



Department of Community Sustainability

MICHIGAN STATE
UNIVERSITY

CSUS 491
Modeling Clean Energy Problems
Fall 2019
Wednesday 5pm – 6:30pm
019 NRB

Instructor: Doug Bessette, PhD

Office Location: 327 Natural Resources Building

Office Hours: Tues 1pm – 3pm; Immediately after class or by appointment

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Catalog Course Description: Examines opportunities for and constraints of clean energy systems, energy transitions, and social, cultural, economic and ecological impacts of clean energy. Uses modeling and systems thinking to improve understanding of prominent problems.

Course Materials: We will draw from the textbooks below; additional readings will be provided by the instructor via D2L.

Required: Randolph & Masters, 2018. Energy for Sustainability: Foundations for Technology, Planning, and Policy, Second Edition. Island Press, Washington.

Course Outcomes:

In this course, students will:

1. Use systems thinking to analyze energy systems and decisions.
2. Identify key drivers, leverage points and interrelationships of energy systems and problems.
3. Compare fuels, power-generation technologies, and energy systems from multiple perspectives.
4. Model energy systems using rich pictures, causal loop diagrams and fuzzy cognitive maps (mental models).
5. Work as a team to deepen understanding and examine multiple perspectives.
6. Develop professional materials and relationships alongside energy experts.
7. Incorporate course material and concepts into CSUS themes and curriculum.

Upon completion of this course, students will be able to:

1. Model and think about energy systems and transitions using multiple perspectives and methods.

2. Identify key drivers and leverage points for initiating energy system change.
3. Identify political, social, economic, ecological and technical attributes and impacts of different types of energy and analyze tradeoffs between energy portfolios.
4. Speak authoritatively about real-world, relevant clean energy problems and systems.
5. Develop professional materials and relationships created alongside energy experts.

Course Learning Outcomes:

These course outcomes support the Department of Community Sustainability undergraduate program competencies of *Critical Thinking, Systems Thinking, Economic Literacy, Equity, Civic Engagement, Leadership, Initiative and Practical Skills, and Ethics*. In addition, this course supports Michigan State University's Undergraduate Learning Goals of *Analytical Thinking, Effective Citizenship, Effective Communication and Integrated Reasoning*. Students can learn more about the Department of Community Sustainability undergraduate competencies at http://www.canr.msu.edu/csus/undergraduate/sustainability_core. More information about MSU's Undergraduate Learning Goals is available at <http://undergrad.msu.edu/msu-goals>.

Assignments & Grading:

Grade Distribution

1. Attendance & Participation:	15%
2. Go/No-Go Quizzes:	10%
3. Individual Models	20%
4. Group Models and Discussion Questions	20%
5. Final Project	15%
6. Take-home Final Exam	20%
Total	100%

Grading Scale:

All assignments will be graded using the 4-point scale.

Grade	4.0	3.50	3.00	2.50	2.00	1.50	1.00	0
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Assignments:

1. Attendance & Participation. (15%) Students are expected to attend and participate in each class, and attendance will be taken.

Grading: Students are allowed **ONE** unexcused absence. For each subsequent absence, students' Attendance grade will be reduced by 0.5 points, i.e., one grade (4.0. 3.5, 3.0, 2.5...). Students are still expected to complete Go/No-Go quizzes and submit their individual modeling assignments, regardless of whether an absence is excused or not. Students are also expected to actively and constructively participate in class, by both asking and answering questions, and showing evidence that they have engaged the readings and lectures. If students feel uncomfortable speaking during class, they can attend office hours or schedule times outside of class to speak about the course content one-on-one with the

instructor. Students' Participation will be graded on a -0.5/0/+0.5 scale, which will either be added or subtracted from the overall Attendance & Participation grade.

Learning Outcomes: Initiative and practical skills; leadership; effective communication

Absences will be excused for the following reasons: (a) required field trips for other classes with a note; (b) participation in university athletics with a note; and (c) illnesses for which you have a doctor's note excusing you from class (if you are seriously ill for an extended period, it may not be possible to continue with the class).

If students must miss a class for one of these reasons, they should try to inform the instructor in advance. Students are responsible for turning in all the work missed and the instructor will not respond to emails requesting information about missed classes.

2. Go/No-Go (GNG) Quizzes. (10%) Students are expected to take and answer all questions correctly on a multiple-choice Go/No-Go (GNG) quiz before attending class each week. The student can take each quiz as many times as necessary to pass it, but must ultimately pass it *by answering all questions correctly.*

Grading: Students who take and pass all GNG quizzes will receive a 4.0. Failing to take or pass a GNG quiz with 100% will reduce students' GNG grade by 0.5 points, i.e., one grade (4.0, 3.5, 3.0, 2.5...).

Learning Outcomes: Critical thinking; initiative and practical skills; analytical thinking

3. Individual Models. (20%) Students will be asked to construct models of each week's clean energy problem. The student must turn in the model at the beginning of class, as the groups will use these models to build their group models.

Grading: Each model will be graded on a 4 point scale. To receive full points, the student must demonstrate engagement with the readings and lecture, an understanding of multiple impacts and attributes, and have identified drivers, leverage points and key interrelationships of the system.

Learning Outcomes: Critical thinking; systems thinking; initiative and practical skills; analytical thinking; effective communication; integrated reasoning

4. Group Models and Discussion Questions. (20%) Students will be asked to construct models of each week's clean energy problem as a group. Groups must have at least 4 students. More instructions will be provided each week. Students will also be assigned discussion questions that they must answer as a group. We will go over these models and questions at the end of each class.

Grading: Models and question responses will be graded on a 4 point scale. To receive full points, the student must demonstrate engagement with the readings and lecture, an

understanding of multiple impacts and attributes, and have identified drivers, leverage points and key interrelationships of the system.

Learning Outcomes: Critical thinking; systems thinking; initiative and practical skills; analytical thinking; effective communication; integrated reasoning

5. Final Project (15%). Over the course of the semester, each group will select one clean energy problem and develop either a i) professional report, ii) online video or iii) recorded podcast, describing that problem and potential strategies for addressing it. The focus of each group's project is up to the students involved; however, the instructor must approve each group's project before they proceed. The problem cannot be one of those assigned during the course. A key component of this project will be the addition and inclusion of one energy expert/professional in the group's work. *Students are encouraged to be creative!*

Learning Outcomes: Critical thinking; systems thinking; initiative and practical skills; analytical thinking; effective communication; effective citizenship; integrated reasoning

6. Take-home Final Exam (20%) A take-home final exam will be distributed during the last class period and will be due by 12pm on December 13th. This exam will be a combination of a modeling assignment and short-answer questions.

Learning Outcomes: Critical thinking; systems thinking; economic literacy; equity; ethics initiative and practical skills; analytical thinking; effective communication; integrated reasoning

Course Schedule

Week	Class	Topic	Modeling
Week 1	Wed: Sep 4	Introduction to class & modeling	Intro Quiz
Week 2	Wed: Sep 11	Retire a coal plant	Rich Texture Drawing
Week 3	Wed, Sep 18	Line 5 Pipeline	Rich Texture Drawing
Week 4	Wed, Oct 2	Ideal Setbacks for Wind	EcoModeler
Week 5	Wed, Oct 9	Icebreaker & Offshore Wind	EcoModeler
Week 6	Wed, Oct 16	The Duck Curve	EcoModeler
Week 7	Wed, Oct 23	Nuclear Power Renaissance	Mental Modeler
Week 8	Wed, Oct 30	Land use: Biofuels	Mental Modeler
Week 9	Wed, Nov 6	MSU Carbon Price	Mental Modeler
Week 10	Wed, Nov 13	Electric vehicle Adoption	Mental Modeler
Week 11	Wed, Nov 20	Concrete, Silicon & Lithium	Mental Modeler
Week 12	Wed, Nov 27	Low-Carbon Futures; Synthesis Models	Mental Modeler
Week 13	Wed, Dec 4	Group Projects & Presentations	Presentations
Final	Fri, Dec. 13	Final Exam Due 12pm. (Provided at end of class on Dec. 4th)	

Course Policies

Attendance:

Students whose names do not appear on the official class list for this course may not attend this class. Students who fail to attend at least one of the first two class sessions may be dropped from the course.

E-Learning Policies:

Information technologies such as D2L and email are widely used in this class. As a result, there are some additional policies that need to be understood.

- Students should visit the course's D2L site on a regular basis.
- Students should check their email frequently (all class email is sent to the student's official MSU email account).
- All assignments submitted electronically, either on disk or via email, should be free of any viruses and/or worms. Any infected file or disk that is submitted will receive a zero (0) for that assignment.
- This course recognizes the students' right to privacy and adheres to the Family Educational Rights and Privacy Act (FERPA).
- Students need to review the university policy "Acceptable Use of Computing Systems, Software, and the University Digital Network" at <http://lct.msu.edu/guidelines-policies/aup/>.
- The Web site tech.msu.edu provides a number of information technology resources for students.
- You are responsible for the operation of any personally owned computers you use on or off campus. **A malfunctioning computer system is NOT a valid excuse for submitting late work.**
- Students are expected to have a high degree of self-motivation and self-direction in this class and develop the needed technology skills to excel in this class and in life.

Excessive emails make an unreasonable time demands on both sender and recipient. Please ensure you have a legitimate need before you write. The instructor will answer emails about:

- Questions arising from difficulty in understanding course content.
- Requests for feedback about graded assignments.
- Private issues appropriate for discussion within the teacher-student relationship.

The instructor will NOT answer emails which:

- Pose questions answered in the course information sections of the course D2L site.
- Pose questions answered in the course syllabus.
- Lack a subject line clearly stating the purpose of the email and the course number (CSUS259).
- Raises an inappropriate subject.

Academic Honesty:

[Article 2.III.B.2](#) of the Academic Freedom Report states: "The student shares with the faculty the responsibility for maintaining the integrity of scholarship, grades, and professional standards." In addition, the Department of Sustainability adheres to the policies on academic honesty specified in General Student Regulation 1.0, [Protection of Scholarship and Grades](#); the all-University

Policy on [Integrity of Scholarship and Grades](#); and [Ordinance 17.00](#), Examinations. (See Spartan Life: Student Handbook and Resource Guide and/or the MSU Web site: www.msu.edu).

Therefore, unless authorized by your instructor, you are expected to complete all course assignments, including homework, lab work, quizzes, tests and exams, without assistance from any source. You are expected to develop original work for this course; therefore, you may not submit course work you completed for another course to satisfy the requirements for this course. Also, you are not authorized to use the www.allmsu.com Web site to complete any course work in this course. Students who violate MSU regulations on Protection of Scholarship and Grades will receive a failing grade in the course or on the assignment.

****Faculty are required to report all instances in which a penalty grade is given for academic dishonesty. Students reported for academic dishonesty are required to take an online course about the integrity of scholarship and grades. A hold will be placed on the student's account until such time as the student completes the course. This course is overseen by the Associate Provost for Undergraduate Education.****

(See also <https://www.msu.edu/~ombud/academic-integrity/index.html>). **There will be no warnings** – the maximum sanction allowed under University policy will occur on the first offense.

Bereavement:

Students seeking a grief absence should be directed to the Grief Absence Request Form found on the RO home page (<https://reg.msu.edu/>) under ‘Student Services – Grief Absence Request Form’ OR to StuInfo (<https://stuinfo.msu.edu/>) under ‘Academics - Enrollment Information and Services – Grief Absence Request Form.’

Disruptive Behavior:

Article 2.III.B.4 of the [Student Rights and Responsibilities \(SRR\)](#) for students at Michigan State University states: "The student's behavior in the classroom shall be conducive to the teaching and learning process for all concerned." Article 2.III.B.10 of the [SRR](#) states that "The student and the faculty share the responsibility for maintaining professional relationships based on mutual trust and civility." [General Student Regulation 5.02](#) states: "No student shall . . . interfere with the functions and services of the University (for example, but not limited to, classes . . .) such that the function or service is obstructed or disrupted. Students whose conduct adversely affects the learning environment in this classroom may be subject to disciplinary action through the Student Judicial Affairs office.

Social Media

As members of a learning community, students are expected to respect the intellectual property of course instructors. All course materials presented to students are the copyrighted property of the course instructor and are subject to the following conditions of use:

1. Students may record lectures or any other classroom activities and use the recordings **only** for their own course-related purposes.

2. Students may share the recordings with other students enrolled in the class. Sharing is limited to using the recordings **only** for their own course-related purposes.
3. Students **may not** post the recordings or other course materials online or distribute them to anyone not enrolled in the class without the advance written permission of the course instructor and, if applicable, any students whose voice or image is included in the recordings.

Any student violating the conditions described above may face academic disciplinary sanctions.

Commercialized Lecture Notes:

Commercialization of lecture notes and university-provided course materials is not permitted in this course.

Understand When You May Drop This Course:

It is the student's responsibility to understand when they need to consider un-enrolling from a course. Refer to the [Michigan State University Office of the Registrar](#) for important dates and deadlines.

Drops and Adds:

The last day to add this course is the end of the first week of classes. The last day to drop this course with a 100 percent refund and no grade reported is **2/1/2019**. The last day to drop this course with no refund and no grade reported is **2/27/2019**. You should immediately make a copy of your amended schedule to verify you have added or dropped this course.

Inform Your Instructor of Any Accommodations Needed

Michigan State University is committed to providing equal opportunity for participation in all programs, services and activities. If you have a documented disability and verification from the [Resource Center for Persons with Disabilities](#) (RCPD), and wish to discuss academic accommodations, please contact your instructor as soon as possible. It is the student's responsibility to provide documentation of disability to RCPD and meet with an RCPD specialist to request special accommodation before classes start.

Once your eligibility for an accommodation has been determined, you will be issued a verified individual services accommodation ("VISA") form. Please present this form to the instructor at the start of the term and/or two weeks prior to the accommodation date (test, project, etc).

Requests received after this date will be honored whenever possible.

RCPD is located in 120 Bessey Hall, near the center of the Michigan State University campus, on the southwest corner of Farm Lane and Auditorium Road. RCPD may be contacted by phone at (517) 884-7273 (884-RCPD), or [via their website](http://www.rcpd.msu.edu) (<http://www.rcpd.msu.edu>).

Handling Emergency Situations

In the event of an emergency arising within the classroom, the Professor will notify you of what actions that may be required to ensure your safety. It is the responsibility of each student to understand the evacuation, "shelter-in-place," and "secure-in-place" guidelines posted in each facility and to act in a safe manner. You are allowed to maintain cellular devices in a silent mode during this course, in order to receive emergency SMS text, phone or email messages

distributed by the university. When anyone receives such a notification or observes an emergency situation, they should immediately bring it to the attention of the Professor in a way that causes the least disruption. If an evacuation is ordered, please ensure that you do it in a safe manner and facilitate those around you that may not otherwise be able to safely leave. When these orders are given, you do have the right as a member of this community to follow that order. Also, if a shelter-in-place or secure-in-place is ordered, please seek areas of refuge that are safe depending on the emergency encountered and provide assistance if it is advisable to do so.

Syllabus Disclaimer

All syllabi are subject to minor changes to meet the needs of the instructor, school, or class. Every effort will be made to avoid changing the course schedule but the possibility exists that unforeseen events will make syllabus changes necessary. The instructor reserves the right to make changes to the syllabus as deemed necessary. Students will be notified in a timely manner of any syllabus changes through the course site announcements. Please remember to check your MSU email and the course site announcements often.