

# PHY 405: Energy & Sustainability (Fall 2021, CRN 98244)

Instructor: Dr. Eric Edlund

SUNY Cortland, Physics Department

“Humankind is challenged, as it has never been challenged before, to prove its maturity and its mastery – not of nature, but of itself.” - Rachel Carson (1962)

## Course Meeting Times & Location

MWF            2:50 PM – 3:40 PM  
Location        Bowers 1113

## Contact Info

Email: eric.edlund@cortland.edu  
Phone: 753-5697  
Office: Bowers 133

Preferred contact method is email or text communication.

## Standing Office Hours

Monday        4:00 PM – 5:00 PM  
Wednesday    9:00 AM – 10:00 AM  
Thursday      1:00 PM – 4:00 PM

## **Or by appointment:**

If you are unable to attend these standing office hours or would like to speak privately about a specific matter, you are welcome and encouraged to make an appointment.

I can also hold office hours virtually through Microsoft Teams.

## Course catalog description

Study of the environmental and social impacts of energy production and consumption and the options for meeting society’s needs for energy services through sustainable technologies and practices.

## Other course attributes

This is a shared resource course (joint undergraduate & graduate) with PHY 505.

## Course student learning outcomes

Upon successful completion of this course, the student will:

1. analyze the scale of energy use in relation to world population, standard of living, and accessible energy sources;
2. understand the relationships between industrialization and power & energy requirements;
3. interpret power infrastructure and power demand in relation to various power sources;
4. critique the pros and cons of various energy sources including coal, natural gas, nuclear, hydro, wind, and solar;
5. describe the connection between energy sources, government policy, and energy markets;
6. and critically analyze sustainable technologies and practices.

## Required personal resources for this course

- *The Physics of Energy* by Jaffe and Taylor, ISBN 9781107016651
- Access to a computer for communications through Microsoft Teams and for conducting research.

### My goals for this course

Physics 405 will be more of a discussion and survey course, though that does not mean that it will be devoid of technical analysis. Decisions regarding energy, especially at the global level, are incredibly complex. I do not expect that we will come close to resolving these issues, but we will try to make sense of a few things. Towards those ends I expect that you will:

- think critically about energy issues, which means that you will not accept at face value the status quo or the concept of alternative energy without critical analysis;
- engage with the readings in this course so that you can argue and debate the instructor and other students on matters of physics, engineering, policy, and markets;
- defend your claims through calculations;
- develop a sense of the pros and cons of each kind of energy source;
- refine your understanding of the relationship between energy reserves, energy utilization, and power;
- come to an understanding of what sustainability means in the global sense and in relation to modern standards of living;
- and enjoy your experience and in the process find renewed passion for your studies.

### What you will need to do to be successful in this course

Given that this course is very interdisciplinary in its focus, bringing in aspects of governmental policy and economic markets, the skills required to be successful in this course may be different from in your other physics courses. Toward those ends, this course will emphasize written and oral argumentation supported by quantitative analysis. I want you to think of yourself as a politician arguing for a right course of action in the broader context of energy-related issues. To be successful toward these ends you will need to:

- apply your knowledge of physics and engineering to calculations;
- build your knowledge base, starting from your intuition about physical systems, through readings from the textbook and outside sources;
- bring your insights to class and be willing to argue a perspective;
- and embrace communication of your findings as the central goal of your work where you prove both your understanding through written and oral communication.

### Online meeting and coordination

We will use Microsoft Teams for all of our class organization activities, including online lectures (if needed), grades, and regular text communications. Please use access code **6ktg3bn** to join the team for this class, called **PHY 405/505 - Fall 2021**.

**Note:** Please do not use the browser-based app for MS Teams and download the desktop app which is far more stable.

**How this class will operate if we are required to online:** Should we move to an online phase then we will adapt this course by using Microsoft Teams to host our lectures and discussions, which will be held synchronously at the scheduled time. In such a scenario it may be necessary to adjust the organization of this course, including changes to assessment categories and weighting of categories/assignments.

Important dates

Monday 8/30	First day of classes
Friday 9/3	End of the add/drop period
Monday 10/11	Midterm exam
Friday 12/3	Last day of class, project reports due
Tuesday 12/7	Final Exam, 1:30 PM – 3:30 PM

Assessment weighting

Problem Sets	30%
Critical analyses	15%
Midterm exam	15%
Final exam	15%
Group project	15%
Weekly questions	10%

Number of assignments in each assessment category

6 problem sets, 5% each  
3 critical analyses, 5% each  
the midterm exam will review physical concepts  
the final exam will be comprehensive  
the final report will be the assessed product of this effort  
ongoing log – will be graded at the end of the term

Score-grade equivalence table

	76.7% ≤ C+ ≤ 79.9%	E ≤ 59.9%
93.4% ≤ A	73.4% ≤ C ≤ 76.7%	
90.0% ≤ A- ≤ 93.3%	70.0% ≤ C- ≤ 73.3%	
86.7% ≤ B+ ≤ 89.9%	66.7% ≤ D+ ≤ 69.9%	
83.4% ≤ B ≤ 86.6%	63.4% ≤ D ≤ 66.6%	
80.0% ≤ B- ≤ 83.3%	60.0% ≤ D- ≤ 63.3%	

**Note:** Completion of the group project and the associated report is a mandatory component of this course. Failure to complete this assessment component will result in an automatic failure of the course.

Course policies and explanation of assessment categories

Note that these policies, including the types of assessment used and weighting of assessment areas, are subject to change if the circumstances regarding the operation of this course changes due to factors outside my control.

**Public health:** This class will be taught in person. This means that you must abide by all state, local, and College policies regarding social distancing, precautionary measures (such as masking), and vaccination. Failure to abide by these policies will result in a warning on the first offense, followed by a request to remove yourself from the class on the second offense, and academic misconduct violation on subsequent offenses.

**Attendance:** Attendance is mandatory as we will use class time to discuss material, work problems, and debate with each other. Each unexcused absence will result in a penalty of 1% to your overall course score.

**Homework:** Our primary source for problem sets will be Jaffe and Taylor's *The Physics of Energy*. You will have six problem sets over the course of the semester. While you are free to collaborate, all submitted work must be your own. That means no copying or otherwise directly using another student's work, no use of solution manuals or posted solutions from any outside source, and no use of internet resources like Chegg. If you are stuck, you should ask questions! I may not be able to answer all questions in lecture given other material that needs to be covered, so you are encouraged to continue our conversations in office hours or in the chat in our class team.

**Critical analyses:** There will be three additional homework assignments that are of more of a combined quantitative and argumentative analysis. These assignments will be more interdisciplinary in nature and will require you to read or watch additional resources and comment on them.

**Weekly questions:** You will each keep an ongoing log of questions that arise in response to your reading assignments. For each reading assignment, you are expected to identify 3 things that you do not understand or are curious about. In order to receive credit for these questions, they must be (1) submitted at least one hour prior to start of lecture each at the start of each week (2) be specific and state what it is that you know and don't know, and (3) provide a guess as to the answer or how you will find the information to answer each question. These questions will be stored in an ongoing log that is accessible to all students in the class.

**Midterm exam:** The midterm exam will review foundational concepts in physics and engineering and ideas central to this course, such as climate and energy usage. This will include core content covered in PHY 201, 202, and 203. Areas of primary importance here are force, energy, power, and thermodynamics, as well as matters pertaining to climate and general energy usage.

**Final exam:** The final exam will be comprehensive, but will focus primarily on the content of Module 2.

**Group project:** We will conduct a group project over the course of the term will examine in greater detail a matter of either local or global concern. The class will work collectively on the report, but each person will be individually responsible for a section. Your grade for the project will be based on the quality of your individual contribution to the report. Details will be provided in a separate document.

**Extra credit:** You can earn extra credit by providing detailed answers to your peers' weekly reading questions. You can post each answer to the questions log (with your name clearly stated). Your answer must provide a clear and full explanation, as well as a citation to a source that backs up your answer. For each correct answer you provide you will receive 0.2% to your final grade, up to a max of 5% (equivalent to 25 correct answers).

**Late work policy:** You will have plenty of time to complete each assignment. Late work will incur a 10% penalty per day and will not be accepted more than a week late.

## Course Schedule

This is a tentative schedule and is subject to change as necessary. Any changes to the schedule or topics will be shared with the class through Teams.

	Week	Date		Topic	Ch.	P-Set	Critical analysis	
Module 1	1	8/30	to	9/3	Earth's historical climate	35	-	-
	2	9/6	to	9/10	Energy and climate	34	-	-
	3	9/13	to	9/17	Energy, efficiency, and exergy	36	-	-
	4	9/20	to	9/24	Review of introductory physics	1-3	#1	#1
	5	9/27	to	10/1	Fundamentals of thermodynamics	5,6,8,9	-	-
	6	10/4	to	10/8	Thermodynamic processes	10-11	#2	-
	7	10/11	to	10/15	<b>Midterm</b> Engines	12-13	-	-
Module 2	8	10/18	to	10/22	Transmission & storage	37-38	#3	-
	9	10/25	to	10/29	Fossil fuel sources	33	-	-
	10	11/1	to	11/5	Nuclear energy	16-19	#4	#2
	11	11/8	to	11/12	Hydro & geothermal energy	31-32	-	-
	12	11/15	to	11/19	Solar energy	25	#5	-
Module 3	13	11/22	to	11/26	Wind energy	28,30	-	-
	14	11/29	to	12/3	Economic markets	-	#6	#3
	15	12/6	to	12/10	Government policy	-	-	-
	16	12/13	to	12/17	<b>Final Exam</b> on Dec. 14, 1:30 PM			

Holidays and school breaks:

Labor Day                      Monday, September 6  
 Fall Break                      Monday to Tuesday, October 18-19  
 Thanksgiving                Wednesday to Friday, November 24-26

The dates indicated for the problem sets and the analysis notes (the last two columns) are the due dates, which will be Friday afternoon at the start of class on the indicated week.

## SUNY Cortland Policies and Statements

**Academic Integrity Statement:** All students are expected to uphold academic integrity standards. Plagiarism is defined as taking the ideas of others and using them as one's own without due credit. Students who cheat in examinations, course assignments, or plagiarize in this course may be disciplined in accordance with university rules and regulations. SUNY Cortland College Handbook, Chapter 340.

**Disability Statement:** As part of SUNY Cortland's commitment to a diverse, equitable, and inclusive environment, we strive to provide students with equal access to all courses. If you believe you will require accommodations in this course, please place a request with the Disability Resources Office at [disability.resources@cortland.edu](mailto:disability.resources@cortland.edu) or call 607-753-2967. Please note that accommodations are generally not provided retroactively so timely contact with the Disability Resources Office is important. All students should consider meeting with their course instructor who may be helpful in other ways. SUNY Cortland College Handbook, Chapter 745.

**Diversity Statement:** SUNY Cortland is dedicated to the premise that every individual is important in a unique way and contributes to the overall quality of the institution. We define diversity broadly to include all aspects of human difference. The College is committed to inclusion, equity, and access and thus committed to creating and sustaining a climate that is equitable, respectful and free from prejudice for students, faculty and staff. We value diversity in the learning environment and know that it enhances our ability to inspire students to learn, lead and serve in a changing world. We are committed to promoting a diverse and inclusive campus through the recruitment and retention of faculty, staff and students. As a community, we hold important the democracy of ideas, tempered by a commitment to free speech and the standards of inquiry and debate. To this end, we are dedicated to developing and sustaining a learning environment where it is safe to explore our differences and celebrate the richness inherent in our pluralistic society. SUNY Cortland College Handbook, Chapter 130.

**Inclusive Learning Environment Statement:** SUNY Cortland is committed to a diverse, equitable and inclusive environment. The course instructor honors this commitment and respects and values differences. All students enrolled in this course are expected to be considerate of others, promote a collaborative and supportive educational environment, and demonstrate respect for individuals with regard to ability or disability, age, ethnicity, gender, gender identity/expression, race, religion, sex, sexual orientation, socio-economic status or other aspects of identity. In an environment that fosters inclusion, students have the opportunity to bring their various identities into conversation as they find helpful, but are not expected to represent or speak for an entire group of people who share aspects of an identity. If you have any questions or concerns about this statement, contact the Institutional Equity and Inclusion Office at 607-753-2263. <http://www2.cortland.edu/about/diversity/>

**Title IX Statement:** Title IX, when combined with New York Human Rights Law and the New York Education Law 129-B, prohibits discrimination, harassment and violence based on sex, gender, gender identity/expression, and/or sexual orientation in the education setting. The federal Clery Act and NY Education Law 129-B provide certain rights and responsibilities after an incident of sexual or interpersonal violence. When a violation occurs, victims and survivors are eligible for campus and community resources. Where the College has jurisdiction, it may investigate and take action in accordance with College policy. If you or someone you know wishes to report discrimination based in sex, gender, gender identity/expression, and/or sexual orientation, or wishes to report sexual harassment, sexual violence, stalking or relationship violence, please contact the Title IX Coordinator at 607-753-4550, or visit <http://www2.cortland.edu/titleix> to learn about all reporting options and resources.

Updated by SUNY Legal on February 1, 2018.