IDS 2935 Energy and Society

Primary General Education Designation: Physical Sciences

I. Course Information

Quest 2 IDS2935, Course number 23052

Fall 2020

Meeting Day/Time: Tuesday 8th period (3:00-3:50pm); Thursday 7th-8th periods (1:55-3:50pm)

This class is delivered synchronously online via Zoom at the above times. Links to the Zoom sessions and course material, including any updates to the syllabus, will be available from the Canvas course site. The UF Help Desk, 352-392-4357 can help resolve technical issues, but also notify the instructor of any problems such as difficulty accessing Canvas or a slow internet connection.

General Education Designation: [Physical Sciences]

* A minimum grade of C is required for general education credit *

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.

Required Course Materials (to purchase/rent)

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).

Recommended Course Materials (not required)

Vaclav Smil, "Energy and Civilization: A History," MIT Press, Cambridge, MA (2018).

Statement on Materials and Supplies Fees

There is no material fee for this trial course. Prof. Hershfield will ship equipment to you for doing the two labs. You will need to supplement this equipment with everyday items: paper, carboard, tape, glue, scissors, a ruler, and a watch or cell phone for timing.

II. Coursework & Schedule

1. List of Graded Work

Work	Description	Word Count	Percentage
In-class work	During nearly every class, students will be asked to submit via canvas 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.	estimated 2000 words total	30

	The format of the homework each week is indicated in the following pages of the course schedule. 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 Sept. 1 through Sept. 22. 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. 24 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

2. Weekly Course Schedule

Date	Topic (Question/Subject)	Physical Sciences + Q2 Method/Concept/Practice at Work	Reading & Activities for Before Class	Assigned Work Due
	Science			
Tues. Sept. 1	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. Sept. 3 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. Sept. 3 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. Sept. 8	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	Rhodes: Chapters 1-3 (pp. 3-48) [Beginning of Industrial Revolution]	Homework 1: Problems, Question on Reading

Date	Topic (Question/Subject)	Physical Sciences + Q2 Method/Concept/Practice at Work	Reading & Activities for Before Class	Assigned Work Due
		class we will cover the scientific history of energy focusing on key experiments.		
Thurs. Sept. 10 Part 1	Power	Power is energy per unit time. We will examine power output and usage of different everyday objects: cars, cell phones, lights, … From a historical perspective the need for more power led to the development of steam engines.		
Thurs. Sept. 10 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. 15	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. 17 Parts 1,2	Lab: Quantitative Measurement of Energy Conversion	Students measure quantitatively the conversion of energy, specifically from electrical to mechanical energy. This is also explained under Experiential Learning.		
Tues. Sept. 22	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	Rhodes: Chapters 11-12 (pp. 168-206) [Electrification]	Homework 3: Lab Report, Question on Reading

Date	Topic (Question/Subject)	Physical Sciences + Q2 Method/Concept/Practice at Work	Reading & Activities for Before Class	Assigned Work Due
		discussion we will review the now debunked "Cold Fusion" experiments.		
Thurs. Sept. 24 Part 1	Electromagnetism	This lecture will cover Faraday's Law, which is the basis for almost all electrical generators.		
Thurs. Sept. 24 Part 2	Exam 1	The exam will cover all material up through Tues. Sept. 22. A sample example will be made available on Canvas.		Exam 1
	Technology			
Tues. Sept. 29	Lighting	A central theme in the historical reading is the search for better lighting: wood 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.	Rhodes: Chapters 7-10 (pp.105-167) [Lighting] MacKay: pp. 57-59 [Lighting]	Homework 4: Question on Scientific Method, Question on Reading
Thurs. Oct. 1 Parts 1,2	Lab: Wind Generator Design Challenge	This is an open ended lab where students build wind generators using the motor from the first lab, LED's, and a construction of their own choosing. Although we are working remotely, there will be discussions about the design in breakout sessions prior to starting the build. At the end of the class students will share and demonstrate their device.		
Tues. Oct. 6	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	Rhodes: Chapters 15-16 (pp. 229-271) [Oil] MacKay: pp. 76-79 [Food]	Homework 5: Lab Report, Question on Reading

Date	Topic (Question/Subject)	Physical Sciences + Q2 Method/Concept/Practice at Work	Reading & Activities for Before Class	Assigned Work Due
		obesity.) The related technologies of energy storage are crucial to using renewable sources of energy.	MacKay: pp. 186-201 [Storage]	
Thurs. Oct. 8 Part 1	Engines and Efficiency	The internal combustion engine and the electric motor will be explained, including the concept of efficiency.		
Thurs. Oct. 8 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. 13	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 benefits and drawbacks of using nuclear power.	Rhodes: Chapters 17-20 (pp. 272-344) [Nuclear Energy and Future] MacKay: pp. 1 61-173 [Nuclear]	Homework 6: Problems, Question on Reading
	Environment			
Thur. Oct. 15 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. 15 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		

Date	Topic (Question/Subject)	Physical Sciences + Q2 Method/Concept/Practice at Work	Reading & Activities for Before Class	Assigned Work Due
		greenhouse effect we examine energy flow into and away from the Earth.		
Tues. Oct. 20	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. 22 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. 22 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.		
	Natural Resources and Sustainability			
Tues. Oct. 27	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

Date	Topic (Question/Subject)	Physical Sciences + Q2 Method/Concept/Practice at Work	Reading & Activities for Before Class	Assigned Work Due
				Science, Question on Reading
Thurs. Oct. 29 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. 29 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. It will be converted to a virtual format.		
	Economics			
Tues. Nov. 3	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. Nov. 5 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. Nov. 5 Part 2	Exam 2	This exam covers the material covered since Exam 1 through Tues. Nov. 3. A sample exam will be made available in Canvas.		Exam 2
	Personal Choices			

Date	Topic (Question/Subject)	Physical Sciences + Q2 Method/Concept/Practice at Work	Reading & Activities for Before Class	Assigned Work Due
Tues. Nov. 10	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. 12 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. 12 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. 17	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. 19 Part 1	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.		

Date	Topic (Question/Subject)	Physical Sciences + Q2 Method/Concept/Practice at Work	Reading & Activities for Before Class	Assigned Work Due
	International Policy			
Thurs. Nov. 19, Part 2	Preparation Reacting to the Past Climate Conference	This is a historical role playing activity that is part of the *Reacting to the Past* series from Barnard College.		
Tues. Nov. 24	Reacting to the Past Role Playing Climate Conference	The historical event reenacted is the 2009 Copenhagen Climate meetings. Students will have specific roles in the negotiation based on the country they are representing.	Background reading for role playing game (~40 pages)	
	Synthesis			
Tues. Dec. 1	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. 3 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 on virtual whiteboards to try to illustrate what the students see as the energy future.		Final Project
Tues. Dec. 8	Course Evaluation, Exit Interviews	This is required by Quest. Time permitting, the instructor will conduct exit interviews to gather ideas for improving the course.		

III. Grading

3. Statement on Attendance and Participation

Attendance and Participation:

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/UGRD/academic-regulations/attendance-policies/

A component of your grade is based on "in-class" work. This is either work done in small groups or work done individually during class. This work will be submitted via Canvas during the class period and graded on making a "good faith" effort to answer the question or solve the problem. In most instances it is expected that students will get 100% for this part of the grade because the instructor is there to help if you get stuck or want feedback on their response; however, just putting your name and a word or two on a submission will not result in credit. Because the "in-class" work is submitted, if you miss a class due to an excused absence you can make it up by completing the assignment.

4. Grading Scale

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

A	94 – 100% of possible points		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%		F	<60

IV. Quest Learning Experiences

5. Course Delivery and Engagement

Delivery Method: Synchronously on-line via Zoom

This course has one period on Tuesday and two consecutive periods on Thursday. The double period has been chosen so as to provide time for longer experiential activities like labs. The delivery method is varied depending on the content.

For most of the technical material in the science and technology sections there will be short minilectures followed by student engagement through short response questions. The science material in this class has been carefully curated so as to provide both breadth and depth. While there is reference material,

there is no single source that we could find that covers the material at the level we are seeking. Some classes are specifically listed as Discussion. These will follow a more typical humanities style class with the instructor providing questions to start a student centered discussion, perhaps with Zoom breakout rooms.

When there is no experiential activity (described below), the second period on Thursday, labelled Part 2 in the class schedule, will be used for small-group activities in Zoom breakout rooms with the instructor moving from group to group to help and provide guidance. These group work sessions are fashioned after the SCALE-UP program at NC State. The groups may be determined by the instructor so as to maintain intellectual diversity by, for example, making sure different majors are included in each group. With this approach students in the group may be assigned specific roles.

6. 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 a historical role playing activity. Below we explain each of these activities in more detail.

Energy conversion lab: At the end of the drop/add period when the class roll is finalized, the instructor will mail you some simple equipment, which you will use for the labs at home. While this will not be as fancy as the equipment you would have on campus, it will allow you to develop some hands-on experimental skills that you might not experience in a experiment on campus that comes set up beforehand. Like the people in our readings, there will some (modest) challenge to get the experiment set up and working. In this experiment we will lift a mass using an electric motor to measure the conversion of electrical to mechanical energy. The motor will not be able to lift a large enough mass. Data will be taken during class, with the instructor being available to help. This work will lead naturally to a discussion of efficiency and gearing, as well as random and systematic uncertainties in scientific experiments.

Design challenge lab: This is an open-ended lab. The basic equipment is the motor from the first lab, which we will use as a generator here, some wires, and LED's. The challenge is to design a wind turbine which can generate enough electrical energy to light an LED. This is a challenge because you will have to figure out how to mount the motor and optimize blades for your windmill. 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 individually and in groups.

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 and where students are staying, we may do this on campus with social distancing or it may be a virtual event. Students will also be given the opportunity to go somewhere in their local community.

Role Playing Game: *Reacting to the Past* is a set of role playing games developed at Barnard College. They were designed for more engaged learning in history courses by having students reenact key historical events. Students are assigned roles as key players in the event. They research their assigned person or group, and during the reenactment pursue their role's interests. The particular event that we will revisit is the Copenhagen 2009 Climate Agreement. After participating in this event, students will write a reflection on what they have learned about international diplomacy.

7. 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. 10, 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.

8. What is the essential/pressing question your course explores?

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

V. General Education and Quest Objectives & SLOs

9. This Course's Objectives—Gen Ed Primary Area and Quest

Physical Sciences Objectives ➔	**Quest 2 Objectives ➔**	**This Course's Objectives ➔** (This course will….)	**Objectives will be Accomplished By:** (This course will accomplish the objective in the box at left by…)
Physical science courses provide instruction in the basic concepts, theories and terms of the scientific method in the context of the physical sciences.	Address in relevant ways the history, key themes, principles, terminologies, theories, or methodologies of the various social or biophysical science disciplines that enable us to address pressing questions and challenges about human society and/or the state of our planet.	Explore the use of quantitative measurements in supporting or disproving scientific hypotheses.	This will be accomplished through a lab on energy conversion and the subsequent analysis and discussion.
		Explain the laws of conservation of energy and thermodynamics and apply them to studying energy use today.	This will be accomplished through traditional (short) lectures on the scientific laws and problems in which students calculate energy usage.
Courses focus on major scientific developments and their impacts on society, science and the environment, and the relevant processes that govern physical systems.	Present different social and/or biophysical science methods and theories and consider how their biases and influences shape pressing questions about the human condition and/or the state of our planet.	Study how scientific and particularly technological developments have impacted the environment.	This will be accomplished through a historical reading (Rhodes) and examination of current data on the impact of human energy use on the environment.

Physical Sciences Objectives ➔	**Quest 2 Objectives ➔**	**This Course's Objectives ➔** (This course will….)	**Objectives will be Accomplished By:** (This course will accomplish the objective in the box at left by…)
Students will formulate empirically-testable hypotheses derived from the study of physical processes, apply logical reasoning skills through scientific criticism and argument, and apply techniques of discovery and critical thinking to evaluate outcomes of experiments.	Enable students to analyze and evaluate (in writing and other forms of communication appropriate to the social and/or biophysical sciences) qualitative or quantitative data relevant to pressing questions concerning human society and/or the state of our planet.	Teach students how to formulate quantitatively testable hypothesis and critically analyze the results of such measurements.	This will be accomplished through an energy conversion experiment and the subsequent analysis, including the discussion of other experiments in which the scientific reasoning was flawed. Students will write a detailed lab report on this experiment.
		Equip student to analyze quantitatively how energy usage affects the environment.	This will be accomplished through careful examination of data on climate change and having the students use their critical thinking skills to draw their own conclusions.
	Analyze critically the role social and/or the biophysical sciences play in the lives of individuals and societies and the role they might play in students' undergraduate degree programs.	Develop students' quantitative reasoning skills and show the students what questions quantitative reasoning can and cannot address.	This will be accomplished through open-ended problems in class and in homework assignments, though reflection on the course reading, and in the final project.
	Explore or directly reference social and/or biophysical science resources outside the classroom and explain how engagement with those resources complements classroom work.	Provide students with experience speaking to a scientist who is not their instructor and finding and accessing data not part of the course reading.	This will be accomplished through a guest (non-UF) lecturer with a question and answer session, and in the research for the students' final project.

10. This Course's Student Learning Outcomes (SLOs)—Gen Ed Primary Area and Quest

	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.

VI. Required Policies

11. Students Requiring Accommodation

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://disability.ufl.edu/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

12. 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/.

13. 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.

14. 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.

15. 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/ .

16. Online Privacy

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

17. Additional Resources

The course Canvas site has a listing of additional Health/Wellness and Academic Resources available to UF students.