Physics 200 Energy, The Physics of Sustainability
Professor Hans Bozler Office SSC 211B
hbozler@usc.edu ext. 01125

Wait – this changes everything.

This year, the climate change alarms have been more urgent, so that we may not have the 20,30, 50 year deadline to start working on reducing green house gasses in a major way – closer to 10 years to get our act together. So while we are planning to follow the same plan as laid out in the syllabus, we will be particularly focused on what we can do sooner, new technologies, and developing a better strategy for the near future.

Introduction

Fifty Years ago, Racheal Carson's book *The Silent Spring* was published with huge interest along with controversy, ridicule, and criticism. Her detailed exposition of facts surrounding the use of pesticides and other chemicals eventually won out and remains today a warning of the ability of humans to alter our environment in significant and potentially permanent ways. As concern rose about the environment in general, the broader lesson that remains is that human activities soon led to the creation of the United States Environmental Protection Agency. The Clean Air, Clean Water, and Endangered Species Acts became law soon after.

The Worldwide increasing need for energy causes ever-increasing impacts on our environment. These impacts are roughly categorized as *Pollution*, *Resource depletion*, and *Climate Change*. This course aims at understanding how we use energy, where it comes from, and how to avoid the worst negative consequences of energy use. Fortunately, we are coming to an era where a true shift to "greening" of our energy use looks feasible. California has committed to an aggressive shift to greener energy use and we want to take a close look at that progress.

Who this course if for

PHYS200 is a general education course that does not use any advanced math. The course does fulfill quantitative requirements. *Energy* is both a physics term and a commodity that is bought and sold and plays a central role in our economy. So I am interested in getting students to think with numbers and thinking in terms of some really large numbers. (How much of the nation's energy supply does that supertanker sitting in our own harbor, San Pedro, represent?) Energy quantities come in strange units – barrels of oil, tons of coal, cubic meters of gas, megawatt hours of electricity, etc.

Learning goals

With widespread concern about global warming (climate change), energy policy is certainly on the National agenda with issues like the Keystone pipeline, coal mining, are in the news daily. Recently we added a new word to add to our vocabulary "fracking" and the issues around recovery of previously unreachable hydrocarbon resources are becoming a really big deal. Energy production and use represents a rapidly changing landscape with future prospects for technologies such as nuclear power may have dimmed while other technologies such as solar energy has gained ground. I would like to go behind many of these issues to understand the physics and technology that forms the basis of so much of our modern life.

There is some interesting and fundamental physics in the understanding about how energy passes through society. Physics says that energy is conserved, so why do we need more? Why do we have waste? We will address these questions.

Professor Hans Bozler Office SSC 211B
hbozler@usc.edu ext. 01125

Climate change, clean energy, nuclear energy are examples of "wicked problems". (Other examples would include world hunger, peace and justice, etc.) As in many of society's larger issues, there are no simple answers. In fact, there may not be complete answers. There are instead many choices, some better or "less bad" than others. This theme shows up in the way possible solutions for existing energy problems play out. What looks like a great idea on a small scale may look terrible on a large scale. A technology that seems "clean and green" may have negative consequences that are severe. So if you want a simple answer so that at the end of the day you can say "Now I know the solution" you may be disappointed. But, I hope you will come to appreciate that simple answers are often false – energy policy as well as most other important questions in life are complex. Sometimes the person with all the answers should be the first person to distrust!

Textbook

We will use *Energy, Environment, and Climate (Third edition)* by Richard Wolfson (Norton 2018) ISBN-13: 978-0393622911 or ISBN-10: 0393622916 . Since this is a new edition, be sure that you get the new one. The textbook will be at the USC Bookstore, but is available through any book seller in both a printed version (my favorite) and on Kindle. It can be rented.

I will add a short list of additional resources including popular (inexpensive) books and web sites on Blackboard.

Student presentations and capstone project

Throughout the course, questions will come up. Students will be assigned to come up with a short presentation on these questions. Usually (but not necessarily always) this will be a 10 minute Power Point on an intentionally narrow topic. Examples of topics might be: What is the price history for petroleum? How much wind power is being produced in the US this year? How much solar power do we produce? etc. The presentation assignments will be done on a rotating basis with each student responsible for at least one.

We will have a "capstone" project for this course. There are two types of projects: a term paper or a class presentation. There are a lot of issues with papers and presentations. I will talk about citing literature during the course. For the moment, the most important thing to do is to arrange a meeting with me to discuss your project ideas. These will be one-on-one meetings where you should be prepared to show some preliminary research.

Important elements of the capstone project:

- Presentation of quantitative information via graphs, tables, and numbers where they have meaning.
- Citations for references cross referenced in a reference section at the end of the paper (bibliography).
- Organization should include an introduction and conclusions based on the information presented.

Laboratory

The laboratory will be closely associated with this course. Having hands-on experiences is very important. In fact, this semester, I plan to teach the lab myself in most cases. I think it will be fun. During the semester there will be some choices on which lab you work on.

Professor Hans Bozler Office SSC 211B
hbozler@usc.edu ext. 01125

Exams

There will be a midterm and a final in this class. The in-class exams will all be open book and open notes.

Homework

Homework will be due on Wednesdays. A schedule for homework assignments will be posted on the first day of class.

Web access, news group etc.

The course web page is on BlackBoard. You already have access to this web page and should check it for updates, homework solutions, and course materials.

Office hours

I really want to see students during office hours. The office hours are currently on Tuesday and Thursday from 12:00 to 3:00. I will take a poll early in the semester and change those hours if that is needed. If these hours don't work for you, please let me know and we will adjust them. In any case, you can always email me or call me to schedule an appointment. My office hours will be considerably extended for project reviews. If you need to see me at other times, please do not hesitate to email me so that we can arrange a time that will work for both of us.

Grading

Homework – 20%

Midterm – 20%

Term project – 20%

Lab – 20%

Final – 20%