

ENG PHYS 3ES3
Introduction to Energy Systems
Fall 2023
Course Outline

CALENDAR/COURSE DESCRIPTION

A survey course on energy systems with emphasis on the analytic tools needed to evaluate them in terms of performance, resources and environmental sustainability, costs, and other relevant factors over their life cycles.

We will examine the science, technology and human factors that interact in energy systems. Energy technologies (including resources, production, consumption, conversion, storage and transportation) will be analyzed in a global context including their societal and environmental impacts. Issues related to long term sustainability and sustainable development will be evaluated for current and proposed energy systems. The environmental impact of energy technologies, with an emphasis on climate change, will be examined. Innovations in energy technologies and systems will also be discussed.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): Registration in level III or above of an Engineering program or permission of the Instructor.

Antirequisite(s): MECH ENG 4004 and CHEM ENG 4A03

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Zobia Jawed

jawedz@mcmaster.ca

Office Hours:

Every Tuesday and Wednesday before & after Class

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

TA Name

- | | |
|---|---|
| 1 | Clayton Vrenjak, vrenjakc@mcmaster.ca |
| 2 | Jieci Yang, yangj217@mcmaster.ca |
| 3 | Brenda Cruz Razgado, cruzrazb@mcmaster.ca |

Office hours, every other Friday during class timings (12:30-1:20 PM), see the assessment section!

CLASS SCHEDULE

Tuesday, Wednesday, Friday- 12.30-13.20 PM

Tuesday, Wednesday (Lecture Days); Friday (Quizzes, Reflections and Meet your TA)

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

<http://engphys.mcmaster.ca/undergrad-studies/ug-courses/eng-phys-3es3/>

<http://avenue.mcmaster.ca/>

COURSE OBJECTIVES

By the end of this course, students should be able to:

1. Gain a comprehensive understanding of energy systems and the science, technology, and human factors that drive them, along with the concept of a net carbon zero vision.
2. Acquire in-depth knowledge about various energy resources, including fossil fuels, nuclear energy, renewable sources, and waste-to-energy systems.
3. Understand the technological underpinnings and physical principles behind key energy technologies such as solar panels, wind turbines, and hydroelectric dams.
4. Analyze the processes of energy production and consumption across various sectors including buildings, transportation, industry, and agriculture.
5. Understand the role of energy policies and regulations in shaping the energy landscape, with a focus on strategies toward sustainability.
6. Understand the design and implementation of energy storage and distribution systems, including batteries, hydrogen fuel cells, pipelines, and the electric grid.
7. Develop the ability to evaluate international trends and metrics in the energy sector through global data exploration.
8. Develop the ability to evaluate and recommend future energy sources, considering their potential to contribute to sustainability.
9. Understand the path towards sustainability, including the concepts of sustainable development, long-term viability of energy systems, and the importance of sustainable planning.
10. Recognize the link between energy systems and climate change and understand the implications of this relationship for energy policy and planning.
11. Apply the knowledge and skills gained in the course to a practical project, designing a community energy system with the goal of achieving net carbon zero.

This course is sustainability-focused based on the AASHE (www.aashe.org) standards for sustainability.

This course is on the [Course List](#) for the [Interdisciplinary Minor in Sustainability](#).

MATERIALS AND FEES

Required Texts: None.

Other required or recommended resources used during the course will be posted on Avenue to Learn.

Calculator: Only the **McMaster Standard Calculator** will be permitted in tests and examinations. This is available at the Campus Store.

Other Materials: None.

COURSE OVERVIEW

| Module | Lecture Topics (Tuesday and Wednesday Session) |
|--------|--|
| 1 | Introduction to Energy Systems and the Net Carbon Zero Vision: An Exploration of the Science, Technology, Human Factors, and the Role of the Energy Sector in Achieving a Net Carbon Zero Vision |
| 2 | Comprehensive Overview of Energy Resources: Examination of Fossil Fuels, Nuclear Energy, Renewable Sources |
| 3 | Energy from Waste: Exploring the Potential of District Energy, Wastewater to Energy, and Waste to Energy Systems |
| 4 | Technological Breakdown and Understanding Physics of Energy Technologies: Detailed Study of the Mechanisms and Physics Behind Solar Panels, Wind Turbines, Hydroelectric Dams, and Other Key Energy Technologies |
| 5 | Unveiling Energy Production and Consumption: An Overview of Energy Use in Buildings, Transportation, Industry, and Agriculture |
| 6 | Energy Policies and Regulations: Navigating the Intersection of Energy and Policy, with a Special Focus on Strategies Toward Sustainability |
| 7 | Energy Storage and Distribution: Understanding the Design and Implementation of Batteries, Hydrogen Fuel Cells, Pipelines, and the Electric Grid |
| 8 | Global Data Exploration in the Energy Sector: Analyzing International Trends and Metrics |
| 9 | Evaluating Energy Alternatives: Comprehensive Comparison and Recommendations for Future Energy Sources, with Consideration of Their Potential to Contribute to Sustainability |
| 10 | The Path Towards Sustainability: Investigating Sustainable Development, Long-term Viability of Energy Systems, and the Importance of Sustainable Planning |
| 11 | The Climate Change Connection: Assessing the Link between Energy Systems and Climate Change |
| 12 | Practical Project: Re-designing a Community Towards Net Carbon Zero with a Focus on Energy Systems |
| 13 | Practical Project: Re-designing a Community Towards Net Carbon Zero with a Focus on Energy Systems |
| 14 | Review and Final Exam: Consolidation of Learning and Assessment of Knowledge Gained Throughout the Course |

At certain points in the course it may make good sense to modify the schedule outlined above. The instructor reserves the right to modify elements of the course and will notify students accordingly, both in class and on Avenue to Learn. Posted changes take precedence over this course outline.

ASSESSMENT

| Due Date | Topic |
|--|--|
| Friday Session (Quizzes and Reflections-Pair/Share)- All these activities start at 12:30 PM and due at 1:20 PM | |
| Quiz 1 and Initial Reflection: September 8 and Meet your TA day | |
| Reflection 1: September 15 and Meet your TA day | |
| Quiz 2: September 22 | |
| Reflection 2: September 29 and Meet your TA day | |
| Quiz 3: October 6 | |
| Reflection 3: October 13 and Meet your TA day | Quizzes (Individual) |
| Quiz 4: October 20 | Reflections (Pair and Share) |
| Reflection 4: October 27 and Meet your TA day | |
| Quiz 5: November 3 | |
| Reflection 5: November 10 and Meet your TA day | |
| Quiz 6: November 17 | |
| Reflection 6: November 24 and Meet your TA day | |
| Note: Use of any AI-based software to write reflections or any kind of plagiarism will result in a 0. See note below ** | |
| September 20 (Due: 11:59 PM) | Assignment 1 (Individual) |
| October 18 (Due: 11:59 PM) | Assignment 2 (Individual) |
| November 8 (Due: 11:59 PM) | Assignment 3 (Individual) |
| November 22 (Due: 11:59 PM) | Assignment 4 (Individual) |
| Presentation dates: November 28, November 29, December 1, December 5, December 6 (during class) | Major Project Presentations (In-Class) and |
| Reports due date: All Reports due on December 5 (Due: 11:59 PM) | Report (Group Work) |
| During the Exam Period (TBD) | Final Exam |

**** Guidelines on AI Use for Assignments:** Please refrain from utilizing ChatGPT or any other AI platform for your class reflections and other assignments unless explicitly directed to do so by the course instructions. Unauthorized use of AI tools may result in a deduction of marks, and in severe cases, a score of zero for the assignment in question if such usage is identified. It's important to adhere to these guidelines to maintain the academic integrity and fairness of the assessment process.

Quizzes/Reflections: In every Friday class, your participation involves either completing an online quiz via A2L or preparing a reflection based on the weekly assigned readings. These reflections can be shared in pairs, emphasizing the importance of regular class attendance. Please note that no extensions or late submissions are permitted for this course component, and completion is expected within the 50-minute class duration. This activity not only serves as

an opportunity for assessment but also encourages you to delve deeper into the subject matter, explore diverse topics, and stay informed through relevant news articles. Additionally, our Friday sessions provide a valuable chance to connect with your Teaching Assistant, should you have any grading inquiries or concerns to discuss. Please be aware that **no MSAF requests** will be accommodated for any missed quizzes/reflections.

Assignments: Completion of **all four** assignments is mandatory, as they will factor into your final grade. Submitting your assignments via Avenue to Learn is crucial. These assignments also offer you the chance to deepen your comprehension of the subject matter, engage in research across various topics, and incorporate relevant news articles to enrich your learning experience. Please be aware that **no MSAF requests** will be accommodated for missed assignments. It is essential to note that using any AI-based software to enhance your assignments or any signs of plagiarism will result in a score of 0. These assignments serve as opportunities to expand your knowledge both broadly and deeply in this field while ensuring academic integrity.

Major Project (Group Work): Prepare for an exciting engineering mission where you'll lead teams in an ambitious effort to transform a community into a carbon-neutral powerhouse, with a strong focus on revolutionizing energy systems. Your role as energy detectives begins with a thorough analysis of the community's energy landscape, from sources to emissions, using your engineering expertise. Utilizing innovative solutions and renewable energy, you'll engineer a greener future for energy systems. Additionally, you'll tackle sustainable transportation improvements, envisioning efficient bike lanes, robust public transit, and the adoption of electric vehicles, all intricately linked to energy systems. As engineering champions, you'll craft strategies to engage the community and boost awareness (i.e., energy efficiency). Utilize your engineering skills for cost analysis, savings projections, and metric development, including energy consumption and emissions tracking. This isn't just a project; it's your chance to engineer a sustainable community for generations to come with revolutionizing energy systems.

| Component | Weight | Notes |
|--|--------|--|
| Assignments (4) (Individual) | 20% | No extensions, No MSAF |
| Quizzes (Individual) and Reflections (Pair/Share) | 25% | No extensions, No MSAF |
| Major Report and Presentation (Group) | 30% | -5%/day late |
| Class Participation (Attendance/Participation- Individual) | 5% | |
| Final Exam (Individual) | 20% | Cumulative: covering lectures, readings, and assignments |
| Total | 100% | |

Regular attendance at lectures and active participation in classroom discussions is expected for class participation.

ACCREDITATION LEARNING OUTCOMES

The Learning Outcomes defined in this section are measured for Accreditation purposes only, and will not be directly taken into consideration in determining a student's actual grade in the course.

| Outcomes | Indicators |
|---|------------|
| 1. Can demonstrate an ability to identify and quantify the full range of short-term, long-term, local and global impacts of their engineering projects on society, including: economic aspects; social, cultural, and human health aspects, and; ecosystem integrity aspects. | 9.1 |
| 2. Can demonstrate an ability to identify the interaction between engineering and society, and to address uncertainties in predictions in a structured and transparent manner. | 9.2 |
| 3. Can demonstrate an ability to assess the options from a sustainability engineering perspective, which emphasizes environmental stewardship and long-term decision-making. | 9.3 |

For more information on Accreditation, please visit: <https://www.engineerscanada.ca>

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at <http://www.mcmaster.ca/academicintegrity>

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.

ACADEMIC ACCOMMODATIONS

Students who require academic accommodation must contact Student accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contact by phone at 905.525.9140 ext. 28652 or e-mail at sas@mcmaster.ca. For further information, consult McMaster University's Policy for [Academic Accommodation of Students with Disabilities](#).

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the Religious, Indigenous and Spiritual Observances (RISO) policy. Students requiring a RISO accommodation should submit their request to their Faculty Office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students

should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests. You can find all paperwork needed [here](#).

NOTIFICATION OF STUDENT ABSENCE AND SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

1. The [McMaster Student Absence Form](#) is a self-reporting tool for Undergraduate Students to report absences DUE TO MINOR MEDICAL SITUATIONS that last up to 3 days and provides the ability to request accommodation for any missed academic work. Please note, this tool cannot be used during any final examination period.
2. You may submit a maximum of 1 Academic Work Missed request per term. It is YOUR responsibility to follow up with your Instructor immediately (NORMALLY WITHIN TWO WORKING DAYS) regarding the nature of the accommodation. Relief for missed academic work is not guaranteed.
3. If you are absent for reasons other than medical reasons, for more than 3 days, or exceed 1 request per term you MUST visit the Associate Dean's Office (JHE-H301 (Hatch Building)). You may be required to provide supporting documentation.
4. This form must be submitted during the period of absence or the following day, and is only valid for academic work missed during this period of absence.
5. It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work in his/her course.
6. You should expect to have academic commitments Monday through Friday but not on Saturday, Sunday or statutory holidays.

NOTICE REGARDING POSSIBLE COURSE MODIFICATION

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

TURNITIN.COM STATEMENT

In this course we will be using a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. Students will be expected to submit their work electronically via Avenue to Learn (A2L) plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish to submit their work through A2L must still submit an electronic and/or hardcopy to the instructor. No penalty will be assigned to a student who does not submit work to A2L. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). To see the Turnitin.com Policy, please go to www.mcmaster.ca/academicintegrity.

ON-LINE STATEMENT FOR COURSES REQUIRING ONLINE ACCESS OR WORK

In this course, we will be using Avenue to Learn. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.