IDS 2935: Energy and Society
Quest 2

I. General Information

Class Meetings

- Course number 22323, Section number 2PH1
- Meeting Day/Time: Tues. 4th period (10:40-11:30am), Thurs. 4-5th periods (10:40am-12:35pm)
- MAEB 0229

Instructor

- Instructor: Selman Hershfield, selman@ufl.edu (preferred method of communication outside class time)
- Office location: 2138 NPB
- Office hours: Office hours will be determined by a poll during the first class. Appointments can always be made for times outside of the regular office hours.
- Phone: (352) 392-9387

Course Description

How will we meet our energy needs based on available resources in a way that is environmentally friendly, economically viable, fair, and politically attainable?

This course addresses the question of what energy usage will be in the both the short and long term based on availability of resources, technology, environmental concerns, economics, personal choices, and national and international policy. The course will provide the background in science, technology, the environment, natural resources, economics, and policy so that students can make their own decisions as to what their and the world's energy future will be. As part of the process students will develop the quantitative reasoning skills necessary to make informed policy decisions and learn to communicate their ideas clearly.

The course starts by introducing the scientific basis for energy and reading in parallel a historical account of energy usage. Energy played a central role in how society developed. Many of the concerns that one sees now in terms of availability of natural resources and environmental impact have arisen throughout history. Students will develop quantitative reasoning skills by tackling energy related problems. The math involved is only basic arithmetic, but students will be asked to explain in writing their reasoning. Following this initial stage, the course will address in turn energy technologies, environment concerns both today and in the past, the economics of energy costs, personal choices that we make and that people in different countries make, national energy policies, and international policies and politics. At the end of the course, students will write a white paper proposing a particular energy solution that may be either at the personal, local, national or international level.

Quest and General Education Credit*

- Quest 2
- Physical Sciences

**This course accomplishes the Quest and General Education objectives of the subject areas listed above. A minimum grade of C is required for Quest and General Education credit. Courses intended to satisfy Quest and General Education requirements cannot be taken S-U.*

Required Readings and Works

Richard Rhodes, "Energy: A Human History," Simon and Schuster, New York, NY (2018).
David J.C. MacKay, "Sustainable Energy – Without the Hot Air," UIT Cambridge Ltd, Cambridge, UK (2009). This book is available for free on-line from https://www.withouthotair.com/ .
William Kamkwamba and Bryan Mealer, "The Boy Who Harnessed the Wind," Harper Collins, New York, NY (2009).

Materials and Supplies Fees: n/a

II. Graded Work

Description of Graded Work

Work	Description	Word Count	Percentage
In-class work	During nearly every class, students will be asked to submit responses to questions or worked problems. In the second period on Thursdays, the work submitted will often be for a group of students. The grading for these activities will be based on making a good faith effort to solve the problem. Simply submitting a one or two word answer or just a number will not result in any credit; however, considering that the instructor will be available to assist you, it is expected that most grades will be for 100% for this portion of the grade. The answers to questions and responses must be expressed in full sentences.		10
Homework	There are 10 weekly homework assignments in this course, which are due the first 10 Tuesdays after the start of the course. The homework assignments consist of problems, questions about the readings, and lab reports. The format of the homework each week is indicated in the following pages of the course schedule.	estimated 2000 words total	30

	Unlike those in a typical Physics class, most problems do not have a single correct answer. Rather students are expected to list the assumptions for their calculation, explain the calculation, and then present their conclusions – all in full sentences. In many ways this is a class on quantitative reasoning. The readings during the first 10 weeks of the course are spaced so as to maintain an even workload. To ensure that you keep up with the readings, there will be a weekly prompt or question on the reading requiring a response of approximately half a page (125 words). The lab reports are specific to each lab. They will be started in class and submitted in final form the following Tuesday.		
Exam 1	One-period exam based on material covered in class from Aug. 24 through Sept. 16. A sample exam will be placed on Canvas prior to the in-class exam.		20
Exam 2	One-period exam based on material covered in class from Sept. 18 through Nov. 3. A sample exam will be placed on Canvas prior to the in-class exam.		20
Final Project	After homework 10, the focus will be on the final project, which is to write a white paper promoting an energy solution at the personal, national, or international level. The proposal must use some material discussed in the class as well as some new data that the student has found on their own, include at least one quantitative calculation presented in a logical manner from start to finish, and have a clear concluding call to action. Students must also address how this proposal will affect them personally. There will be a workshop in class to develop an abstract and an outline, and another workshop in class to comment on a draft. Both the abstract/outline and drafts will be handed in for instructor comment as well.	2000	20

Grading Scale

For information on how UF assigns grade points, visit: https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/

A	94 – 100%		C	74 – 76%
A-	90 – 93%		C-	70 – 73%
B+	87 – 89%		D+	67 – 69%
B	84 – 86%		D	64 – 66%
B-	80 – 83%		D-	60 – 63%
C+	77 – 79%		E	<60

III. Annotated Weekly Schedule

Date	Topic (Question/Subject)	Physical Sciences + Q2 Method/Concept/Practice at Work	Reading & Activities for Before Class	Assigned Work Due
	Science			
Tues. Aug. 24	Course Introduction, Forms of Energy	After reviewing the syllabus and course structure, students will be asked to list individually, in small groups, and as a class different forms of energy.		
Thurs. Aug. 26 Part 1	Energy Units, Unit Conversion	Through a set of short lectures, the different units used for energy will be reviewed and energy conversion calculations will be modelled. In breaks in the lecture, students will do simple questions on their own.		
Thurs. Aug. 26 Part 2	Small-Group Work on Open Ended Problems	These are problems on energy in the spirit of the University of Minnesota's Context Rich Problems. There is not necessarily a single right answer to these problems. Groups submit a single written answer in full sentences clearly stating the assumptions made, explaining the calculation, and summarizing their conclusions.		
Tues. Aug. 31	Discussion of Joule's Experiment in Historical Context	The reading is on the history of energy in the industrial revolution. Conservation of energy and the Laws of Thermodynamics were developed during this period. In class we will cover the scientific history of energy focusing on key experiments.	Rhodes: Chapters 1-3 (pp. 3-48) [Beginning of Industrial Revolution]	Homework 1: Problems, Question on Reading
Thurs. Sept. 2 Part 1	Power	Power is energy per unit time. We will examine power output and usage of different everyday objects: cars, cell		

Date	Topic (Question/Subject)	Physical Sciences + Q2 Method/Concept/Practice at Work	Reading & Activities for Before Class	Assigned Work Due
		phones, lights, … From a historical perspective the need for more power led to the development of steam engines.		
Thurs. Sept. 2 Part 2	Small-Group Work on Everyday Power and Energy Usage	Students will work in small groups to estimate the power and energy usage in their everyday lives. We will use these numbers later in the course when discussing personal choices.	MacKay: pp. 68-71 [Gadgets]	
Tues. Sept. 7	Steam Engine in Historical Context, Laws of Thermodynamics	The different engines in the reading will be discussed, followed by an explanation of the laws of thermodynamics, which were motivated by the search for a better engine.	Rhodes: Chapters 4-6 (pp. 49-104) [Steam Engines]	Homework 2: Problems, Self-Reflection Question, Question on Reading
Thurs. Sept. 9 Parts 1,2	Lab: Quantitative Measurement of Energy Conversion	Students measure quantitatively the conversion of energy and energy conservation. This is explained under Experiential Learning.		
Tues. Sept. 14	Scientific Method	The measurements made last week will not have demonstrated exact conservation of energy. We will discuss what that means and how science works with quantitative measurements. In this discussion we will review the now debunked “Cold Fusion” experiments.	Rhodes: Chapters 11-12 (pp. 168-206) [Electrification]	Homework 3: Lab Report, Question on Reading
Thurs. Sept. 16 Part 1	Electromagnetism	This lecture will cover Faraday’s Law, which is the basis for almost all electrical generators.		
Thurs. Sept. 16 Part 2	Exam 1	The exam will cover all material up through Tues. Sept. 14. A sample example will be made available on Canvas.		Exam 1
	Technology			
Tues. Sept. 21	Lighting	A central theme in the historical reading is the search for better lighting: wood	Rhodes: Chapters 7-10 (pp.105-167) [Lighting]	Homework 4: Question on

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		burning, oil burning, gas lights, and incandescent light bulb. We will discuss these as well as more recent developments like the blue LED, which received the 2014 Nobel Prize in Physics.	MacKay: pp. 57-59 [Lighting]	Scientific Method, Question on Reading
Thurs. Sept. 23 Parts 1,2	Lab: Wind Generator Design Challenge	This is an open ended lab where students build windmill generators using a small motor/generator that we supply. At the end of the session we will have a contest to see whose generator produces the most power.		
Tues. Sept. 28	Energy Density and Storage	The concept of energy density will be introduced and applied to transportation and to the human diet. (Easy access to high-energy-density foods is one cause of obesity.) The related technologies of energy storage are crucial to using renewable sources of energy.	Rhodes: Chapters 15-16 (pp. 229-271) [Oil] MacKay: pp. 76-79 [Food] MacKay: pp. 186-201 [Storage]	Homework 5: Lab Report, Question on Reading
Thurs. Sept. 30 Part 1	Engines and Efficiency	The internal combustion engine and the electric motor will be explained, including the concept of efficiency.		
Thurs. Sept. 30 Part 2	Small-Group Work on Energy Usage in Transportation	What are the most efficient forms of transportation? How much energy does a car use compared to a person or an airplane? Students will study these questions using a worksheet and then discuss their own personal transportation energy usage.	MacKay: pp. 29-30 [Cars] MacKay: pp. 35-36 [Planes] MacKay: pp. 118-134 [Transportation]	
Tues. Oct. 5	Nuclear Energy	Nuclear energy does not produce greenhouse gases, but there are environment risks in usage and in waste storage. We will review and discuss the	Rhodes: Chapters 17-20 (pp. 272-344) [Nuclear Energy and Future] MacKay: pp. 1 61-173 [Nuclear]	Homework 6: Problems, Question on Reading

Date	Topic (Question/Subject)	Physical Sciences + Q2 Method/Concept/Practice at Work	Reading & Activities for Before Class	Assigned Work Due
		benefits and drawbacks of using nuclear power.		
	Environment			
Thur. Oct. 7 Part 1	Discussion: Energy and Environment in Historical Context	One way to interpret *Energy: A Human History* is as chronicling a search for more environmentally friendly forms of energy.		
Thur. Oct. 7 Part 2	Greenhouse effect, Comparison of Earth and Moon	Why is the moon colder than the Earth on average although they are basically the same distance from the sun? To understand this question and the greenhouse effect we examine energy flow into and away from the Earth.		
Tues. Oct. 12	Experimental Evidence for Climate Change	We will take a close look at real data indicating climate change and the cause of climate change. Students will draw their own conclusions.	Rhodes: Chapters 13-14 [Black Clouds] MacKay: pp. 3-18 [Climate Data]	Homework 7: Question on Environment and Energy in context of readings
Thurs. Oct. 14 Part 1	Waste in Energy Production and Use	Climate change is not the only environmental concern in energy production. Mining, drilling, making solar cells and creating dams all have potential damaging consequences. This session will ask students to think critically about pros and cons of different sources of energy.		
Thurs. Oct. 14 Part 2	Small-Group Work: Communicating Science to the Public	How does one best convey scientific results to the public? Why do some views persist even in the face of scientific evidence? Students in small groups and with the class as a whole will examine these questions.		

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	Natural Resources and Sustainability			
Tues. Oct. 19	Worldwide Nonrenewable Resources	On Earth we have a limited supply of nonrenewable resources like fossil fuels. According to our best estimates, how long will those supplies last?	Kamkwamba: Chapters 1-5 (pp. 3-97)	Homework 8: Question on Communicating Science, Question on Reading
Thurs. Oct. 21 Part 1	Renewable Resources	How much energy is produced by renewable sources today and can be in the future?	MacKay: pp. 32-34, 38-44, 55-56, 60-63, 103-112 [Renewable energy sources]	
Thurs. Oct. 21 Part 2	Game: Meeting the United States' Energy Needs	This is a game called Stabilization Wedges from Princeton University. Students work with wedges representing different possible energy sources to meet our energy needs and at the same time reduce environmental impacts.		
	Economics			
Tues. Oct. 26	Personal Energy Costs Today	How much money do you spend on energy on an average day? Students will work in class to figure this out based on their own personal lifestyle.	Kamkwamba: Chapters 6-10 (pp. 98-193)	Homework 9: Reflection on Wedge game, Question on Reading
Thur. Oct. 28 Part 1	Energy Costs at the National and International Level	How much money per year is spent on energy in the US, in total and per capita? Compare with other countries.		
Thur. Oct. 28 Part 2	Exam 2	This exam covers the material covered since Exam 1 through Tues. Oct. 26. A sample exam will be made available in Canvas.		Exam 2

Date	Topic (Question/Subject)	Physical Sciences + Q2 Method/Concept/Practice at Work	Reading & Activities for Before Class	Assigned Work Due
	Personal Choices			
Tues. Nov. 2	Energy Usage Choice, Emergency Preparedness	Students will examine their own personal energy choices. Are there things they can change now? How does their energy usage change during an emergency like a hurricane?	Kamkwamba: Chapter 11-15 + Epilogue (pp. 194-286) MacKay: pp. 50-53 [Heating/cooling]	Homework 10: Self-Reflection Questions, Question on Reading
Thur. Nov. 4 Part 1	Personal Energy Usage Around the World	Drawing on *The Boy Who Harnessed the Wind*, how does your energy usage compare to that in other countries?	MacKay: pp. 231-239 [World Usage]	
Thur. Nov. 4 Part 2	Workshop on Final Project	Students will bring a general idea for their final project to class. This idea will be refined working individually and in small groups so that an outline can be created. There will also be an introduction to using library databases to find relevant information.		
	National Policy			
Tues. Nov. 9	US Government Policy	What are the national policies toward energy such the energy star ratings system, fuel standards, ethanol requirements, and subsidies to various industries?	Background reading on US Energy Acts (~30 pages)	Abstract for Final Project
Thurs. Nov. 11	Veteran's Day	No class		
	International Policy			
Tues. Nov. 16	Preparation for Role Playing Climate Conference	The UN Climate Conference (COP26) takes place in Glasgow from Nov. 1 – 12, 2021. We will review what happened at that conference and provide resources to understand different countries goals and perspectives.		

Date	Topic (Question/Subject)	Physical Sciences + Q2 Method/Concept/Practice at Work	Reading & Activities for Before Class	Assigned Work Due
Thur. Nov. 18 Parts 1,2	Role Playing Climate Conference	Small groups of students represent different countries in our own model climate conference.		
Tues. Nov. 23	Energy Tour	The goal here is to get out in your community and visit an energy production facility. Depending on the COVID-19 situation, we may visit facilities on campus, have a virtual tour, or have students visit facilities where they live outside of Gainesville.		
	Synthesis			
Tues. Nov. 30	Workshop Final Project Draft	Students bring a draft of their final project paper to class to work on in small groups and also on their own. This is the final tune-up before submission.		Draft of Final Project
Thurs. Dec. 2 Parts 1,2	Discussion: Future Energy Prospects and Student Projects	This is a course capstone lecture where we put together everything we have learned, including the students' final project papers. A large diagram will be made to try to illustrate what the students see as the energy future.		Final Project
Tues. Dec. 7	Course Evaluation, Exit Interviews	This is required by Quest. Time permitting, the instructor will conduct exit interviews to gather ideas for improving the course.		

IV. Student Learning Outcomes (SLOs)

At the end of this course, students will be expected to have achieved the Quest and General Education learning outcomes as follows:

	Physical Sciences SLOs ➔ Students will be able to…	**Quest 2 SLOs ➔ Students will be able to…**	**This Course's SLOs ➔ Students will be able to…**	**Assessment Student competencies will be assessed through…**
Content	**Identify, describe, and explain** the basic concepts, theories and terminology of natural science and the scientific method; the major scientific discoveries and the impacts on society and the environment; and the relevant processes that govern biological and physical systems.	**Identify, describe, and explain** the cross-disciplinary dimensions of a pressing societal issue or challenge as represented by the social sciences and/or biophysical sciences incorporated into the course.	**Identify, describe, and explain** the laws of conservation of energy and thermodynamics, different forms of energy, energy units, and power.	Homework problems and exams.
Content			**Identify, describe, and explain** how environmental concerns, economics, personal choices, national and international policies and politics affects and determines energy usage.	Homework questions on the readings, exam questions, in-class work, and the final project.

	Physical Sciences SLOs ➔ Students will be able to…	Quest 2 SLOs ➔ Students will be able to…	This Course's SLOs ➔ Students will be able to…	Assessment Student competencies will be assessed through…
Critical Thinking	**Formulate empirically-testable hypotheses** derived from the study of physical processes or living things; apply logical reasoning skills effectively through scientific criticism and argument; and apply techniques of discovery and critical thinking effectively to solve scientific problems and to evaluate outcomes.	**Critically analyze** quantitative or qualitative data appropriate for informing an approach, policy, or praxis that addresses some dimension of an important societal issue or challenge.	**Critically analyze** and **evaluate** quantitative data to draw conclusions and test hypotheses.	Energy conversion lab report and problems in homework and exams featuring data.
Critical Thinking			**Evaluate** quantitatively energy needs and energy sources so as to **critically analyze** energy policy.	Homework problems and exam questions.
Communication	Communicate scientific knowledge, thoughts, and reasoning clearly and effectively.	**Develop and present**, in terms accessible to an educated public, clear and effective responses to proposed approaches, policies, or practices that address important societal issues or challenges.	**Develop and present** in writing quantitative arguments showing clearly assumptions, logical reasoning, and conclusions.	Homework problems and final project.

	Physical Sciences SLOs ➔ Students will be able to…	Quest 2 SLOs ➔ Students will be able to…	This Course's SLOs ➔ Students will be able to…	Assessment Student competencies will be assessed through…
Communication			**Develop and present** in writing energy solutions accessible to the public.	Final project.
Connection	N/A	**Connect course content** with critical reflection on their intellectual, personal, and professional development at UF and beyond.	Analyze personal energy usage and its impacts.	Self-reflection homework assignments.
			Develop their own proposal for energy solutions and their own vision for the future.	Final project.

V. Quest Learning Experiences

1. Details of Experiential Learning Component

This class contains four separate experiential learning components. There are two lab experiments, an energy tour, which might be virtual this semester, and an international conference role playing activity. Below we explain each of these activities in more detail.

Energy conversion lab: One of the historical advances in building more efficient steam engines is due to understanding the energy needed to turn water into steam, which is called the latent heat of vaporization. With our regular classroom it is not going to be safe to measure this, but we can measure the latent heat of fusion or the energy required to turn ice into water. In this lab we will use calorimeters to measure the latent heat of fusion and other thermodynamic properties. We will check for agreement between theory and your observations, as well as compare the observations of different groups to gain a better understanding uncertainties in quantitative measurements.

Design challenge lab: This is an open-ended lab. You will be given a small electrical generator and asked to construct a windmill generator just as in the book "The Boy Who Harnessed the Wind." You will have to design, build, and test the windmill blades and the support structure. Don't expect everything to work the first time. Having a difficulty or setback and overcoming it is a valuable experience. The instructor will be available to help you. At the end of the class we will have a competition to see whose windmill generates the most power.

Energy tour: Where does the energy come from that runs the UF campus or in your community? Prior to COVID-19, this was intended to be a walking tour on campus. Depending on the COVID-19 situation, we may do this on campus or it may be a virtual event. Students will also be given the opportunity to go somewhere in their local community.

Role Playing Game: We are fortunate this year that a major international climate conference, COP26, takes place from Nov. 1 to Nov. 12, just before we are set to discuss international policy. After reviewing what happened at that conference and providing resources for students to understand different countries goals, motivations, and perspectives, we will hold our own climate conference. Small groups of students will represent different countries in mock negotiations.

2. Details of Self-Reflection Component

In the context of this course on energy, self-reflection means that students become aware of their energy usage, the choices about energy that they make, and the implications of those choices. In class this is discussed on Sept. 2, Nov. 3, and Nov. 10. Explicit self-reflection questions are included in homework assignments 2 and 10, following and leading up to these discussions in class.

VI. Required Policies

Attendance Policy

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx
If you are feeling ill or think you may have been exposed to COVID-19, please do not come to class. You will have an opportunity to make up the in class questions and other work. If you have an extended absence, documentation will be required as explained in the above linked policy.

Students Requiring Accommodation

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

UF Evaluations Process

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Counseling and Wellness Center

Contact information for the Counseling and Wellness Center:
http://www.counseling.ufl.edu/cwc/Default.aspx , 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

The Writing Studio

The writing studio is committed to helping University of Florida students meet their academic and professional goals by becoming better writers. Visit the writing studio online at http://writing.ufl.edu/writing-studio/ or in 2215 Turlington Hall for one-on-one consultations and workshops.