

EC 438 Energy Economics Syllabus Fall 2023

If you have questions ask them in the Energy Economics Chatspace

Course Objectives

The theme of the course this year is “Electrify Everything” and what that means for Oregon. We will introduce you to the language of energy economics, which includes a little knowledge of chemistry, physics, law, and economics. Along the way, you will learn about electricity generation technology, short and long-term energy storage, transmission, generation, and distribution regulation, some insight into many energy and energy-adjacent markets, and some extra information about those highly mobile batteries we call electric vehicles.

This is an online course, and I have done my best to use modern tools to make it as close as possible to an in-person experience, with the exception of the one-to-many lectures, which are of dubious use when compared to one-to-one.

Many of the classic student tasks, quizzes, exams, homework, and term papers have been transformed by technology. I grew up in a world of blue book exams, card catalogs, and typewriters. While computers and the internet have made this all much easier to complete, turn in, and grade, relatively little has changed about what you are being asked to do to demonstrate that you have achieved the goals of the course.

In early 2022, ChatGPT demonstrated that it could outperform most of my introductory classes on online quizzes and more than pass the course with the most straightforward copy-and-paste techniques. After this, the price of Chegg and CourseHero stocks began to fall. By Fall, the version of ChatGPT specialized for code made courses that previously focused on simple coding irrelevant.

As a result, I will be learning how to teach, meaning teach others how to learn, in a world of rapidly developing Large Language Models (LLMs). LLMs, such as ChatGPT, Bard, etc. These tools can be very effective when properly used, and we will be learning how to use them.

Contact Information

This online class and finding times for regular office hours that work for everyone is tough. I encourage you to ask questions via [Google chat through your @pdx.edu account](#). It is built into your student account, and there are apps so you can use it on mobile. You can upload files, share screens, and it is all built into your student email account.

If you have a course-related question that does not include personal information you would not usually share in class, ask it in the [Energy Economics Chatspace](#). I or -- others -- will respond there or get back to you in a DM. I encourage others to help out.

I guarantee fast turnaround time and video available for my regular office hours:

- Tuesday 10-Noon.
- Wednesday Noon-2 pm

If you have something more personal that concerns the class, please DM me at woodsj@ in [chat](#).

Basis for Grade

Grades in the course are distributed over several modules which cover specific topics. Within the topics, there are a few common tasks.

- **Social Annotation** of documents using the Hypothesis tool. You can find the rubrics at the end of each assignment. There are 17 of these worth 15 points each. The deadlines are almost all on December 1, but you should do the reading and annotate before writing your essays.
- Brief one to **two-page essays** within each of the modules. You can find rubrics for each assignment. These will be used as the basis for a dialog with ChatGPT. There are 7 of these worth 50 points each. Except for one essay, these are due at the latest on November 27th. I use these to generate the dialogs every week. If you turn in three in one week, I will generate three dialogs for you to complete.
- **Dialogs** that I generate with interview guides based on your two-page essays. The dialogs will generally be 1,000 or so words long. There will be one for each of your essays, and they will be worth 50 points each. I will create these assignments after you turn in your essays. These are not on your schedule because I create them after you turn in your essay. They will be due on December 8.
- **Assurance of Mastery** in two units from introductory microeconomics in Khan Academy. The Supply and Demand and Imperfect Competition Units are each worth 200 points on completion. You have until December 1 to achieve the Mastery level.
- Finally, your 10-15 page **term paper**, broken into interim deliverables, is worth 1,000 points, plus another 300 points for graduate students who must also complete some data analysis for their term paper. There are deadlines for every stage.

You can see the details in “Grades.”

The deadlines should give you maximum flexibility. Please do not attempt to complete these tasks on the due date. That is a recipe for frustration and disaster.

I will check on annotations and essays weekly and generate any dialogs after grading your work. I recommend quickly completing the modules through Getting Prices Right for Retail Electricity and starting on your term paper while you finish the remaining modules.

Eventually, we will need to convert all these numeric grades into a course grade. I do this at the end of the term, drawing grade boundaries in any large gaps. Students usually form clusters

Technology Requirements

This experimental online course will significantly use Large Language Models (LLM) -- ChatGPT in particular. This kind of technology is and will change education. With the correct type of guardrails, the place of Universities will be to set specifications and standards and then certify that students meet those standards. In this class, I aim to provide you with some of those guard rails and give goals that may have been unattainable before the LLM period.

There is massive innovation in this area, and keeping track of the best tools for the job is very hard. I've narrowed this down to a few tools that can be integrated into ChatGPT, but you are welcome to use others as well.

Participating in the course will require a subscription to ChatGPT Plus. This costs \$20 a month and has access to the tools we will use in the form of plugins and a code interpreter. The code interpreter and plugins are important for students enrolled in EC 538 since you will be differentiating your work with some statistical analysis.

This will allow us to analyze data, run simulations, and interact with text with natural language and limited programming skills. We will also use it to have dialogs similar to an [Oxford tutorial](#). The primary limitation is window size, i.e., the working memory of ChatGPT in the conversation. The discussions will be broken into smaller topics to compensate.

Beyond the subscription, there should be no cost to the student. All resources are free, open source, or provided through the library.

Getting Started with ChatGPT

Go to <https://openai.com/chatgpt> and sign up for an account using your @pdx.edu address. If you already have a ChatGPT Plus account, use that for this class. Once you have signed up, look in the lower left for a button to "Upgrade to Plus."

- Then go to settings in the lower left, turn on the plugin, and code interpreter beta features.
- Click on the dropdown menu at the top to select the GPT-4 model and choose the option with "Plugins."

- If no plugins have been added, click the “Plugins” dropdown menu on the right. A new plugin store will appear.
- In the plugin store, you will find a list of available plugins. Select the plugins you want to install by clicking the “Install” button. You can install multiple plugins at once.

There is a zoo of useful plugins in the ChatGPT Plugins module. The most important are:

- WebPilot: Gives search ability to ChatGPT-4
- AskYourPDF: This can embed PDFs of up to 400 pages and allow you to ask questions about the contents of the PDF.
- Notable.io: This allows us to create Jupyter notebooks and interact with Python in natural language. It will enable us to analyze data and run simulations with minimal coding experience. Please note that you will need a free notable.io account to use this.
- Wolfram Alpha: Gives better access to data and ground truth.

We will also use the Python code interpreter for data analysis and numeric problems.

Topics

Introduction to the Course

This Module is all about the tools. If you have trouble, contact me [immediately](#) on chat. I will get back to you as soon as I can.

Goals:

- Prod students into making the required technology installations for the term, including the paid ChatGPT Plus subscription.
- Demonstrate how ChatGPT can be used as an asynchronous study partner and coach through a student intake that asks about background and interests and how this dialog can be shared as a work product.
- Demonstrate the social annotation tool Hypothesis to asynchronously read and discuss reading material using this syllabus as a first example.
- Read the popular press article “To cut carbon emissions, a movement grows to ‘electrify Everything’” which we will use to motivate the course and to explore your existing knowledge of the field.
- Demonstrate how ChatGPT can be used as an asynchronous tutor in the Oxford tutorial sense, allowing the student to discuss course topics with the students that can be used as the basis for the grade.

Electricity and Transportation Energy Vocabulary

There are new actors, terms, and technology daily, and the importance differs immensely depending on who you are speaking to. You need to get into the habit of just noting when you find a new term and then doing something about it. In this class, that means highlighting, finding the definition in the [EIA Glossary](#) or some other source, and then sharing that annotation with the rest of the course.

The language in energy economics crosses over several disciplines. A little physics, chemistry, accounting, and law would be best. You will either have some of this because of prerequisites or background, or it is something you will have to learn as you go.

Consistency in terminology or even pronunciation is not a thing. Acronyms are pronounced differently depending on where you are and the age of the person you are speaking to. Get used to spending time cross-checking what definitions people are using.

The reading volume is immense, but you can use academic skimming and ChatGPT to help you learn the vocabulary.

There are also new tools to use. You will be producing two one to two-page essays. I will read your essays and then make a ChatGPT thread with an interview guide. I will send these back to you, and when you are done with the interview, you submit the dialog, and I evaluate it with the rubric that goes with each assignment.

Goals:

- Develop a legislator level of familiarity with the typical units used to describe energy.
- Develop the start of a vocabulary of fuels and electricity generation technology.
- Develop a functional list of regulators, agencies, governmental units, and for-profit and nonprofit firms interacting in this area.
- Use Hypothesis to share the newly acquired vocabulary with other students.

Getting Prices Right for Retail Electricity

This Module uses welfare analysis and other tools from your introductory microeconomics courses to look at why retail electricity prices look the way they do and some of the welfare costs of how we have implemented those tariffs. To ensure you don't get lost, you must sign up for the [Khan Academy](#) course and work through the videos and quizzes until you have "Mastery" in both the Supply and Demand and Imperfect Competition Units.

There are a lot more details in my module comments.

Once those preliminaries are done, there are two connected papers. The first explains the theory and principles of how you price electricity to pay for long-lived assets. The second paper shows the welfare effects of violating some of these principles, and the final document shows

some recent rate designs. The case designs are all over the map, literally and in terms of quality.

Transmission

This section aims to help you understand the importance of transmission to our clean energy transition. Twenty years ago, the majority of the conversation was about generation, but now transmission, getting power from one place to another, is the thing that keeps me up at night.

We will probably start with [uprating](#) our existing transmission and using the existing rights-of-way as much as possible, but there are a lot of opportunities for exotic solutions. If EVs are batteries on wheels, we can use batteries to do more than time-shift; we can also location-shift.

This Module starts with a simulation to help give you some intuition about transmission lines and how adding loads in one place can overload a transmission line on the other side of the network.

This Module has more vocabulary, one essay, and another one of the ChatGPT threads as a dialog partner.

Resilience

Once you consider the problems of electrifying everything or as much as possible, you will notice that having the electricity go out for a few minutes, hours, or days is suddenly much more critical. Visualize not just all the natural gas we use in our houses but also the gasoline in our cars being replaced with electricity. This puts a significant premium on reliability, being there, and resilience, snapping back after a significant shock.

There is a lot of language around resilience, which we will be annotating, as well as some expert perceptions on the effects of electric vehicles on the US grid.

This is where Oregon has unique concerns. We have earthquakes and wildfires. We have large catastrophic events, and the nuance between the reliability and resilience measures is essential. Your main essay here is on the kinds of reliability and resilience measures and methods most appropriate for Oregon.

Transportation Electrification

This is one of the more exciting areas, not just because it means gas stations will no longer be gas stations, but also because the refineries, with their huge electricity demands, and our trucking and pipeline networks that transport fuel won't be used for their original purposes.

This Module will focus less on the legacy side, what to do with our existing gasoline infrastructure, but more on the effects of transportation electrification and the inclusion of mobile batteries, i.e., EVs, on our electric grid. Yes, we will need more electricity and transmission to get the power to the EVs, but the EVs will move from place to place. Load forecasting, which we do moment-by-moment, will have to expand to forecasting transportation demand and patterns. They also have the potential to help to make our electric grid more resilient.

The WEIM, Wholesale Electricity Purchases and Shutting Down Natural Gas

The final Module should provide additional jumping-off points for term papers and include a variety of topics. I included one article law journal, which is rare in some subfields of economics. You will notice that the footnotes are as long or longer than the paper. Still, they make very sophisticated use of economic reasoning without much of the formalism you see in economics journals.

The Term Paper

I feel like I am one of the few people who like term papers. There is nothing like writing something down and finding all the flaws and holes in your logic, the data that is still missing, and all the mistakes you made while you just had the idea in your head.

Writing is a very good way of making sure you understand things.

The term paper is 10-15 pages, not including bibliography, figures, and tables, with at least 10 good references. The module sets out interim deliverables with separate due dates, and you will receive feedback at each stage.

The key is to find a topic that interests you or keeps you up at night. While you are free to choose a topic, any topic that challenges you, graduate students will have to perform some statistical analysis. This is becoming easier with the LLMs. I will have some demonstrations up later in the term.

If any students wish to explore the following topics, I would be very appreciative, but you don't need to restrict yourself to this list.

- Anything relating to the interconnection queue reform We have TW scale backlogs of renewable energy, and we can't get them connected to the grid.
- Expanding the lifecycle of EV batteries for stationary use. This is motivated by a pilot program for electric buses and figuring out how to use the batteries beyond recycling the materials.
- Residential tariffs for low-income, including the income-based tariffs now in California.
- Equity in rooftop solar and community solar participation for owners and renters.

- Labor force changes needed for Oregon off-shore wind development in coastal communities.

Policy Statements from the University

- **Generative AI:** Tools are Generally Allowed with Attribution: In this course, those students who wish to utilize Generative AI tools, such as ChatGPT, are encouraged to do so. AI tools may be employed to brainstorm assignments or projects or to refine pre-existing work. However, to uphold scholarly standards, students are required to cite any AI-generated material that contributes to their work, including in-text citations, quotations, and references. The generation of content through AI without appropriate attribution constitutes academic misconduct.
- **Academic Integrity:** Academic integrity is a vital part of the educational experience at PSU. Please see the PSU Student Code of Conduct for the university's policy on academic dishonesty. A confirmed violation of that Code in this course may result in failure of the course.
- **Incomplete Policy:** Students do not have a right to receive or demand an Incomplete grade. The option of assigning an Incomplete grade is at the discretion of the instructor when the following criteria are met. Eligibility Criteria:
 - Required satisfactory course completion/participation.
 - Reasonable justification for the request.
 - Incomplete grade is not a substitute for a poor grade.
 - Written agreement. (See Incomplete Contract)
 - Resolving the Incomplete.
- **Student Services Disability Access Statement:** If you have, or think you may have, a disability that may affect your work in this class and feel you need accommodations, contact the Disability Resource Center to schedule an appointment and initiate a conversation about reasonable accommodations. The [DRC](#) is located in 116 Smith Memorial Student Union, 503-725-4150, <https://www.pdx.edu/disability-resource-center/>.
- **Safe Campus Statement:** Portland State University desires to create a safe campus for our students. As part of that mission, PSU requires all students to take the learning module entitled Creating a Safe Campus: Preventing Gender Discrimination, Sexual Harassment, Sexual Misconduct and Sexual Assault. If you or someone you know has been harassed or assaulted, you can find the appropriate resources on PSU's Enrollment Management & Student Affairs: Sexual Prevention & Response website at <http://www.pdx.edu/sexual-assault>

- **Student Food Security:** Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact [Committee for Improving Student Food Security](#) for support. Furthermore, please notify the professor if you are comfortable in doing so. This will enable her to provide any resources that she may possess.
- **Title IX Reporting:** As an instructor, students frequently come to me for assistance in matters that are not related to the course material. Please be aware that PSU's policies require instructors to report any instance of sexual harassment, sexual and relationship violence and/or other forms of prohibited discrimination to University Officials, who keep the information private. If you would rather share information about these experiences with a PSU staff member who does not have these reporting responsibilities and can keep the information confidential, please contact one of the following campus resources.
 - Confidential Advocates: 503.894.7982, or by scheduling online (for matters regarding sexual harassment and sexual and relationship violence)
 - Center for Student Health and Counseling (SHAC): 1880 SW 6th Ave, 503.725.2800
 - Student Legal Services: 1825 SW Broadway, (SMSU) M343, 503.725.4556. For more information, please complete the required student module Understanding Sexual Misconduct and Resources in D2L. PSU Sexual Misconduct Response website gives you comprehensive information about how to support and/or report an incident. Please complete the required student module Understanding Sexual Misconduct and Resources, which provides information about PSU policy and resources.
- **Cultural Resource Centers:** The Cultural Resource Centers (CRCs) create a student-centered inclusive environment that enriches the university experience. We honor diversity, explore social justice issues, celebrate cultural traditions, and foster student identities, success, and leadership. Our centers include the Multicultural Student Center, La Casa Latina Student Center, Native American Student & Community Center, Pan African Commons, Pacific Islander, Asian, Asian American Student Center and the Middle Eastern, North African, South Asian program. We provide student leadership, employment, and volunteer opportunities; student resources such as computer labs, event, lounge and study spaces; and extensive programming. All are welcome!
- **Recording Technology Notice:** We will use technology for virtual meetings and recordings in this course. Our use of such technology is governed by FERPA, the Acceptable Use Policy and PSU's Student Code of Conduct. A record of all meetings and recordings is kept and stored by PSU, in accordance with the Acceptable Use Policy and FERPA. Your instructor will not share recordings of your class activities outside of course participants, which include your fellow students, TAs/GAs/Mentors, and any guest

faculty or community-based learning partners that we may engage with. You may not share recordings outside of this course. Doing so may result in disciplinary action.

- **Turnitin:** Students agree that by taking this course all required papers may be subject to submission for textual similarity review to Turnitin.com for the detection of plagiarism. All submitted papers will be included as source documents in the [Turnitin.com](https://turnitin.com) reference database solely for the purpose of detecting plagiarism of such papers. Use of [Turnitin.com](https://turnitin.com) page service is subject to the Usage Policy and Privacy Pledge posted on the [Turnitin.com](https://turnitin.com) site.