, energy and the environment are central issues that can be used to connect and explain a great deal of what is transpiring both globally and locally.

First year students can see how their individual choices, taken as part of an aggregate society, affect disparate elements of the global society. Because these problems will only become worse in coming years unless we change course, now is a critical time to become informed about energy and the environment.

2. Courses:

Physics 2005: Science of Energy

Geology 1006: Energy and the Earth System

Philosophy 1101: Social and Ethical Issues

3. Integration of Course Content: In order to facilitate integration of course content, we have decided that each course will share a common text [Energy: Science, Policy, and the Pursuit of Sustainability, ed. by R. Bent, L. Orr, and R. Baker (Island Press, Washington DC, 2002)]. Course content will be supplemented with handouts and additional texts as needed. In the final course in the sequence (Philosophy 1101), the course will conclude with a "mini-conference" on the subject of Energy and the Environment where students will give presentations combining

knowledge and analysis from all three courses. Professors from all the courses will attend the conference and share in the evaluation of the presentations.

Each of the courses will address the fundamental problem of how society can address human energy needs in a sustainable way while protecting the environment. Each course will encourage students to creatively engage this central question in different ways:

- a) In *Physics 2005 (Science of Energy)*, students will first study the scientific facts concerning energy. They will learn what energy is and the laws of physics that govern the creation, use, and distribution of energy. Different means of energy production will be studied: fossil fuels, nuclear, solar, geothermal, etc. Quantitative reasoning will be stressed as students will analyze the impact of population growth, standard of living and economic issues, and efficiency. Students will synthesize their knowledge by writing quantitative papers on how to meet human energy needs in a sustainable way.
- b) *Geology 1006 (Energy and the Earth System)* will provide students with a broad survey of Earth System Science with a focus on energy in the environment, energy resources (e.g., coal, natural gas, petroleum geothermal, etc.), and the environmental implications of some energy technologies (e.g., air pollution, acid rain, global warming, etc.). This course provides a broad interdisciplinary (systems approach) introduction to energy and our environment. GEOL 1006 will satisfy the Earth Science requirements of Multiple Subject Preparation Program (Liberal Studies) for elementary science teachers. In addition, students in this cluster may elect to enroll in GEOL 1002 (Environmental Geology Lab) to satisfy the General Education science lab requirement.
- c) In *Philosophy 1101 (Social and Ethical Issues)*, students will become familiar with the methodology of argument and how to apply this methodology to moral issues. They will be required to take the information and skills developed in the other classes and use them to provide informed answers to questions about how our behavior toward the environment is a moral issue and what sort of behavior is correct.

4. Fulfillment of General Education Learning Outcomes:

B1: Physical Science – Physics 2005: Science of Energy

Outcome 1: Students will develop broad science content knowledge in the physical sciences by learning about the physical laws pertaining to energy:

- A. The **scientific concept of energy** will be introduced and discussed. Distinctions will be made between scientific definitions and common usage. Important ways to classify energy will also be introduced – classification itself being a central manner of organizing thought.
- B. **Conservation of energy** is one of the most fundamental physics laws in the universe. The law of conservation will be used to highlight the real issue of finite resources for energy production, and to illustrate the fundamental nature of scientific theories and laws – and how they have stood the test of time and multiple experiments.
- C. The fundamentals of **thermodynamics** will be used to explain weather patterns, motors and power generation. Thermodynamics is also critical to the idea that some forms of energy are more useful than others, which ties nicely back to the second content point, conservation of energy.
- D. Basic **mechanics** will be introduced at a level necessary to connect mass and motion to energy, and to understand why fuel efficiency goes down as speed increases.

- E. **Electricity and magnetism** will be used to explain the entire electric grid, from how motion of water or steam is used to produce electricity to how it is delivered to households.
- F. The **structure of the nucleus** and the concept of **binding energy** are critical to understanding how both fission (currently >22% of CA's energy supply) and fusion work/could work.
- G. A conceptual understanding of **atomic energy levels** and the nature of semi-conductors is introduced in the discussion on photo-voltaics and fuel cells.

Outcome 2: Students will demonstrate the application of quantitative skills to physical science problems by making basic calculations and **order-of-magnitude estimates** concerning limits on the world's population, energy production by various sources (fossil fuels, nuclear, solar), future world energy needs, and the relationship between energy consumption and economic growth. Effort will also be made to make clear to students that in the scientific world many of our laws are still called "theories" based on convention, not any weakness on the part of the theory.

The focus on quantitative literacy begins on the very first day of class with a series of **graphs** that show the country and world's energy resources and uses in various manners. Students see how graphs change shape as energy consumption is plotted next to consumption per capita or consumption per GDP (gross domestic product). We discuss who would present data in which ways and why so often energy debates are not about who's right and who's wrong, but about perspectives, values and consequences.

Six **problem sets** throughout the quarter will give the students practice solving quantitative problems. These problems will require students to combine quantitative examples with their conceptual understanding of the basic science content listed in Outcome 1.

The papers will require students to seek out and obtain **real-world data** about various methods of power production. They will have to organize all the data they find, analyze, and discuss its significance.

Basic mathematical skills that will be covered in the class include arithmetic and algebra, **ratios and percents, exponential growth**, multiplicative growth, and **statistical fluctuations and trends**.

Outcome 3: Students will demonstrate a general understanding of the nature of science by evaluating scientific claims about energy production, learning about and applying the scientific method for addressing scientific questions about energy production and use, and differentiating between the scientific problems related to energy and the social, political, and cultural problems related to energy.

Since energy is such an interdisciplinary topic, there are numerous places to clarify where the science stops and the economics/politics/value judgments start. In early discussions we will work, as a class, to classify various passages in an article, distinguishing facts from assumptions from values. We will also look at where that facts or data are coming from, and discuss the scientific method of designing experiments – or even surveys.

In exploring how much oil is left we will examine data from various agencies, discuss how the data were collected, uncertainties in data collection, and how measurements can always be repeated. We can then discuss the various assumptions that have been made when interpreting the data.

The focus on the fundamental laws of thermodynamics as they relate to energy, will facilitate a discussion on how these concepts became accepted "laws" and the variety of experiments that have verified these relationships. A bit of historical context will be provided to provide an example of a scientific theory standing the test of time.

Pseudoscience will be touched on during a discussion of perpetual motion (or lack there-of).

B5: Science Elective – GEOL 1006 Energy and the Earth System

Outcome 1: This course examines content in the four fundamental Earth Sciences: Geology, Atmospheric Science, Oceanography and Planetary Science. Students will gain knowledge in the following areas:

- Earth materials
- structure and composition of the Earth
- plate tectonics
- atmospheric structure
- weather and meteorology
- climate and global change
- physical and chemical oceanography
- solar science
- comparative planetology
- origin of the solar system (solar nebula hypothesis)

Students will demonstrate their understanding of the content of the course through examinations, homework exercises and web activities.

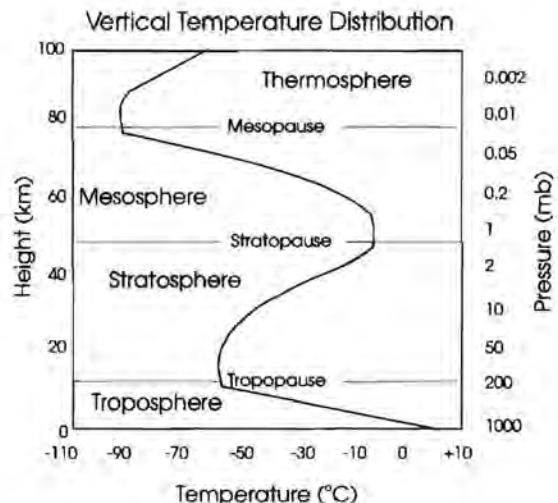
Outcome 2: Students will have the opportunity, in both the lecture and laboratory sections, to interpret graphical data and perform simple numerical calculations. In this course, we will stress the connection between mathematics and science. It is important that students understand that science is a way of understanding the physical world around us and that we can achieve a deeper understanding through quantitative skills. As an example:

If the speed of light is 299,792,458 meter/second and the Earth is 149,598,000,000 meters from the Sun, how long does it take for sunlight to reach the Earth?

$$(149,598,000,000 \text{ m}) / (299,792,458 \text{ m/s}) = 499 \text{ seconds}$$

This simple problem gives us the ability to gain a deeper appreciation of the Earth-Sun relationship through a very simple calculation. In addition, this problem reinforces mathematical skills (e.g., dimensional analysis, unit conversion) and science content such as the speed of light and the definition of the astronomical unit.

Students will have the opportunity to interpret graphical data that describe the physical world. In the figure, the thermal structure of the Earth's atmosphere is presented. Students will interpret graphical data in terms of mathematical relationships. As an example, students will recognize that the temperature of the stratosphere increases with altitude from these data. In addition, students will be able to explain that the temperature of the stratosphere increases with altitude due to the absorption of solar ultraviolet radiation by ozone molecules.



Students will demonstrate their understanding of this learning outcome through examinations, homework exercises, and/or web activities.

Outcome 3: The content of this course includes some of the most important historical advances in the natural sciences such as our understanding of the heliocentric solar system, geologic time, evolution and plate tectonics. These examples (and others) will be used to demonstrate the nature of science, empiricism and experimentation. Through this course, students will begin to evaluate scientific data and claims. Lastly, the contrast between astronomy and astrology serves as an excellent example of the differences between science and pseudoscience.

Students will demonstrate their understanding of this learning outcome through examinations, homework exercises, web activities and/or a local fieldtrip.

C2: Letters – Philosophy 1101: Social and Ethical Issues

Outcome 1: The body of literature that relates to human interaction with the environment is vast and diverse. It covers both developments in science as well as social issues such as attitudes toward our environment. Students will be required to address a variety of works across a variety of fields.

Outcome 2: Students will be required to study writing and ideas about the environment both historical and modern. Students will realize how certain concerns are persistent (like the difference between intrinsic and instrumental value) while other concerns are contemporary (like concerns based on recent science).

Outcome 3: Critical reflection is the theme of the class. Students will be required to develop a detailed understanding of the arguments, but they will also be required to evaluate the arguments in such a way so that they are aware of their strengths and weaknesses and can identify what would qualify as support or criticisms of those arguments.

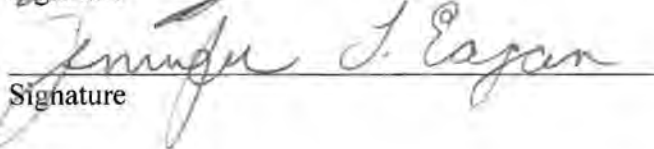
Outcome 4: Students will discover that the obvious arguments are rarely the best because they fail to demonstrate a thorough understanding or relevant skills related to the detailed study of environmental ethics. Students will come to appreciate the value of interesting thoughtful studies and arguments.

5. Course Outlines: (see attached pages).

Approved by Department Chairs:


Signature

Physics 4/11/11
Department Date

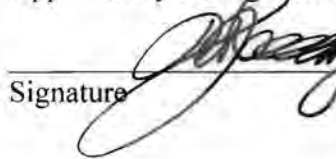

Signature

PHIL 4/11/11
Department Date

Signature

Department Date

Approved by College Dean/Associate Dean from each participating college¹


Signature

4/11/11
Date

Signature

Date

Signature

Date

Signatures of three faculty members: Ideally, the person who will teach the courses will participate in the cluster planning. However, recognizing the staffing difficulties departments face, the faculty member who plans the cluster must agree to provide a thorough orientation to the expectations and methods developed for the learning community to the actual instructor. **We each agree, if selected, to meet on for six hours during the following three days for an end-of-Spring workshop on interdisciplinary curriculum, pedagogy and course integration**


Signature

Apr 1 '2011
Date


Signature

4/11/11
Date

Signature

Date

¹ While Colleges do not approve courses for GE, College approval assures support for departmental participation.

Physics 2005 – Science of Energy: Course Syllabus

Instructor

Prof. Derek F. Jackson Kimball

Office: South Science Building Room S251.

Phone: (510) 885-4634

e-mail: derek.jacksonkimball@csueastbay.edu

Office hours: MWF 10:30 am-11:30 am, and by appointment.

Web information

Course information, handouts, problems, paper and project descriptions, etc. will be posted on BlackBoard. There will also be a discussion board that I will participate in, and occasionally announcements may be posted there as well as sent to you via e-mail.

Lectures

M W F 12:00 - 1:10, Room: N206

Texts

Robert Bent, Lloyd Orr, and Randall Baker, eds., *Energy: Science, Policy, and the Pursuit of Sustainability* (Island Press, 2002) [ISBN #: 1-55963-911-3].

Philosophy and approach

There is a serious and continuing problem of energy creation, distribution, and use throughout the world. It profoundly affects economics, politics, the environment, human rights, culture, war and peace. In this course we will see how your (our) generation's ability to solve these problems and achieve a sustainable way of life is essential to the future of all people.

First and foremost, we will study the scientific facts concerning energy. We will learn what energy is and the laws of physics that govern energy. We will learn the scientific approach to energy issues stressing quantitative analysis study various approaches to creating, using, and distributing energy, and evaluate their strengths and weaknesses.

Armed with a scientific understanding of energy issues, we will then approach the relation of energy issues to societal challenges. This will require a multidisciplinary approach. Each of you brings unique knowledge and skills to the class and to life, and we will call on all our resources to address these very fundamental issues.

The class will be taught at a high level because of the importance of these issues. We will use math, logical reasoning, writing skills, creative and critical thinking. Our goal will be a comprehensive understanding of energy issues and some ideas on how society can resolve the energy crisis.

Course outline

- **Week 1:** Overview of class. What is energy? Scientific approach. Increase in human energy consumption over time. Sustainability.
- **Week 2:** Limits on world population (Earth's carrying capacity). Work, potential energy, kinetic energy, chemical energy, heat.
- **Week 3:** Laws of Thermodynamics, limits on efficiency.
- **Week 4:** Energy balance on earth. Exponential growth. Electricity production and distribution.
- **Week 5:** Future world energy needs. Comparison of developed and developing world. Energy as an instrument for socio-economic development. Connection between energy consumption and population growth.
- **Week 6:** Fossil Fuels. Peak oil and exhaustion of resources. Connection to greenhouse gases and global warming.
- **Week 7:** Renewable energy sources: biomass, geothermal, hydropower, solar power, ocean thermal power, tidal power, wave and wind power.
- **Week 8:** Nuclear energy: fission and fusion.
- **Week 9:** Energy policy: political and cultural aspects of problem.
- **Week 10:** Energy and economic growth. Conclusion and Review.

Papers

There will be two papers. The first will involve quantitative analysis of the energy crisis, your view on what problems the world faces in terms of energy, how serious the problems are, time scales, and other important details. You may choose to focus in on some particular aspect of the energy problems, such as overpopulation, economic development, environmental degradation, etc. You may even want to focus on some particular region of the world.

In the second paper you will propose some concrete solutions to the problems raised in your first paper. You are expected to analyze the advantages and disadvantages of your approach in a scientific, quantitative manner, and look at multidisciplinary impacts (economic, political, social).

In-class responses

Often you will be given a brief in-class essay question or quantitative problem. Your responses will not be graded, except for participation, but they will be used (anonymously) as a starting point for class discussions in the next class. Your thoughtful responses are appreciated.

Problems

There will be six problem sets assigned throughout the course asking for quantitative analysis. These will be graded.

Exams

There will be one midterm exam on Feb. 17th, covering the scientific aspects of energy. There will be no final exam, the second paper will substitute for the final exam.

Grading

The breakdown of the grading is as follows:

1. Problems: 20%
2. In-class responses: 20%
3. Midterm: 20%
4. Paper 1: 15% (5% for first draft, 10% for final version)
5. Paper 2: 25 %

The grading will be curved, in a sense. There will be no set number of A's or B's or C's, so the grading is not "competitive" per se, but the overall scale will be adjusted to take into account overall class performance. Improvement will be taken into account when considering "borderline" cases. A general sense of where you are at will be provided near the middle of the course.

Disabilities

If you have a documented disability and wish to discuss your Student Disability Resource Center (SRDC) approved academic accommodations, or if you would need assistance in the event of an emergency, please make an appointment to meet with me as soon as possible.

ENERGY AND THE EARTH SYSTEM
Geology 100x
Winter 2008
Department of Earth & Environmental Sciences
California State University, East Bay

Contact Information

Professor Jeffery Seitz	E-mail: jeff.seitz@csueastbay.edu
Office Hours: Monday 1:00-2:15 &	Phone: (510) 885-3438
Thursday 2:00-3:15 and by appointment	FAX: (510) 885-2526
Office: SC N329 & N350	Geology Dept.: (510) 885-3486

Texts

Lutgens F. K. and Tarbuck E. J. (2005) Foundations of Earth Science. 4th Edition. Prentice-Hall. 460 pp.

Bent R., Orr, L. and Baker R., editors (2000) Energy: Science, Policy, and the Pursuit of Sustainability. Island Press, Washington DC, 2000.

Additional course materials will be available through the course webpage – students are required to regularly access Blackboard, other web resources and their Horizon accounts.

Course Requirements

The format of this course consists of lectures and structured in-class discussion — thus, ATTENDANCE IS REQUIRED! Students are responsible for completing assigned readings before class. Grades will be determined based upon the following:

Homework Assignments	20%
Mid-Term Examination #1	25%
Mid-Term Examination #2	25%
Final Examination	30%

General Education Learning Outcomes:

1. Students should be able to demonstrate broad science content knowledge in the physical and/or interdisciplinary sciences.
2. Students should be able to demonstrate the application of quantitative skills (such as statistics, mathematics and the interpretation of numerical graphical data) to physical science problems.
3. Students should be able to demonstrate a general understanding of the nature of science, the methods applied in scientific investigations, and the value of those methods in developing a rigorous understanding of the physical world. Students should be able to identify the difference between science and other fields of knowledge. Students should be able to distinguish science from pseudoscience.

Schedule

Week	Date	Lecture
1	April 2	Introduction Chapter 1: Minerals
1	April 4	Chapter 1: Minerals (cont)
1	April 6	Chapter 1: Minerals (cont) Chapter 2: Rocks
2	April 9	Chapter 2: Rocks (cont)
2	April 11	Chapter 2: Rocks (cont)
2	April 13	Chapter 3: Landscapes Fashioned by Water
3	April 16	Chapter 3: Landscapes Fashioned by Water (cont.) Chapter 4: Glacial and Arid Landscapes
3	April 18	Chapter 4: Glacial and Arid Landscapes (cont.)
3	April 20	Chapter 5: Plate Tectonics
4	April 23	Chapter 5: Plate Tectonics (cont.)
4	April 25	Chapter 6: Earthquakes & Mountain Building
4	April 27	MID-TERM EXAM #1 (Chapters 1-5)
5	April 30	Chapter 6: Earthquakes & Mountain Building (cont.) Chapter 7: Igneous Activity
5	May 2	Chapter 7: Igneous Activity (cont.)
5	May 4	Chapter 8: Geologic Time
6	May 7	Chapter 8: Geologic Time (cont.) Chapter 9: Physical Oceanography
6	May 9	Chapter 9: Physical Oceanography
6	May 11	Chapter 9: Physical Oceanography Chapter 10: Ocean Circulation and Coastal Processes
7	May 14	Chapter 10: Ocean Circulation and Coastal Processes (cont.)
7	May 16	Chapter 10: Ocean Circulation and Coastal Processes (cont.)
7	May 18	Chapter 11: Heating and the Atmosphere
8	May 21	MID-TERM EXAM #2 (Chapters 6-10)
8	May 23	Chapter 11: Heating and the Atmosphere (cont.) Chapter 12: Clouds and Precipitation
8	May 25	Chapter 12: Clouds and Precipitation (cont.)
9	May 28	MEMORIAL DAY – NO CLASS
9	May 30	Chapter 13: Atmospheric Circulation
9	June 1	Chapter 13: Atmospheric Circulation (cont.) Chapter 14: Weather Patterns and Severe Weather
10	June 4	Chapter 14: Weather Patterns and Severe Weather (cont.)
10	June 6	Chapter 15: The Solar System
10	June 8	Chapter 15: The Solar System (cont.)

Note: schedule is subject (and likely) to change.

Final Examination: Monday, June 11, 11:00-12:50

California State University, East Bay
Department of Philosophy

PHIL1101 Social and Ethical Issues

**Thinking Globally: An Interdisciplinary Approach to the Environment
Contemporary Problems in Environmental Ethics**

Contact Info

Dr. Craig Derksen
Office: MI 4002
Email: craig.derksen@csueastbay.edu
Office Phone: (510) 885-3578

Goals

Understand and develop skills in the philosophical methodology of argument.
Understand and evaluate the sort of facts involved in discussions of morality and the environment.
Understand and evaluate the shortcomings in the various worldviews associated with the environment, be able to apply these worldviews.
Take positions on various environmental issues and be able to support these positions.

Texts

Energy: Science, Policy, and the Pursuit of Sustainability, ed. by R. Bent, L. Orr, and R. Baker
Earth Ethics by James Sterba

Requirements/ Evaluation

2 Take Home Exams (25% each) These exams (one mid-term and one final) will test your broad knowledge of the material.
2 Papers (25% each) These papers will test your ability to discuss one topic in depth.

Policies

Blackboard

Course Materials, Assignments, and Announcements will be posted on Blackboard. It is your responsibility to check for updates regularly.

Attendance

There is no portion of the grade allocated to attendance (attendance and participation can aid you if you are a borderline case). The lecture is the main source of information. I will do my best to make it worth your while to attend class. I will not tolerate disruptive attendance.

Academic Dishonesty

Familiarize yourself with the University's policies on academic dishonesty. No, really do it. Ignorance is not a viable excuse and mistakes like that travel with you forever.

Disabilities

Students with disabilities should make arrangements with University's Disability Support Service and discuss arrangements with me well before testing times.

Schedule

Arguments and Facts

Moral Theories

Intrinsic and Extrinsic Values

Cultural Influences

Worldviews

Respect

Animals

Government Controls

Global Warming

Extremism