

# Energy and Climate

## Course Syllabus - Spring 2017

**Instructor:** Peter McDonough

**Contact:** peter.mcdonough@umontana.edu

**Class times:** Tues/Thurs 11:00 – 12:20

**Location:** JRH 205

**Office Hours:** TBD and by appointment

### Course Summary

The world of energy and its corresponding environmental issues is rife with controversy. The decline of the coal industry, fracking, offshore wind, solar net metering, nuclear risk - the list is long and varied, and proposed solutions are met with fierce resistance from one “side” or another. Through these issues and the disparate perspectives that define them, students will develop a vocabulary around and understanding of how the energy world operates, particularly with respect to its role in causing, mitigating, or adapting to climate change.

The class will begin by exploring energy as we experience it in our daily lives, and then trace it back through the grid to its generation sources, touching on the basic science and technology, environmental factors, financial and economic considerations, and politics of each step along the way. Students from both technical and theoretical backgrounds will collaborate to explore these issues in depth through debate, hands-on exercises, field trips, and simulations, as well as a final class portfolio.

### Expectations

This is an experimental course in the truest sense: not only is it relatively new to UM, but the methods we will employ do not fall into any one academic box. Within this class you will do everything from writing personal opinion essays to bidding for power purchase agreements, and from testing laws of electromagnetism to negotiating world energy policies. Given the breadth of our topic, nothing is off the table. Therefore there will be days when you, personally, are completely comfortable with the material, and days when you are anything but. You are not alone. The class will always begin with the most fundamental concepts and build from there; your job is to be prepared for each class and to persist when there are unanswered questions. If you have a question then chances are, especially in a class this broad, others do too.

This is also a diverse class, including students from a range of backgrounds and interests, as well as various guest speakers and guides. One of the difficulties in the contentious energy and climate world(s) is working with hard-liners, and so this class will strive to remain objective and inclusive of diverse opinions. I expect you to avoid digging trenches (unless an assignment calls for it) and, instead, to listen and respond with a better question.

### Course Reading

All texts will be available electronically on Moodle, and will be assigned individually. This is not a reading-heavy class, though you are expected to find your own sources in preparation for other class activities and assignments.

## **Course Assignments and Activities**

### Short Exercises

These will be assigned throughout the portion of the class focusing on energy generation types in order to give you practice with some of the math and science behind generation. As the name suggests, these are each fairly short, but also very different. The questions are deliberately brief in order to give you some freedom to decide/discover how to approach the problem. Each assignment is on Moodle. If you are out of practice approaching mathematical problem solving, worry not! Office hours are for you.

### Issue Essays and Presentation

These are 5-part, iterative essays that will allow you to explore popular controversial issues that will not be discussed in depth during class time. From a list of controversies you will choose one and write a brief summary (1); then you can kiss that issue goodbye because two days later you will receive someone else's summary (of a different issue), onto which you will add a more detailed, factual description (2). Then that, too, will go to someone else and you will tackle a third issue by taking a stand on one side of the debate (3). Upon receiving someone else's opinion essay, you will then take the opposite stand (4). For the fifth and final essay you will review the four previous essays written by four of your classmates and prepare a recommendation paper (5). One day of class will be devoted to presentations based on those recommendations. The essay and presentation prompts are on Moodle.

### Home Energy Challenge

After the first week of class you will perform a basic energy audit of your home, painting a picture of how much electricity you consume and when, as well as your associated emissions. Each class day for the next three weeks (weeks 2 - 4) you will add one new energy reduction measure to your repertoire and share what you've done in class. At the end you will see how much you have managed to save and present briefly to the class. All instructions are on Moodle and will be explained in class.

### IPP Game

For three weeks outside of class you will play the role of an independent power producer (IPP), building a portfolio of generating plants and competing against your classmates to sell power to the utility. Auction bids, agreements, portfolio changes, etc. will be done via email. Rules and procedures will be given and explained in class.

### World Energy Game

We will dedicate two class periods to simulating energy policy negotiations. This will be explained further in class and all materials will be provided.

### Final Class Portfolio

There are two parts to the portfolio, each designed to test different skills in the class. The first is a public campaign or project that you and a group will design or join to address a particular energy or climate issue on campus (main campus or Missoula College) or the city of Missoula. The second is a device that you will design and build to capture wasted energy and convert it to useful electricity. Instructions for both will be explained in class and are available on Moodle. I recommend that you begin planning for these early. There is no homework for the final two weeks, so you will have time to finish and fine-tune them. The final exam period is dedicated to presentations about campaigns; everyone will display their devices that day, exhibition-style around the classroom.

### Presentations

Due to the size of the class, each student will only give one presentation this semester. You may present either on the Issue Essays in Week 7, or on your campaign experience during the final exam period. If you present on the former, remember that at least one member of your final portfolio group will need to present in the final period.

### Energy in the News

Two students each day will briefly regale the class with the latest energy news. This will count towards your participation.

### Field Trips

There is the potential to take Friday trips to a hydroelectric dam, wind farm, gas power plant, and the grid central control center. If there is enough interest and willing drivers (we don't have University vehicles for this), we'll make it happen.

### Take-Home Final

This will be a slightly longer version of one of the short exercises in which you will be free to explore a scenario, make appropriate assumptions, and provide a reasonable solution.

### **Final Exam**

Students will present their final portfolios during the final exam period. There will be a short take-home final due that day, but no in-class exam.

<b>Assignment</b>	<b>Points (out of 250)</b>	<b>Time Frame</b>
Short assignments	5 pts each (x9)	Weeks 8 - 12
Letters	5 pts each (x2)	Week 1, 14
Home Energy Audit	10 pts	Week 1
Home Energy Challenge	20 pts	Weeks 2 - 4
Issue Essays	10 pts each (x5)	Weeks 2 - 7
IPP Game	20 pts	Weeks 6 - 8
World Energy Game	20 pts	Week 13
Final Portfolio	30 pts	All Semester
Presentation	10 pts	Week 7 or Final
Take-Home Final	10 pts	Weeks 14 - 15
Participation	25 pts	All Semester

## Schedule

Date	Topic	Assigned	Due
1/24	Class Intro	Letter Moodle Reading ( <i>Graphic</i> )	-
1/26	Energy Basics	Home Audit	Letter
1/31	Energy Consumption	Begin HEC Footprint exercise Moodle Reading ( <i>Causes</i> )	Home Audit results
2/2	Energy to waste, Climate science	Issue Essay #1 (HEC active) Moodle Reading ( <i>Maps</i> )	Personal footprint
2/7	Energy Service	(HEC active) Moodle Reading ( <i>Power to the People</i> )	Issue Essay #1
2/9	Utilities	Issue Essay #2 (HEC Active)	-
2/14	Load Duration and Energy Mixes	(HEC Active)	Issue Essay #2
2/16	Smart Grid, DSM	Issue Essay #3 (HEC Active)	-
2/21	Policies and Net Metering	-	Issue Essay #3 HEC Results
2/23	Northwestern Energy guest speakers	Issue Essay #4 Moodle Reading (1)	-
2/28	Climate Change and Response	(IPP Active)	Issue Essay #4
3/2	Carbon Market Policies	Issue Essay #5 (IPP Active)	-
3/7	Integration of Renewables	(IPP Active)	Issue Essay #5
3/9	Presentations	Pres Responses Final Portfolio proposal (IPP Active)	Issue Presentations Final Portfolio proposal
3/14	Electromagnetism	EM exercise (IPP Active)	Presentation Responses
3/16	Fossil Fuels	Fracking Fluid exercise (IPP Active)	EM exercise
3/28	Solar PV	Solar I-V Curve exercise	Fracking Fluid exercise
3/30	Solar Thermal	Solar Consumption exercise	* I-V Curve exercise

4/4	Wind	Wind exercise	Solar Consumption exercise (possibly I-V exercise)
4/6	Hydro	Hydro exercise	Wind exercise
4/11	Fuel Cells, Batteries, Hydrogen	-	-
4/13	Nuclear	Fission exercise Moodle Reading ( <i>Is wood green energy?</i> )	(Hydro Exercise)
4/18	Biofuels	Ethanol exercise	Fission exercise
4/20	Transportation	Transportation Exercise (Receive World Energy materials)	Ethanol exercise
4/25	World Energy Game	-	Transportation Exercise
4/27	World Energy Game	Letter (part 2)	-
5/2	Global Energy Development	(Work on final projects) Optional Reading ( <i>The Geopolitics of Energy</i> )	Letter (part 2)
5/4	Future Tech	(Work on final projects) Take-Home Final	-
Final	Final presentations, Exhibition	-	Devices, Reports, Take-Home Final