



GES 441

Analysis of Sustainable Energy Solutions

Spring 2025

Traditional energy technologies rely on non-renewable resources and negatively impact the environment through air and water emissions, solid waste, and landscape degradation. Greenhouse gas emissions from the energy sector are a key contributor to climate change. Interest in sustainable energy solutions that can meet our current and future energy needs is accelerating. Fully evaluating the sustainability of a given solution requires us to consider environmental impacts across its entire life cycle. To gain widespread acceptance, these solutions must also be economically viable. Public policy can be used to encourage sustainable technologies and discourage unsustainable ones. Energy justice endeavors to ensure that the benefits and burdens of our energy systems are distributed equally.

This course will introduce Life Cycle Assessment (LCA) as a holistic approach to provide a comprehensive view of the environmental impacts of energy solutions. Techno-Economic Analysis (TEA) tools will be used to evaluate the economic viability of different energy technologies and systems. Another important performance metric is the energy that must be expended to acquire, refine, and produce energy resources, known as Energy Return on Investment (EROI). The role of political ecology to advance sustainable solutions and promote energy justice will be examined.

Time: Tuesdays and Thursdays, 9:30-10:45 AM

Class Format: In-person instruction

Location: 104 Eddy

Instructors

Mr. Christopher Lute, Research Associate, Energy Institute

chris.lute@colostate.edu

Mr. Lute's Office Hours

Tuesday 1-2pm, Wednesday 10-11am

328 Powerhouse

430 N. College Ave.

Google Meet:

<https://meet.google.com/mvh-mryo-vxg>

Microsoft Teams:

https://teams.microsoft.com/l/meetup-join/19%3ameeting_NzgwMjBjNDgtMTgyNi00ZjRhLWJmYzMtOTRkNzRjOGM1MjNk%40thread.v2/0?context=%7b%22Tid%22%3a%22afb58802-ff7a-4bb1-ab21-367ff2ecfc8b%22%2c%22Oid%22%3a%224ab04b84-7404-45e1-a7f6-f8e965f9c353%22%7d

Course Objectives

Upon completion of this course, you should:

- Have a working knowledge of the principles of LCA and a basic familiarity with some of the tools and data sources used to conduct LCA
- Understand key metrics used in TEA and how to calculate them
- Be able to define EROI and use it to assess the viability of energy technologies
- Be familiar with political ecology as it relates to sustainable energy and energy justice

Text

M.Z. Hauschild, R.K. Rosenbaum, and S.I. Olsen, *Life Cycle Assessment: Theory and Practice*, 2018.

Free electronic version available at: <https://www.dbooks.org/life-cycle-assessment-3319564757/>

Physical version is available for purchase for \$170 at:

<https://link.springer.com/book/10.1007/978-3-319-56475-3>

Exams

There will not be a midterm or final exam as part of this course. Instead, students will conduct individual semester-long projects on topics related to sustainable energy solutions. These will be broken into smaller graded portions that will be due over the course of the semester.

Course Grading

Traditional letter grades will be assigned based on the following criteria.

Assignments and quizzes: 40%

Class participation: 10%

Semester project: 50% (broken down as follows)

Goal and scope document: 20%

Final oral presentation: 10%

Final written report: 20%

Students should expect that letter grades will be assigned on a traditional basis (A is >90%, B is 80-89%, C is 70-79%, etc.).

Attendance

Attendance is strongly encouraged. Class participation will be worth 10% of your total grade. Instructors reserve the right to give graded assignments during time. If you are unable to attend class due to illness or other circumstances, please reach out to the instructors using Canvas or via email prior to class time to let us know you'll be absent.

Grading Errors

Students have 10 days to respond to grading discrepancies or challenge potential errors in grading. If you believe that there was an error in grading any of your assignments, please let one of the instructors know as soon as possible. Grades will not be changed later than 10 days after graded assignments have been returned.

Expectations

You are expected you to take an active role in learning by:

- Coming prepared to class sessions
- Attending classes and participating
- Completing all assignments
- Checking graded assignments and exams to learn from any prior mistakes
- Attend office hours to ask questions as needed

The instructors will provide class sessions that facilitate learning the material and will be available during office hours to answer questions. The instructors also expect that in-class discussions will be held in a respectful, thoughtful manner. When one person is speaking, the rest of the class members should listen and not interrupt, and the speaker should make his/her remarks concisely. Responses should be made to the facts or ideas presented; personal attacks will not be tolerated.

Homework policies

There will usually be weekly homework assignments in the form of readings, short quizzes, or online discussions. For individual assignments, you may discuss the questions/tasks with others, but copying is not allowed. Assignments, quizzes, and exams are due at their specified due date and time listed on the GES 441 Canvas site. Late homework will be penalized 10% per day.

Zero tolerance for academic dishonesty

There is a zero tolerance policy in this class for violations of university academic integrity policies. The course will adhere to the Colorado State University Student Conduct Code (<http://www.conflictresolution.colostate.edu/conduct-code>) and Academic Integrity Policy (<http://catalog.colostate.edu/general-catalog/policies/students-responsibilities/>) of the General Catalog. In addition to violations such as plagiarism and classroom cheating, use of unauthorized materials constitutes academic dishonesty. For this course, materials authorized for use on homework assignments and studying for exams are the course textbook, lecture

notes, and content available on GES 441 Canvas site. All other materials are unauthorized unless express written permission is granted by the instructor.