

Critical Perspectives on Sustainable Design

MAS.S73, IAP 2023

3 Credits, listeners accepted
1/10/23 - 1/26/23
Tu/Th 1pm - 5pm
E15-359

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I. What is this course?

Course Description

Is oat milk more environmentally friendly than almond milk? How many times do I need to reuse a grocery bag to offset its production energy? How long does a solar panel have to last to justify its production? These questions don't have simple answers, and the background and skill set of those investigating them can lead to very different conclusions. However, through their rigorous analysis, these questions can lead us to new insights into the nature of the climate crisis and how we might mitigate its impact.

The climate crisis represents an existential threat to humanity, and therefore is a key consideration across many fields of study. While the benefits of this widespread focus include an accelerated pace of discovery and innovation, it can also lead to challenges with different disciplines and communities approaching issues of environmental sustainability with goals that do not align. Understanding these varied perspectives on what environmental sustainability means and how we can work to achieve it is key to unifying our efforts in mitigating the impacts of climate change.

In this course, students will learn to analyze claims of sustainability in existing products and systems and judge whether these designs truly mitigate environmental harm. The first half of the course will focus on the analysis of existing designs, while in the second half students will iterate and refine their own proposals for sustainably designed products and systems. Examining the environmental, political, and social implications of their proposals, they will justify their approaches with current data and methods and demonstrate how their design ultimately benefits the world.

Objectives

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

1. *Summarize* current research and academic consensus on the nature of environmental, social, and economic sustainability.
2. *Critically evaluate* current approaches to the assessment of system sustainability such as LEED, LCA, or Emergy evaluation.
3. *Propose* appropriate justifications and metrics for assessing the sustainability of a given system.
4. *Analyze* and illustrate the system-level interactions that designs have with the non-human environment.
5. *Quantify* the environmental impacts of a design in terms of metrics that relate to environmental sustainability.
6. *Examine* arguments for and against the implementation of sustainable designs and practices, weighing the evidence that supports each side.
7. *Evaluate* whether a given design (product, system, or technology) can be considered sustainable.
8. *Propose* their own sustainable designs for products, systems, or technologies and justify how they benefit the environment.

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Prerequisites

This course is intended to bring in students from a diverse range of backgrounds and disciplines, and so there is no strict set of prerequisites for the class. Students who excel in this class will be passionate about environmental, political, social and economic sustainability in their lives and work.

If you are interested in enrolling in the class, please fill out the poll [here](#) so that the instructor can get a sense of the class's background and interests.

II. What to expect

Class Structure

Each 3 hour class will be divided into three parts:

- 1. Lecture:** Lectures will introduce core concepts of sustainability, systems thinking, and case studies as well as provide examples of applying technical skills. Students can expect to participate in various activities during lectures that will assist with learning and applying concepts from the material.
- 2. Discussion:** This course applies a specific focus to understanding sustainability as a complex and nuanced idea where answers are rarely simple. In-class discussions provide students with an opportunity to propose hypotheses, give and receive feedback in real-time, and learn from each other's unique perspectives. Students are encouraged to actively participate in discussions and to both seek and provide constructive feedback.
- 3. Studio:** The studio component of the course gives students a space to actively work on applying material from the class to their own course projects in an environment where they can receive real time feedback from both the instructor and their peers.

Lectures and discussions will directly relate to readings that are to be completed prior to each class. Students should expect to spend at least an hour reading journal articles, case studies, and reports from various fields and disciplines prior to each class. As the focus of this class is on interdisciplinary work, students will be challenged to interpret work that may use unfamiliar vocabulary and methods.

Office Hours

Open office hours will be held via Zoom at the link below from 4pm to 5pm on Monday and Wednesday each week: <https://mit.zoom.us/j/9986710514>

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Assessment and Evaluation

Course Project (80%): Students will select a design (product, system, policy or process) that makes claims of sustainability and analyze whether these claims can be justified. This analysis will be iterated upon throughout the course and will culminate in a 15 minute presentation to the class and a review board of experts from across disciplines. The course project will provide an opportunity to apply the concepts and methods from readings, lectures, and discussions to a topic chosen by the student. Several assessments will be applied in reference to this core project including:

1. Project Proposal (10%): Students will submit a one-page written document describing the design that they have chosen to analyze. The document should outline what claims of sustainability are being made and what justifications are provided.

2. Mid-Term Presentation (15%): Students will present their selected design to the class in a 10 minute presentation with a format of their choosing. The presentation should include an overview of the selected design and its claims of sustainability as well as their intended process for analyzing these claims.

Final Presentation (15%): Students will have 15 minutes to present their analysis of their selected design in a format of their choosing to the class and a review board of interdisciplinary experts. The presentation will be followed by 10 minutes of Q&A from the reviewers and audience. Presented material is expected to take a stance on whether the analyzed design can be considered sustainable and to provide evidence to justify any claims.

3. Analysis Portfolio (40%): Following the final presentation, students will incorporate feedback from the reviewers, instructor, and class and compile a final document outlining their claims in the format of their choosing. The compiled document can consist of a mix of written materials, figures and illustrations, or any other media that the student chooses. Portfolios are intended to convey the findings of the project to a lay-person audience.

Attendance and Participation (20%): Students are expected to attend all lectures and discussions. Participation will be evaluated according to whether students demonstrate application of course objectives 1 & 4 (analyzing and evaluating claims of sustainability) through the provision of constructive feedback to their peers and the analysis of in-class case studies.

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Course Expectations and Policies

Attendance: Attendance to all lectures and discussions is a crucial component of the class. Hybrid attendance options may be provided upon request. Studio attendance is strongly encouraged so as to provide you with an opportunity for real time feedback on your course projects, but students may work independently as suits their needs.

Class participation: Giving and receiving constructive feedback is a core to this class, and so active participation in discussions and Q&A is expected for all students. Please refer to the guidelines for discussion for an outline of expectations during in-class discussions.

Collaboration: Class projects will be carried out individually or in pairs. For projects submitted by teams, team members will receive the same grades and may balance responsibilities as they see fit.

Use of technology: You may use any technology that assists with their ability to participate in the class. I recommend that you come to class with a device larger than a phone on which you can read handouts and take notes.

Late assignments: Each assignment is meant to serve as a stepping stone that builds students towards their final presentation and analysis portfolio. If an assignment is turned in late, you may miss an opportunity to receive important feedback on your project. If you are unable to submit an assignment on time for any reason, please contact the instructor in advance.

Rescheduling Evaluations: Due to the class's short timeline, there will not be an opportunity to reschedule presentations or evaluations.

Guidelines for Discussion and Inclusivity: Sustainability is a complex issue that many of us are passionate about. It is important to honestly engage with new perspectives and to be open to changing our minds. During in-class discussions, we must listen to and respect one another, even if we do not agree. It is important that we honor the uniqueness of our colleagues and their experiences and appreciate the opportunity we have to learn from each other. Please respect others' opinions and refrain from personal attacks or demeaning comments of any kind. Finally, remember to keep confidential all issues of a personal or professional nature that are discussed in class.

MIT values an inclusive environment, and a diversity of perspectives are critical to dealing with the existential threats posed by climate change. I hope to foster a sense of inclusive community in this classroom; one that supports a diversity of thoughts, perspectives, and experiences. I welcome individuals of all backgrounds, beliefs, ethnicities, national origins, gender identities, sexual orientations, religious and political affiliations – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive class environment. I am still in the process of learning about diverse perspectives and identities, as are we all. If something is said in class that makes you feel uncomfortable, please do not hesitate to talk to me about it.

Masking on MIT's campus is not mandatory - and is left to individual discretion. Please be respectful of others' choices to mask while on campus.

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Course Units

Unit 1: What is Sustainability? What is Design?

1/10 - 1/12

The goal of this unit is to break down a complex question (is X system sustainable?) into smaller, simpler questions. We will examine works such as the United Nations goals for sustainable development, scientific reviews on sustainable technologies and climate science, and the mission statements and supply chains of sustainability-focused companies. Additionally, we review quantitative metrics of sustainability, such as the LEED certification for architecture, life-cycle assessment, and embodied carbon and energy to understand where these methods are, and are not, appropriate.

By the end of this unit, students will be able to:

1. *Summarize* current research and academic consensus on the nature of environmental, social, and economic sustainability.
2. *Critically evaluate* current approaches to the assessment of system sustainability such as LEED, LCA, or Energy evaluation.
3. *Propose* appropriate justifications and metrics for assessing the sustainability of a given system.

Unit 2: Critical Evaluation of Sustainable (?) Designs

1/17 - 1/19

In this unit, we will focus on the critical evaluation of existing designs and determine whether we consider them to be sustainable or not. Building upon skills from the previous unit, we will review case studies on products ranging from permaculture farms to meat substitutes in order to determine how their processes interact with local and global environmental forces.

By the end of this unit, students will be able to:

4. *Analyze* and illustrate the system-level interactions that designs have with the non-human environment.
5. *Quantify* the environmental impacts of a design in terms of metrics that relate to environmental sustainability.
6. *Examine* arguments for and against the implementation of sustainable designs and practices, weighing the evidence that supports each side.

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Course Units

Unit 3: Designing Sustainable Systems

1/24 - 1/26

In our final week of class, we will build comprehensive analyses of the sustainability claims made by products and systems of our choosing. Final analyses will be presented to the class for feedback and critique from one another and a panel of experts.

By the end of this unit, students will be able to:

7. *Evaluate* whether a given design (product, system, or technology) can be considered sustainable.
 8. *Propose* their own sustainable designs for products, systems, or technologies and justify how they benefit the environment.
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III. Additional Resources

Academic Integrity Statement

In this course, I will hold you to the high standard of academic integrity expected of all students at the Institute. I do this for two reasons. First, it is essential to the learning process that you are the one doing the work. I have structured the assignments in this course to enable you to gain a mastery of the course material. Failing to do the work yourself will result in a lesser understanding of the content, and therefore a less meaningful education for you. Second, it is important that there be a level playing field for all students in this course and at the Institute so that the rigor and integrity of the Institute's educational program is maintained.

Violating the Academic Integrity policy in any way (e.g., plagiarism, unauthorized collaboration, cheating, etc.) will result in official Institute sanction. Possible sanctions include receiving a failing grade on the assignment or exam, being assigned a failing grade in the course, having a formal notation of disciplinary action placed on your MIT record, suspension from the Institute, and expulsion from the Institute for very serious cases.

Please review the Academic Integrity policy and related resources (e.g., working under pressure; how to paraphrase, summarize, and quote; etc.) and contact me if you have any questions about appropriate citation methods, the degree of collaboration that is permitted, or anything else related to the Academic Integrity of this course.

Special Accommodations and Disability Support

If you need disability-related accommodations, I encourage you to meet with me early in the semester. If you have not yet been approved for accommodations, please contact Student Disability Services at sds-all@mit.edu.

I look forward to working with you to assist you with your approved accommodations.

Mental Health

As a student, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may impact your ability to attend class, concentrate, complete work, take an exam, or participate in daily activities.

Undergraduates: Please discuss this with Student Support Services (S3). You may consult with Student Support Services in 5-104 or at 617-253-4861.

Graduate Students: Please reach out to the deans for personal support in the Office of Graduate Education.

For urgent or after-hours concerns, please contact MIT Police.