

SEMESTER AT SEA COURSE SYLLABUS
University of Virginia, Academic Sponsor

Voyage: Spring 2016

Discipline: Engineering (open to non-engineering students)

Course Title: ENGR 2595-101: Energy for the World

Division: Lower

Faculty Name: John Tyner, Ph.D., P.E., P.G.

Credit Hours: 3; Contact Hours: 38

Pre-requisites: none

COURSE DESCRIPTION

Energy is one of the basic units of our physical world, and its availability strongly defines a populace's standard of living. Debates over the risks related to fracking, mining, nuclear power, hydroelectric dams, wind farms, solar farms, burning fossil fuels and implications for climate change will be weighed against the need to deliver power to an increasing human population. In this course we will investigate how energy is derived from all the available technologies, from coal to tidal. This will include the full aspect of energy consumption including: infrastructure, mining, energy storage, energy delivery, and waste disposal. As we visit various countries during the semester, we will see that the proportion and the total amount of energy generated by the various technologies differ dramatically. We will discuss opportunities made and those available in the various countries. Lastly we will discuss the inherent conflict generally between energy producers (generating self-wealth) and those downstream of the energy production (enduring poor environmental conditions), and how this conflict is becoming intergenerational.

COURSE OBJECTIVES

The goal of this course is to provide a conceptual understanding of the various forms of energy and how it is produced so that students can better assess the complex issues associated with how it affects human populations. We will pay special attention to energy issues in the countries we will visit. This goal will be met by concentrating on the following objectives:

1. Understand the basic physics of energy, and how different forms of energy can be produced.
2. Understand the complex relationships between energy production and the environment, with special attention paid to climate change.
3. Understand the complex interplay between energy, politics, law, and international relationships.
4. Understand world human population dynamics and energy demand.
5. Reflect and express how energy impacts each of us personally over the course of a semester.

REQUIRED TEXTBOOKS

Energy: Its Use and the Environment

AUTHOR: Hinrichs and Kleinbach

PUBLISHER: Brooks/Cole

ISBN-13: 978-1111990831, ISBN-10: 1111990832

DATE/EDITION: 2012 5th Ed.

Note: the cost is quite variable for this text. On 4/15/2015 Amazon lists a new prices from \$111-\$236. A used 4th Ed. is also suitable and is much cheaper.

Sustainable Energy – Without the Hot Air

AUTHOR: David MacKay

PUBLISHER: Cambridge

ISBN-13: 978-095445293, ISBN-10: 0954452933

DATE/EDITION: 2009

Note: available for legal free download here: <http://www.withouthotair.com/>

TOPICAL OUTLINE OF COURSE

Note: The textbook chapters have been assigned in an order that aligns with our itinerary, so that the various subjects may be understood partly in relation to our experiences at the ports. When you visit various ports, please pay particular attention to color coded lecture material and readings that correspond to the same color coded port. You may expect the pre-and/or post lectures following ports visits to discuss what you might/did experience while visiting the ports in relation to the class material.

Depart Ensenada- January 5:

A1- January 7: Course Introductions and Units – What is energy, and watt is power? (ungraded in-class writing assignment) (Chapter 2, SE)

A2- January 9: Energy use and energy resources (Chapter 1, E)

A3- January 11: Work, energy and power mechanics (Chapter 2, E)

Honolulu: January 12

A4- January 14: Conservation of Energy (Chapter 3, E)

A5- January 17: Oil, natural gas, and fracking earthquakes (Chapter 7, E)

Study Day: January 19

A6- January 20: Solar Heating Systems (Chapter 6, E)

A7- January 22: Nuclear (Chapter 13, 14, E)

Yokohama: January 24-25

In-Transit: January 26

Kobe: January 27-28

A8- January 29: Big Coal V. Green Coal (Chapter 7, E)

Shanghai: January 31-February 1

In-Transit: February 2-3

Hong Kong: 4-5

A9- February 6: Journal Reflections I, Each student will present several minutes on their thinking about energy at this point in the course - turn in Journals (Chapter, 23 SE)

Ho Chi Minh: February 8-12

A10- February 13: The politics of energy collection, conversion / transmission, consumption, and the resulting pollution (Chapter 8, E)

Study Day: February 15

A11-February 16: Global Warming: the science and the political debate (Chapter 9, E; Chapter 1 SE)

Yangon: February 18-22

A12- February 23: Increases in energy efficiency versus increased energy demand (e.g., from candles to LEDs) (Chapter 5, E)

A13- February 25: Exam 1

Cochin: February 27-March 3

A14- March 4: Journal Reflections II, Each student will present several minutes on their thinking about energy at this point in the course - turn in Journals (Chapter 25, SE)

Study Day: March 6

A15- March 7: Electricity and the Steam Cycle (Chapter 10, 11, E)

Port Louis: March 9

A16- March 10: Solar-PV (Chapter 12, E)

Study Day: March 12

A17- March 13: Engineering energy storage and consumptive devices (Chapters 3, 9, 11, and 26, SE)

Cape Town: March 15-20

A18- March 21: Wind and hydropower (Chapter 12, E)

A19- March 23: Biofuels and landfills (Chapter 17, E)

A20- March 25: Geothermal- both as a source of energy and a source of efficiency (Chapter 18, E)

Takoradi: March 27-28

Tema: March 29-31

A21- April 1: Ocean and tidal energy (chapter 12, 14, F, and G, SE)

A22- April 3: Design Presentation and Report (Each team will give a 10-15 min presentation and report describing their design of a small-scale solar, wind, or hydrologic based systems suitable for one of our host countries)

A23- April 5: Review and Journal Reflections III, Each student will present several minutes from their journals - turn in Journals (Chapters 30-32, SE)

Casablanca: April 7-11

Study Day: April 12

A24- A Day Finals, April 13 Final

April 16: Disembarkation Day

FIELD WORK

Experiential course work on Semester at Sea is comprised of the required field lab led by your instructor and additional field assignments that span multiple ports.

FIELD LAB (At least 20 percent of the contact hours for each course, to be led by the instructor.)

Field lab attendance is mandatory for all students enrolled in this course. Do not book individual travel plans or a Semester at Sea sponsored trip on the day of your field lab.

The field lab for this course takes place in Cape Town: Date TBA

We are planning a site visit to a coastal area near Cape Town where we will break into groups that will assess the different ways that energy could be produced from this environment. Some of these energy sources may be “conventional” (already a strategy used somewhere on Earth) whereas others may be purely speculative (no current technology available to take advantage of it). You will then consider the pros and cons of each type, and develop a plan for how energy could be generated from this site over the next 20 years. We will then visit with scientists and planners with the City of Cape Town who will discuss their plans for dealing with the effects of climate change on the development of energy.

Each student will complete an extended journal entry that includes the energy assessment (each group member must complete their own unique journal entry) and the visit with the City of Cape Town.

FIELD ASSIGNMENTS (*Cape Town Lab and other Port Stops*)

- Students will be required to attend the Cape Town field lab. Absence from the lab will result in a 20% loss of the course grade.
- Each student will prepare an extended journal entry dealing solely with the field lab experience.
- Students are also expected to provide journal entries from each port stop dealing with some aspect of energy that they observed. Journal entries may be supplemented with photos or other relevant materials from their port journeys. Journals may be written, or some may be in electronic format as a blog.
- The Cape Town field lab journal entry will receive a separate grade from the rest of the journal, and count towards 10% of the student’s overall grade (20% including attendance).

THE JOURNALS

Each student will create a journal that includes their in-class notes and daily personal entries. This journal will be graded at various times during the semester, and will constitute 30% of your course grade. This journal will become your own personalized textbook of experiences and thoughts that originate both inside and outside of the classroom. Basically, you will build

this journal during our class periods, our field trip, from out-of-class discussions with classmates and perhaps professors, and after some personal reflection of what you learn each day. Your journal will contain written notes, and perhaps written daily entries, although you may elect to put some or all of the daily entries into electronic format as a blog. You may structure your notebook anyway you desire, but you must at least include:

- 1) Class notes/drawings from each class period.
- 2) An additional entry from every day reflecting on what was learned in class, what you learned from assigned readings, and how this information relates to you personally. On those days when we do not have class, you will spend some time thinking about the lessons learned in previous classes, and how that information relates to things that interest you. This is essentially the "diary" portion of the notebook where I want you to step back and assess the importance of what you have learned each day. This section will be your own personal account of the value of this portion of the class. You will want to consider new things that you learn each day, and whether or not you believe that these lessons will be of value to you in the future. I want you to be honest with your reflections. Your grade for this task will be based on how clearly and thoroughly you convey your thoughts, and not on whether I agree with your assessment. Feel free to be creative, and run with your thoughts. Create a record of your thinking.

In addition, you may include:

- 1) Diagrams and accompanying explanations of things you see during our port stops. You may want to bring colored pencils with you as you travel around to aid you with this task. If you wish, you can also photo-document various aspects of energy use or consumption that you see.
- 2) Anything else you want to include. I do not want to place boundaries on where you take this exercise. Each student brings a different set of background experiences to this class that will affect their learning. Be as creative as you wish!

There are several goals that accompany creating and keeping a class journal. First, it will require that you constantly think and reflect upon what you learn, and what you see and experience. I've found that this enriches our classroom discussions, and enables us to delve deeper into this subject. It also requires you to write each day, and I want each of you to practice clear, concise writing. Finally, it is a record of what you learned and what you thought about over a semester that may be transformative for you, and you may find it enlightening and useful later in life to page through this journal.

NOTE: I want you to start your journal by writing your first reflection piece at the end of our first lecture. This first entry should focus on what your goals are for this course, and what you anticipate learning during this semester. I think you will find it interesting after the course is finished to compare your goals at the outset of the course with your final reflection piece where you summarize what you learned during the semester.

METHODS OF EVALUATION / GRADING RUBRIC

- 20% - Field Lab and Field Lab Journal Entry (10% attendance, 10% quality of journal entry)
- 20% - Midterm
- 25% - Final Exam
- 20% - Design Project (10% presentation, 10% report)
- 5% - Journal Reflection and Check I
- 5% - Journal Reflection and Check II
- 5% - Journal Reflection and Check III

Please note attendance and participation is required on Semester at Sea. Absences are only excused when accompanied by a note from the clinic.

RESERVE BOOKS AND FILMS FOR THE LIBRARY

Power Generation Technologies

AUTHOR: Paul Breeze

PUBLISHER: Elsevier

ISBN-13: 978-0750663137, ISBN-10: 075066313

DATE/EDITION: 2005

ELECTRONIC COURSE MATERIALS

Electronic course materials will be made available as needed.

ADDITIONAL RESOURCES

May be supplied by the instructor through the course folder.

HONOR CODE

Semester at Sea students enroll in an academic program administered by the University of Virginia, and thus bind themselves to the University's honor code. The code prohibits all acts of lying, cheating, and stealing. Please consult the Voyager's Handbook for further explanation of what constitutes an honor offense.

Each written assignment for this course must be pledged by the student as follows: "On my honor as a student, I pledge that I have neither given nor received aid on this assignment." The pledge must be signed, or, in the case of an electronic file, signed "[signed]."