

Course Syllabus: EGY 105 – Energy in Our World

Fall 2023

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Context for the course

Energy is a vitally important part of the universe and impacts our lives on a moment-by-moment basis. Essentially every branch of science deals with energy in some way. It is an integral part of the laws of physical motion, chemical reactions, and biological processes for cells, organisms, and ecosystems.

Most people rightfully think of energy as something that we have to purchase to power our vehicles, heat, cool, and light our homes, and run our computers and appliances. We normally don't think about energy unless it becomes unavailable, or the price increases sharply – as witnessed by the rise in gasoline prices earlier this year.

Energy issues are often covered heavily in the media, and are frequently controversial. We depend upon sources like coal, oil, and nuclear to power our modern lives. But yet, each poses risks to health and the environment. Burning fossil fuels (coal, oil, and natural gas) releases carbon dioxide into our atmosphere, causing changes to our climate. Last year, we saw a battle raging at a nuclear power plant in Ukraine that threatened catastrophic consequences to Europe and beyond. Last December, and early in August, the media covered advances in cold fusion that could revolutionize our future energy situation.

In the meantime, many people believe that we must switch to alternative energy sources (wind, solar, geothermal, hydropower). But at present, they don't have sufficient output to power our modern lives. Energy also must be transported from point of production to point of consumption via power-lines, pipelines, truck, or rail – all posing some risk. Many people are concerned that we waste energy, and that we need to engage in strict conservation. For those reasons, energy figures as a central topic in national and international discussions.

Despite its importance, there is a growing sense that we simply don't know enough about basic energy concepts to make intelligent decisions about how we produce, transport, or consume it. For example, a member of the US Congress recently criticized the increasing use of solar power, believing that she wouldn't be able to “turn on the lights” after the sun goes down (ignoring that other sources of energy are still available).

There is a growing consensus that if we are to survive as a society, we must do more to improve *energy literacy* at all levels. EGY 105 aims to do that for Wilkes students, particularly for students majoring in areas other than the sciences and engineering (though those students are welcome as well).

Course Objectives:

Students completing EGY 105 will be able to:

- Understand the physical basis of energy in our universe, its importance in biological systems, and various ways in which it is measured.
- Understand the history of energy use both worldwide and in “developed” countries.
- Understand current trends of energy production and consumption locally, nationally, and worldwide.
- Critically evaluate arguments about the sustainability of fossil fuels and nuclear energy
- Learn and critically evaluate information about the benefits and weaknesses of potential sources of alternative energy from a variety of perspectives (potential energy yield, economic, environmental, sociopolitical)
- Examine whether we can improve energy efficiency and reduce consumption
- Develop a well-reasoned personal philosophy about the present energy situation and the best way to move forward on developing and implementing alternative sources.
- Develop the ability to meaningfully participate in a group seeking to understand a complex issue from a variety of perspectives, and communicate its findings to others.
- Understand employment opportunities that relate to energy.
- Take more advanced courses in Wilkes’s Interdisciplinary Energy Minor

Long-Term Objective

Students will develop a mature attitude about - and lifelong interest in - energy issues, and will assert leadership on that topic long after the course is completed, whether as citizens or through careers that involve energy in some way.

Note: Past students of this course have gone on to hold elected office and otherwise make important decisions on energy-related issues. I hope the same will be true for the EGY 105 class of Fall 2023.

Course theme:

Can we, and should we, switch from fossil fuels to non-fossil-based alternatives?

EGY 105 as an Area II Elective:

EGY 105 qualifies as an Area II (the Scientific World) category of courses at Wilkes University by fulfilling several Student Learning Outcomes (SLOs). Those SLOs, and the way that they are met, are listed below.

Throughout the semester, students will:

- *Describe how science affects contemporary issues;*
 - Discussed throughout the course, especially the manner in which the world relies on different forms of energy to power our lives. Scientific research is used to provide us with more energy options, more efficiency, and safer forms of energy. Specifically met through lectures and readings – from which students will complete weekly assignments, exams, and the Op-Ed assignment.
- *Access sources of scientific information that are both relevant and reliable;*
 - Met by having students discover and evaluate relevant and reliable sources when putting together their Op-Ed and presentation assignments, as well as their weekly assignments.
- *Explain ethical issues in the practice of science;*
 - Students will discuss the ethics surrounding the use of fossil fuels and non-fossil alternatives (wind, solar, nuclear) through weekly assignments, periodic exams, and the presentation / Op-Ed assignments.
- *Communicate scientific concepts effectively;*
 - Accomplished by presenting clear answers to questions that have scientific relevance on the weekly assignments, exams, and the presentation / Op-Ed assignments.
- *Draw logical conclusions based on scientific data;*
 - Students are required to interpret graphs and tables during weekly assignments and exams. Part of the students' grades will also be based on presentation and interpretation of scientific data during the presentation / Op-Ed assignments.
- *Distinguish between scientific evidence and pseudoscience; and*
 - During the weekly assignments and exams (especially the final), students will be asked to evaluate the scientific validity of information discussing different forms of energy. This will be done by having the students visit websites prepared by different stakeholders having divergent views of fossil fuels and non-fossil alternatives.
- *Explain the development of scientific theories using the scientific method.*
 - Students will discuss the role of science process and findings in comparing different forms of energy. From the information provided and uncovered during literature searches, will construct a science-based viewpoint of how to best conserve existing energy sources, as well as develop new energy sources.

EGY 105 – Schedule of Topics

(Subject to change. Corresponding text readings will be provided in a week or two)

Topic / Activity

- I. Course introduction:
 - a. Overview: Energy as a wicked problem, with scientific, economic, and political dimensions
 - b. Course objectives, organization, grading
 - c. Energy literacy
- II. Energy: Physical basis and measurements
 - a. Definitions, forms of energy
 - b. Newtonian motion
 - 1. Speed, acceleration, gravity
 - 2. Momentum, force, weight, mass
 - 3. Newton's laws
 - 4. Energy vs power vs work
 - c. Conservation of energy, laws of thermodynamics, efficiency
 - d. Temperature and heat
 - 1. Definitions
 - 2. Heat transfer
 - 3. Specific heat, conduction vs convection vs radiation
 - e. Energy consumption
 - 1. Basic concepts
 - 2. Space heating, role of insulation, energy audits
- III. Energy in living systems
 - 1. Basic concepts
 - 2. Energy in individual organisms
 - 3. Energy in ecosystems
- IV. Introduction energy problem assignment; Information on the web
- V. Basics of electricity
- VI. Energy production - Conventional energy
 - a. Coal
 - b. Petroleum
 - c. Conventional natural gas
 - d. Unconventional natural gas
 - e. Hubbert curve
 - f. Climate change
 - e. Nuclear (fission and fusion)
- VII. Energy production – Alternative energy
 - a. Solar
 - b. Wind
 - c. Hydropower
 - d. Hydrogen
 - e. Ethanol
 - f. Biomass / Biodiesel
 - g. Geothermal
- VIII. Energy conservation
- IX. Student presentations – controversies and energy

Information delivery

Students will gain information by way of:

- Online presentations and study guides provided by the course instructor
- Presentations given by guest lecturers
- Articles assigned by the instructor
- Information provided by students

Outside Information Sources

Textbook: Hinrichs, R.A. 2024. *Energy: Its Use and the Environment*. 6/e. Brooks / Cole Cengage Learning. Specific reading assignments from the text will be provided in a week or two into the semester. In addition, I will provide you with numerous readings (essays, websites) that address various energy issues – and will expect you to read those sources.

Assessment and Grading

Grading System (subject to change; students will be given fair notice of any changes):

Exams	250 points
Writing assignments, problem sets	500 points
Group oral report, writing project	80 points
Total	830 points

Grades will be assigned as follows: $\geq 90\%$ = 4.0; 85-90% = 3.5; 80-85% = 3.0; 75-80% = 2.5; 70-75% = 2.0; 65-70% = 1.5; 60-65% = 1.0; $< 60\%$ = 0.0. These cutoffs may be adjusted downward.

Honors Designation (&H)

EGY 105 is eligible for Wilkes Honors Designation. Each Honors student will conduct an in-depth analysis of an op ed or letter to the editor (LTE) dealing with an energy issue published in a periodical (newspaper, magazine) that must be approved by the instructor. The essay - which is worth 50 points – will be 7-10 well-written pages that: (1) reviews the issue covered by the op-ed, (2) assesses the degree to which the op ed / LTE is supported by scientific literature published within the past five years, (3) points to any fallacies introduced by the op ed that are contradicted by the scientific literature. The process for preparing the analysis will involve: (1) a preliminary discussion with the course instructor regarding potential articles, (2) a follow up discussion in which the student and instructor will discuss the selected article, and review pertinent literature, (3) a draft version of the analysis that will be reviewed by the instructor, (4) a finalized version of the analysis taking the instructor's comments into account, and a posting of the article in a web-accessible manner. Timing and grading will follow a rubric provided by the instructor.

Miscellaneous

E-mail: kenneth.klemow@wilkes.edu

Available Hours: MTWRF: 12:00 noon – 5:00 PM

Course webpage: <http://klemow.wilkes.edu/EGY-105.html>

Facebook: <http://www.facebook.com/DrKlemow> Twitter: @Dr.Klemow

Note: If you need to discuss anything by phone or Zoom, send me an email and I will provide contact information.

Course Delivery:

As was true for the last three times this course was offered, this run of EGY 105 will be delivered using an Asynchronous Online format. To that end, lectures will be made available as recorded versions on Panopto, available on demand. I will record and post lectures to the course website for all students in the class. I will provide a suggested pace though the lectures throughout the semester. Note that the recorded lectures replace face-to-face lectures that have been previously offered in EGY 105.

In addition, I will periodically provide access to outside readings that will be accessible through the web, or emailed to you.

The primary goal is to have you view all of the lectures and read the readings - and to learn from them. To facilitate that goal, I will provide study guides that you will complete as you progress through each lecture. Students who took the course in the past consistently reported those study guides to be very helpful.

To verify that you are keeping up with the material, I will provide assignments (typically on a weekly basis) that generally consist of selected questions from the study guides or problem sets. You are to complete each assignment by the due date, and then email it back to me for grading. Note that, at present, the assignments are collectively worth 500 out of the 830 points, so they are important.

EGY 105 also contains three exams that will provide an additional assessment of your understanding of the material. The exams will consist of a variety of questions (multiple choice, matching, short answer, essay, problems). Collectively, the exams will count for 250 points. Each exam will be emailed to you, and you will email your completed exam back to me by the due date.

As lectures are made available, students are welcome to move through the material more quickly than the suggested pace. Those who lag behind run the risk of not being able to complete the assignments and exams in a timely and successful fashion.

Looking through the course requirements, you will also see reference to a group project that will involve a presentation and a written assignment. I will provide more details about that part of the course in mid-late September.

Despite the online, on-demand format of course delivery, you are encouraged to ask questions and participate in class discussions through the Google Group that has been set up. I will also set up periodic Zoom meetings so you can meet each other and discuss course material. In short, I want you to learn the material and gain energy literacy – and will do what I can to help you achieve that goal.

Please refer all additional questions about class format to me.

Academic Honesty:

In order for you to learn the material, you must honestly review the lectures and readings, and complete the corresponding assignments and exams. Since we are doing this course remotely, I acknowledge that it is easy to not do the work, and submit somebody else's work (either from this semester or one previous) as your own. That is academically dishonest, and short-circuits the learning process. Please don't do that!!

More generally, Academic Honesty requires students to refrain from cheating and to provide clear citations for assertions of fact, as well as for the language, ideas, and interpretations found within the works of others. Failure to formally acknowledge the work of others, including Internet resources, written material, and any assistance with class assignments, constitutes Plagiarism. Moreover, use of Artificial Intelligence – such as ChatGPT – to answer questions on your assignments or exams also constitutes plagiarism. Cheating and plagiarism are serious academic offenses that cannot be tolerated in a community of scholars. Violations of academic honesty will be addressed at the programmatic and university levels and may result in a decision of course failure or program dismissal (see Wilkes University Student Handbook).

As noted, you will be participating in a group assignment – the instructions for which will be provided to you a bit later in the semester. Naturally, for that assignment to be successful, you will be expected to collaborate. The assumption will be that every person on the team will be expected to contribute. Failure to contribute in a meaningful way will result in lost points.

University Statement on Intellectual Responsibility and Plagiarism

At Wilkes the faculty and the entire University community share a deep commitment to academic honesty and integrity. The following are considered to be serious violations and will not be tolerated:

1. Plagiarism: the use of another's ideas, programs, or words without proper acknowledgment
2. Collusion: improper collaboration with another in preparing assignments, computer programs, or in taking examinations.
3. Cheating: giving improper aid to another, or receiving such aid from another, or from some other source.