

London Summer Travel Course

Summer 2018

NSP III: Energy Issues in Science and Society

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Our modern civilization uses vast amounts of energy, inviting a number of questions, issues, and potential problems. Is this energy use “sustainable”? What consequences does this have for our global environment? How can we make informed decisions about the generation and use of energy?

We will explore these issues, and we will approach the discussion using some quantitative rigor. That is, we’ll investigate the underlying physics behind energy and use real numbers in our investigation and characterization of energy use. Why is this? It is because, as Richard Wolfson puts it in the preface of the textbook, “any serious study of energy and the environment has to be quantitative”. It is pointless to get excited about a possible alternative energy source, for instance, if there is no way it can be physically or economically viable as a significant energy source for our needs. The way to determine whether it is viable is, in part, through a quantitative understanding. It is also impossible to make informed and sensible decisions about these issues without quantitative data to back up these decisions.

In order to make quantitative assessments, we will use math in this course at the level of algebra and fractions (no trigonometry or calculus), so you must be prepared for that.

My hope is that as future decision-makers (business people, policy makers, voters, etc.) you will be better positioned to make good, informed choices regarding complex issues involving energy after having taken this course. Plus, you may learn some interesting things as well in this course just for the sake of knowing them.

The course is divided into three main themes which connect to each other:

1. Energy Basics
2. Energy Options
3. Climate and Energy

Apart from the general course goals expressed in the previous section, there are a number of specific skills that I’d like you to try to develop as we proceed. These skills are widely applicable (i.e., they aren’t just “science” or “math” skills but have value in business, politics, medicine, etc.).

1. *The art of quantitative estimation; developing a sense of scale; facility in roughly calculation of quantities.* These skills are widely used in a variety of contexts (e.g., case studies for management consulting). Order of magnitude or back of the envelope estimates are often important first steps in any kind of further detailed analysis.

2. *Creation, interpretation, and understanding of graphical data.* Usually, quantitative results and trends are visually presented. You need to know how to decipher and understand data presented in this way (example: a logarithmic plot. Do you know how to interpret this? Why is a logarithmic plot even used at all?)

3. *Development of critical and quantitative reasoning skills.* This is what “science” is (it’s not just memorizing a bunch of facts). For example, exponential growth is a concept that appears again and again in the natural world. Simple quantitative relationships can be manipulated to reveal a lot of powerful information.

4. *Development of research and writing skills; being able to acquire useful and accurate data; interpretation of same; assessing the useful limits of such data.* These skills are useful no matter what kind of professional path you end up taking. Having some quantitative chops is a big asset in many fields, and companies will often place a premium on this.

We will have several field trips to various facilities in London and in other areas of the UK.

The course is 5 weeks in London during the summer (with two preliminary lectures at F&M during the spring semester)

This course is designated as an NSP course and partially satisfies the science requirement at F&M.

Prerequisites: none. But you must be able to handle algebra and fractions and units with ease. No trigonometry or calculus is used.

Students who are interested in energy and environmental/climate issues may find this course of interest. Also, students looking to satisfy the NSP science requirement may want to apply to this course.

Grading and Evaluation

Homework and research assignments (64%)

These are investigative questions, quantitative exercises, and research problems that are to be done outside of class (and occasionally worked on in class as well). For some of these problems computer resources like the web will be needed to find outside sources beyond the textbook, make plots, etc.

Field trip photographic assignments (4 photos x 4% per photo = 16%)

You will take four representative photographs (one for each field trip we will take) which represent and encapsulate the notion of energy use, sustainability, climate change, or other subject we have covered in this course. For each photograph, I would like you to feel free to use visual techniques (shadowing, lighting, object placement, plus image manipulation tools on a smartphone) to emphasize the subject. Photos can contain people or not, as suited. For each photograph, you will construct a brief caption of no more than 3 sentences describing the photo and its meaning. Think of this set of assignments as a photo essay that you might see in a magazine. You should think creatively about this set of assignments: boring is bad, be creative!

Each member of the class will send me their selected photo and caption from the field trip by the next class meeting. I will compile them for display to the class at the class meeting following that. During class I will ask each person to briefly describe their photo and what it means (and why you chose to photograph that subject). I may pick the photographs I deem most interesting to post publicly on social media or a web site for the course. I hope we will be able to make a photographic record of the course and our experience as a group that we can preserve and share with others.

Participation, attendance, effort, citizenship, general attitude while abroad (20%)

This is based on questions, comments, interest (either in class or after class), attendance record, and demonstrated effort to do the best you can in the class. It is also based on my perception of your attitude, behavior, and interest in the experience abroad (i.e., citizenship) and on field trips. Active participation in class and positive interactions with the group, the instructor, and others we meet along the way will be noted and rewarded. Part of this is also your positive interaction and engagement with the group as a whole (including me!) and your sense of adventure and getting the most out of this opportunity.

Class and Events Schedule

The listed readings are from *Energy, Environment, and Climate* (3rd edition) by Richard Wolfson

Thu Apr 26 (11:30 am – 12:30 pm): Pre-departure F&M Class #1 in Hackman 218

Ch. 1: Overview; The Earth as an Energy System

HW #1 and #2 handed out

Fri Apr 27 (10 am – 11:30 am): Pre-departure F&M Class #2 in Hackman 218

Ch. 1, 2: Energy Use and Consumption in Industrialized Societies

Fri May 4 at 4 pm:

HW #1 and #2 due

Sat Jul 7: depart for London

Sun Jul 8: arrive LHR before 11 a.m., transfer to Highgate residence, orientation at Arcadia

Mon Jul 9: Orientation at Arcadia

Note: All of the following class meetings are at the Arcadia Center in London.

Tue Jul 10 (10 am - 1 pm):

Ch 3: Quantitative Basics of Energy and Related Concepts

HW #3 handed out

Wed Jul 11 (10 am - 1 pm):

Ch. 4: Quantitative Basics of Energy and Related Concepts

HW #4 handed out

Thu Jul 12 (half day):

Field Trip #1 to the Thames Barrier (London)

Mon Jul 16 (10 am - 1 pm):

Ch. 4, 5: Quantitative Basics of Energy; Fossil Fuels

Photo Assignment #1 due

HW #3 due

Tue Jul 17 (10 am - 1 pm):

Ch. 5, 6: Fossil Fuels; Environmental Impacts of Fossil Fuels

Photo Presentation #1

HW #4 due

HW #5 handed out

Wed Jul 18 (half day):

Field Trip #2 to the Crystal (London)

Mon Jul 23 (10 am - 1 pm):

Ch. 6, 7: Environmental Impacts of Fossil Fuels; Alternative Energies: Nuclear

Photo Assignment #2 due

HW #5 due

HW #6 handed out

Wed Jul 25 (10 am - 1 pm):

Ch. 7, 8: Alternative Energies: Nuclear, Geothermal, and Tidal

Photo Presentation #2

HW #6 due

HW #7 handed out

Thu Jul 26 (all day):

Field Trip #3 to Dungeness Power Station (Kent)

Mon Jul 30 (10 am - 1 pm):

Ch. 9, 10: Alternative Energies: Solar, Hydropower, Wind, Biofuels

Photo Assignment #3 due

HW #7 due

HW #8 handed out

Wed Aug 1 (10 am - 1 pm):

Ch. 11, 12, 13: Alternative Energies: Hydrogen; Climate Change and the Connection to Earth as a System

Photo Presentation #3

HW #8 due

HW #9 and #10 handed out

Thu Aug 2 and Fri Aug 3 (all day):

Field Trip #4a to the Big Pit Mine and #4 to the Centre for Alternative Energy (Wales)

Mon Aug 6 (10 am - 1 pm):

Ch. 13, 14, 15: Climate Change: Trends and Models, Projections and Possible Impacts

Photo Assignment #4 due

HW #9 and #10 due

HW #11 handed out

Wed Aug 8 (10 am - 1 pm):

Ch. 15: Climate Change: Projections and Possible Impacts; Wrap Up

Photo Presentation #4

HW #11 due

Wed Aug 8 (Time TBD): Farewell dinner at Doggett's

Fri Aug 10: Last day in residence (depart by noon)