EGR240 (sections 001 and 002): Global Energy Issues
Fall 2016

Time and Location:

EGR 240 Section 001 (3.0)
Mondays: Combined sections: ***2:00 pm - 2:50 pm***:
Combined sections meet in CP 155 (Chem-Phys *Building)*
Wednesdays: ***2:00 pm - 2:50 pm***:
Individual section: meets in RGAN202 (Ralph G Anderson Bldg.)
Fridays: ***Friday lectures will be available online.***

EGR 240 Section 002 (3.0)
Mondays: Combined sections: ***2:00 pm - 2:50 pm***:
Combined sections meet in CP 155 (Chem-Phys *Building)*
Wednesdays: ***12:00 pm - 12:50 pm:***
Individual section: meets in RGAN202 (Ralph G Anderson Bldg.)
Fridays: ***Friday lectures will be available online.***

Instructor:

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Co-instructor: Dr. Bruce Walcott
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Teaching Assistant:

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Overview: This is a cross-disciplinary course open to all majors. The course critically examines issues associated with the technical, economic, societal, environmental, and geopolitical aspects of energy. The course is taught through lectures, discussions, and invited speakers.

This course satisfies the *Global Dynamics* requirement of the University of Kentucky's *UKCore* general education requirement. As such, some assignments of this course will have special submission requirements to permit the UKCore program to audit the course content.

Prerequisites: None.

Course Outcomes

- Describe basic concepts of energy and power, including types of energy, conversion of energy, and conservation of energy.
- Understand the current mix of energy sources in use around the world, including coal, natural gas, oil, nuclear, solar, wind, geothermal, hydro, and biomass. For each of these, describe the basic technologies, the pros and cons of each, and the major challenges.
- Understand the basics of electric power, including emerging issues of smart grid transmission and distribution.
- Understand the basic environmental issues with energy generation and use.
- Understand the basic policy issues of power and energy, including environmental regulation, pricing, and development.
- Understand the basic economic aspects of power and energy, including energy markets.
- Understand the relationships between energy use and economic activities, standard of living, and cultures.
- Understand the basic geopolitical issues of power, including national security and economic security.

Texts:

This class will rely on several sources for material, with heavy use of readings from a variety of journals, news sources, book chapters, and other sources. Example outside reading assignments will be taken from IEEE Spectrum, IEEE Power and Energy Magazine, Time, Economist, New York Times, and other news and professional publications. Almost all outside reading assignments will be available electronically, either freely available on the web or through the University of Kentucky Libraries electronics subscriptions. For articles in the UK Libraries subscriptions, access requires you to be on a computer operating through the on-campus network to have access to the websites.

A source text (not required) for parts of the class is: *Energy at the Crossroads: Global Perspectives and Uncertainties*, by Vaclav Smil. MIT Press, 2005. (ISBN: 978-0-262-19492-1 or ISBN 978-0-262-69324-0). This is mentioned only for reference, as you will not be required to have this book.

It is expected that there will be two or three movie assignments throughout the semester. Assigned movies in most cases are available online either for no charge or for rental fee.

Global Dynamics and General Education Requirements

This course is being designed to satisfy the *Global Dynamics* requirement of the UKCore general education requirements. As such, the course will satisfy the following:

1. At least 50% of the course will focus on the global aspects of energy.
2. Students will demonstrate an understanding of the change of energy sources and uses over time, and will understand energy in a comparative and cross-national manner.
3. Students will understand how energy issues affect different communities, nations, and regions, including the impact of energy on the economic, cultural, social, and political aspects of these communities, nations, and regions.
4. Students will demonstrate an understanding of the civic complexities and responsibilities of energy choices and policies, including both the commonalities and the differences globally.
5. Students will demonstrate an awareness of the elements of at least one non-US culture or society with respect to energy. This is done through the class project.
6. Students will demonstrate a grasp of the global inequalities and diversities that exist with respect to energy across the world.

Course Format

The course will be taught through lectures, discussions, and invited speakers. A number of topics will be covered during the semester, and for each topic, the typical format will be as follows:

- 2 to 3 lectures on the topic. Some of these background lectures may be recorded and available on-line, as a form of "video textbook". (In a few cases, this background may be provided by additional readings or videos from other sources.)
- 1 discussion class on the topic, where students are to read outside material and come prepared to discuss it during class.

There will also be approximately four outside speakers throughout the semester. Speakers will come from industry, government, and research. On the days that we have an outside speaker, the class will be held in a larger classroom to accommodate people from outside this course to attend.

Grading

The grade in this class will consist of the following:

- (45%) Three tests, each worth 15%. This will be primarily over material covered in the lectures. One of these tests will be given during the semester final exam period, and can include a cumulative component.
- (25%) Homeworks, class preparations, and discussions: There will be a homework assignment one to two times per week. Example homework assignments include the following: basic analysis of data similar to class analyses, finding comparative information through the internet or libraries. Also, students will be required to be prepared for class and to then engage in class discussions. There may be micro-quizzes to confirm students have read assigned readings or

viewed video lectures or recordings. Students will be selected on a rotating basis to lead off the discussions. Larger assignments will be weighted more than smaller assignments. The lowest homework assignment grade through the semester will be dropped, so you should plan on using this "drop" when you are sick or somehow otherwise unable to complete the assignment.

One of the required homeworks may be to attend some energy-related event on campus outside of class time. There would be multiple such outside events from which to choose, but you should be aware that attending such an outside event will be required. You will be expected to write a 1-2page paper that will include a summary and critical thinking statement of the information presented in the outside seminar or event.

- (30%) Project: The students will complete a project that explores a significant energy issue from a global perspective. This will be a major project, and students are required to treat it as such. This project will be used to assess the class for the Global Dynamics credit for UKCore.

Students should hand in material on the day it is due. Unless an absence or delay is excused, late assignments will receive a 10% penalty. Class participation grades for an unexcused absence will be zero points.

The grading scale is:

90%-100%: A
80%-89%: B
70%-79%: C
60%-69%: D
Below 60%: E

If you have a documented disability that requires academic accommodations, please see Dr. Ionel as soon as possible during scheduled office hours or by appointment. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center for coordination of campus disability services available to students with disabilities.

The final exam is being scheduled to correspond with the exam period for the common Monday 2pm classes (the class period common for both sections 1 and 2). As per university schedule, this final exam time would be for Wednesday, December 15 2016 at 1 p.m. More information on the final exam time will be announced during the semester.

Outline of classes, with examples of Global Content for class sections:

1. Introduction to energy and power: Definitions, measuring, comparing, efficiency, energy flows

    a. This content is definitions and introductions, so does not have much global content. However, there is brief mention of different measurements as used internationally.

2. Energy sources: Comparison of major sources of energy with global perspective, including coal, oil, gas, hydro, nuclear, solar, biomass.

    a. Review of history of energy, including rise of coal and fossil fuel in England and then at different times in different countries. Also includes cultural and economic differences that arose in different areas of the world due to scarcity or availability of energy.

    b. Overviews of different global energy strategies and issues: A portion of this is overview of technologies, which is not country specific. However, the mix of energy sources used across different countries is examined, as well as why certain countries have the mixes of energy and the technologies that they do. International focus on solar energy in Spain and Germany, coal in the US and China, hydropower in China, wind in Denmark and the UK and Portugal, geothermal in Iceland, nuclear in France, biofuels in Brazil, etc.

3. Energy and Society: Relationships of energy with health, prosperity, culture, perspectives

    a. Examination of linkages (or lack of linkages in some cases) between national energy usage and Gross Domestic Product, infant mortality, life expectancy, Freedom Index, etc. across countries (Source: V. Smil course text).

    b. Examination of impact of energy on rural development in the third world, including education, fertility, disease, economics, and others. (Source: World Bank report on "The Welfare Impacts of Rural Electrification").

4. Energy Use: Major uses of energy, including differences globally

    a. Examination of major categories of energy uses, including heating/cooling (relationship geographically), manufacturing (how global and domestic manufacturing differences depend on differences in energy availability), agriculture, transportation, etc.

5. Electric Power: transmission and distribution basics, introduction to smart grid issues, and differing regulatory strategies and structures.

    a. Smart Grid – concepts, proposed benefits, and concerns.

    b. Analysis and comparison of regulatory frameworks and public policies for electricity in US, UK, Europe, Latin America, and India.

6. Energy and the Environment: Effects on environment, including pollution types. Regulation methods.

    a. Discussion of pollution effects globally, including discussion of international efforts to regulate pollution. Topics include acid rain (SO2 and NOx), mercury, and CO2.

b. Discussion of environmental issues/concerns across almost all energy sources, including hydro, solar, wind, fossil fuels, nuclear.

7. Energy and Policy: Energy policy issues and roles of governments. Energy and War. Energy and National Security.

    a. Discussion of national security issues via case studies for different countries, including issues with Russian gas shutoff in Europe, OPEC, Hugo Chavez, Iraq, and others.

8. Energy and Economics: energy and pricing and markets (regulated, deregulated). Effect of energy on economy - energy as damper, or energy as driver of innovation?

    a. Examination of the global move to green energy, and how that can shift the balance of power and economics for countries with the knowhow or the sources of this energy.

Project

The project for this course is an energy study of some country (other than the USA). The project details outlined here are tentative, so information in the assignment sheet given during the semester takes precedence over the material here. However, in general, the assignment will cover the following:

1. Overview the country with information that will be relevant in discussing its energy profile (see item 3 below). This will include its population, industries, land characteristics, population characteristics (rural vs. urban, affluence, culture, etc.), GDP, climate, etc. (Only items relevant to later discussions of energy need to be presented.)

2. Information on the energy characteristics of the country. This would include the makeup of the total primary energy supply (TPES) for the country, including imports and exports. (This is available from the International Energy Agency, the IEA, www.iea.org/stats).

3. Information on the major uses of energy (available also from IEA). This information should be presented in the context of the relevant characteristics of country as presented in item 1 above.

4. Compare the energy profile that you present above with another country (such as the US). Discuss the differences in the data between the two countries, including hypotheses as to the reason for commonalities and differences.

5. If you were to present recommendations for the future of the country with respect to energy, what might they be? (Examples – changes in energy sources or energy use). Give reasons for your recommendations. If an energy policy for the country exists and is easily found, you may discuss it in the context of your discussions. (Many countries have such policies publicly available. You are not required to find one and use it, but you may.)

Data for items 1, 2, and 3 above are easily available via the EIA and other standard resources. Your project should include at least three reputable sources other than the EIA.