

**AEDE/IS 4193-9349  
Sustainable Energy  
Spring 2022**

***Time:* Tuesday and Thursday 12:45-2:05 PM**

***Room:* Kottman 116**

*Instructor*

Bruce Braine

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Phone: 614-562-7588

Office Hours: By appointment

**Required Reading Materials:**

Portions of the following documents:

Annual Energy Outlook (AEO) 2021 – US Energy Information Agency EIA;

International Energy Outlook (IEO)- 2021

The Future of Nuclear Energy in a Carbon-Constrained World: An Interdisciplinary MIT Study (2018); U.S. National Electrification Assessment Electric Power Research Institute (EPRI) (2018); Strategies and Actions for Achieving a 50% Reduction in US Greenhouse Gas Emissions by 2030 (EPRI) (2021)

Others assigned from a variety of publicly available sites including **aceee.org**, **nrel.gov**, **eia.gov**, **aceee.org** , **doe.org**

All assigned readings in the syllabus will be made available as pdfs or web site links on the Carmen site, along with specific reading assignments. **Please refer to Carmen Modules for EXACT reading assignments**

**Objectives:** At the completion of the course, the student will be able to

- Understand the concept of sustainable energy as well as the major types of sustainable energy investments available.
- Understand the economics of fossil, nuclear and renewable resources, as well as demand side management, distributed energy and investments in energy efficiency
- Understand the important role of baseload capacity such as nuclear and natural gas and what role they play in sustainability.
- Understand the impact of various subsidies, regulations and policies associated with renewable energy
- Evaluate the underlying finance/economics of various specific sustainable energy projects.

**Prerequisites:** Economics 200 or equivalent or permission of the instructor

## Course Requirements

*Homework:* There are 2 homework assignments during the term. Homework assignments will be available as on-line quizzes on Carmen. I will provide plenty of time to do the homework. (Typically, it will be available for at least a week on Carmen and you will have 1 hour to do it once you begin).

*Exams:* There will be one midterm exam, given on-line /Carmen March 8, 2022.

*Final Project:* There will be a final project (presentation style report) due at the end of the semester as well as an in-class presentation of results.

**Documented illness, death in the family, or other extreme circumstances are the only excused absences. Make-up exams will be given only in the event of excused absences.**

## Attendance

Since we are a small class, it is important that you attend to facilitate discussion. 10% of your grade will be from class participation and your regular attendance. Also, there is no textbook so lecture/discussions will provide much of the course material. This material will be critical in the final project assignment during the second half of the course. Further, mid-term questions will largely come from material covered in class.

Mid Term exam date/time is set and you must take the exam within the time window provided on Carmen. Make-up examinations will only be allowed for reasons required by the University and then only with appropriate documentation.

## Communication

Email is the best way to reach me, and I will use it to reach you.

*Final Project:* There is a final project for this class which is composed of two parts. The first part is to work to develop the material to provide an economic/financial/policy evaluation of a specific type of sustainable energy project. The report should be provided in a presentation-style format. The second part will be to present the results of your evaluation and answer questions on your findings in class. We will devote two classes at the end of the term to provide adequate time for each student to present and discuss its findings and answer questions.

### Course Grades:

Homework (2)	20%
Final Project	40%
Midterm	30%
Class Participation/Attendance	10%
Total	100%

## **Grading Scale: Satisfactory/Unsatisfactory**

S 60-100      U      <60

## **Academic Misconduct**

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's Code of Student Conduct, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's Code of Student Conduct and this syllabus may constitute "Academic Misconduct."

The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's Code of Student Conduct is never considered an "excuse" for academic misconduct, so I recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by University Rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the University's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me. The Code of Student Conduct is available at the Office of Student Affairs' web site -

[http://studentaffairs.osu.edu/info\\_for\\_students/csc.asp](http://studentaffairs.osu.edu/info_for_students/csc.asp)

## **Disability Accommodations**

The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request

that you register with Student Life Disability Services. After registration, please make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: [slds@osu.edu](mailto:slds@osu.edu); 614-292-3307; [slds.osu.edu](http://slds.osu.edu); 098 Baker Hall, 113 W. 12th Avenue.

## **Counseling and Consultation Services/Mental Health**

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life Counseling and Consultation Services (CCS) by visiting [ccs.osu.edu](http://ccs.osu.edu) or calling (614) 292- 5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on-call counselor when CCS is closed at (614) 292- 5766- and 24-hour emergency help is also available through the 24/7 National Prevention Hotline at 1-(800)-273-TALK or at [suicidepreventionlifeline.org](http://suicidepreventionlifeline.org).

David Wirt, [wirt.9@osu.edu](mailto:wirt.9@osu.edu), is the CFAES embedded mental health counselor. He is available for new consultations and to establish routine care. To schedule with David, please call 614-292-5766. Students should mention their affiliation with CFAES when setting up a phone screening.

## **Creating an environment free from harassment, discrimination, and sexual misconduct**

The Ohio State University is committed to building and maintaining a community to reflect diversity and to improve opportunities for all. All Buckeyes have the right to be free from harassment, discrimination, and sexual misconduct. Ohio State does not discriminate on the basis of age, ancestry, color, disability, ethnicity, gender, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, pregnancy (childbirth, false pregnancy, termination of pregnancy, or recovery therefrom), race, religion, sex, sexual orientation, or protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment. Members of the university community also have the right to be free from all forms of sexual misconduct: sexual harassment, sexual assault, relationship violence, stalking, and sexual exploitation.

To report harassment, discrimination, sexual misconduct, or retaliation and/or seek confidential and non-confidential resources and supportive measures, contact the Office of Institutional Equity:

1. Online reporting form at [equity.osu.edu](http://equity.osu.edu),
2. Call 614-247-5838 or TTY 614-688-8605,
3. Or Email [equity@osu.edu](mailto:equity@osu.edu)

The university is committed to stopping sexual misconduct, preventing its recurrence, eliminating any hostile environment, and remedying its discriminatory effects. All university employees have reporting responsibilities to the Office of Institutional Equity to ensure the university can take appropriate action:

- All university employees, except those exempted by legal privilege of confidentiality or expressly identified as a confidential reporter, have an obligation to report incidents of sexual assault immediately.
- The following employees have an obligation to report all other forms of sexual misconduct as soon as practicable but at most within five workdays of becoming aware of such information: 1. Any human resource professional (HRP); 2. Anyone who supervises faculty, staff, students, or volunteers; 3. Chair/director; and 4. Faculty member.

This course adheres to The Principles of Community adopted by the College of Food, Agricultural, and Environmental Sciences. These principles are located on the Carmen site for this course; and can also be found at <https://go.osu.edu/principlesofcommunity>. For additional information on Diversity, Equity, and Inclusion in CFAES, contact the CFAES Office for Diversity, Equity, and Inclusion (<https://equityandinclusion.cfaes.ohio-state.edu/>). If you have been a victim of or a witness to a bias incident, you can report it online and anonymously (if you choose) at <https://studentlife.osu.edu/bias/report-a-bias-incident.aspx>.

## Topics and readings

Jan. 11: Introduction/What is Sustainable Energy?

***Readings- AEO Narrative 2021 pp. 1-22***

Jan 13: The Electric Sector and Sustainability

***Readings- AEO 2021 Electric; AEO Chart Library pp. 22-28***

Jan 18: Levelized Cost of Electricity/In class exercise

***Readings- AEO Cost and Performance Characteristics of New Generation***

Jan. 20. Natural Gas —Efficiency and Sustainability?

***Readings- AEO Narrative pp. 23-29; AEO 2021 Natural Gas;***

*HW 1: Understanding Electric Power Economics (Due Jan.23)*

Jan. 25: Nuclear Power

***Readings – EIA Nuclear Power Outlook and Nuclear Explained Documents; MIT Future of Nuclear Energy Report—Background and Executive Summary***

Jan. 27: Renewable Energy—Background and Policy Pt.1

Feb 1: Renewable Energy Pt. 2 Wind and Solar and Role of Storage

**Readings: *HI2021 Solar Industry Update (NREL)***

Feb 3: Renewable Energy Pt. 3: Hydro, Geothermal and Biomass--Evaluating the Economics of Intermittent Renewables vs Baseload Capacity – In Class Exercises

**Readings: *EIA Geothermal Explained; Floating Wind Turbines (WSJ article)***

Feb 8: End-Use Energy Efficiency and Demand Side Management

**Readings-*ACEEE Report Appliances (2020)***

***EIA Demand Side Management Programs (Mar. 29, 2019)***

Feb 10: End Use Electricity Economics—Review and In-Class Exercises

Feb. 15: International Energy Pt. 1

**Readings: *International Energy Outlook (2021)***

Feb. 17: International Energy Pt. 2

**Readings: *International Energy Outlook (2021)***

**HW 2: Understanding End-Use Electricity Economics (Due: Feb 18)**

Feb 22: Electrification

**Readings-*US National Electrification Assessment (2018)* pp. 5-26, pp. 31-38 and Chapter 4.**

Feb. 24: Transmission and Smart Grid Investments

Mar. 1: Transportation/ Vehicles

**Readings: *US National Electrification Assessment (2018)* pp. 27-31, Chapter 4  
*AEO 2021 Chart Library Transportation* pp. 31-37**

Mar. 3: Carbon Policy/Markets; Carbon Offsets and Carbon Capture

**Readings: *EPRI Whitepaper: Strategies and Actions for Achieving a 50% Reduction in US GHG Emissions by 2030 (2021); AEO 2021 Emissions***

Mar. 4 or 6: -Carbon (cont.) / Midterm Review

Mar. 8: **Midterm Exam – March 8 – ON LINE/CARMEN**

Mar. 10 NO CLASS

**SPRING BREAK March 14-18**

Mar. 20 Introduction of Final Project Topics; Project Selection; Guidelines

Mar. 22: No class

Mar. 24: Zoom class on final project (as needed/scheduled by students)

Mar. 29: Zoom Class on final project (as needed by students)

Mar. 31: Developing a Presentation-Style Report—Writing Dos and Don'ts

April 5: Oral Presentation Tips/In Class Time for report

April 7: No Class—final project work

**April 12: Guest Speaker TBD**

April 14: **Summary of Class**

*Final Report Due: April 19<sup>th</sup> by Start of Class*

April 19: In Class Presentations and Q&A.

April 21: In Class Presentations/ Final Thoughts