

CEE 598: Fundamentals of Sustainable Energy Systems

1. Contact Information

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2. Office Hours

Tuesdays 9-11 am, use email for appointments outside office hours

3. Overall Course Objectives and Expected Learning Outcomes

Making proper energy choices depends not only on technology, but also on a basic understanding of core concepts of sustainability science, relevant analysis tools, as well as ongoing efforts in adapting them to energy systems. The course objective is to provide this knowledge which is achieved by: (a) presenting fundamental and foundational topics related to sustainability in general, while linking them to energy systems; (b) discussing energy consumption trends, basic growth/decay models, challenges (such as climate change and human health), and general sustainable solution pathways; (c) covering life cycle analysis and energy costing methods; (d) providing an overview of different types of energy systems and traditional techniques such as systems modeling, uncertainty analysis and risk analysis; and (e) presenting standard models and published work relevant to sustainability and resiliency assessments of energy products, processes and systems. Engineering and science students, wishing to acquire a fundamental understanding of energy issues and systems in terms of current sustainability thinking or those intending to specialize on this subject, would benefit from this course.

Expected Learning Outcomes:

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

- Articulate general sustainability concepts
- Discuss the issues of social justice and political culture related to energy
- Explain the importance of quantitative analyses
- Perform simple quantitative evaluations of alternatives
- Describe different types of studies involving sustainability metrics
- Describe energy consumption patterns and end-uses in modern society
- Explain the concept of limits of growth, and be able to use simple growth/decay models
- Outline the different pathways to sustainable energy
- Discuss climate change, implications and planning tools (carbon wedges)
- Correlate adverse impacts of traditional energy use on human health and the environment
- Use energy and cost investment analysis methods (LCC and LCA methods)
- Explain different ways to classify energy systems
- Solve problems in traditional energy system modeling and optimization
- Explain basic concepts of uncertainty and risk analysis
- Explain the definition, scope and attributes of complex and adaptive systems
- Describe different system resilience assessment methods: structural, performance and hybrid
- Describe studies on sustainability assessment of energy products, pathways and systems

4. Grade Policies

Grading system used: A (94-100%), A- (90-94), B+ (87-89), B (83-86), B- (80-82), C+ (76-79), C (70-75), D (60-69), E (<60), XE (failure due to academic dishonesty).

The final grade will be assigned on the basis of the following categories and indicated weights:

○	Assignments (15 nos.)	75%
○	Quiz/Assessments (2 nos)	25%
	Total	100%

All assignments have to be submitted on canvas and not mailed to the instructor as email attachments. Late submittals without prior instructor consent will be reduced by a letter grade. Submittals later than one week will not be graded. Solutions to the assignments will also be posted one week after the assignment was due. There will be two quizzes (open book) of about 2 hr duration each.

5. Course Schedule

Week	Module	Topics	Lectures
1			Course overview
	A	Broad Concepts	A1: Sustainable development
2			A2: Sustainability and energy
			A3: Energy justice
3	B	Sustainability Issues	B1: Quantitative analysis & sustainability metrics
4			B2: Basic growth and decay models
5			B3: Challenges and solution pathways
6	C	Adverse Societal Impacts	C1: Climate change science and policy
7			C2: Environmental and health impacts
9	D	Economic Analysis	D1: Life cycle costing methods
			D2: Energy and life cycle analysis methods
10	F	Modeling and Analysis	F1: Types of energy systems
11			F2: Traditional system modeling and optimization
12			F3: Uncertainty analysis
			F4: Risk analysis
13	G	Complex & Adaptive Systems	G1: Sustainability attributes
14			G2: Resilience assessment
15			G3: Sustainability assessment

6. Lists of any required readings, assignments, examinations, special materials and extracurricular activities

- Slides, handout notes and published technical papers
- Recommended textbooks:
 - Tester, J.W., E.M. Drake, M.J. Driscoll, M.W. Golay and W.A. Peters, 2013. *Sustainable Energy: Choosing Among Options, 2nd Ed.*, The MIT Press, Cambridge, USA.
 - Randolph, J. and G.M. Masters, 2008. *Energy for Sustainability: Technology, Policy and Planning*, Island Press, Washington.

- Boyle J., B. Everett and J. Ramage, 2012. *Energy Systems and Sustainability: Power for a Sustainable Future*, 2nd Ed., Oxford University Press, UK.
- Reddy, T.A. 2011. “*Applied Data Analysis and Modeling for Energy Engineers and Scientists*”, Springer, NY.

7. Absence policies and the conditions under which assigned work and/or tests can be made up, which should include

Attendance and participation for the duration of the class period is mandatory. If you have more than 3 absences (unexcused), your final grade will be lowered 1/3 grade for each subsequent absence (i.e. B to B-). You should notify me by email prior to absence if possible and provide doctor’s note where applicable. Repeated tardiness and leaving class early will be recorded, and as a result, your final grade will be lowered. It is the student's responsibility to keep track of his/her absences.

Excused absences related to religious observances/practices in accord with [ACD 304–04](#), “Accommodation for Religious Practices.” Students may be excused for the observance of religious holidays. Students should notify the instructor at the beginning of the semester about the need to be absent from class due to religious observances. Students will be responsible for materials covered during their absence and should consult with the instructor to arrange reasonable accommodation for missed exams or other required assignments.

Excused absences related to university sanctioned activities in accord with [ACD 304–02](#), “Missed Classes Due to University-Sanctioned Activities.” Students required to miss classes due to university sanctioned activities will not be counted absent. However, absence from class or examinations due to university-sanctioned activities does not relieve students from responsibility for any part of the course work required during the period of the absence. Students should inform the instructor early in the semester of upcoming scheduled absences and immediately upon learning of unscheduled required class absences. Reasonable accommodation to make up missed exams or other required assignments will be made. Consult the instructor BEFORE the absence to arrange for this accommodation.

Line-of-duty absence and missed assignment policy:

A student who is a member of the National Guard, Reserve, or other U.S. Armed Forces branch who misses classes, assignments or examinations due to line-of-duty responsibilities, shall have the opportunity to make up the coursework in accordance with [SSM 20-18 Accommodating Active Duty Military Personnel](#). This accommodation also applies to spouses who are the guardian of minor children during line-of-duty activities. This policy does not excuse students from course responsibilities during their absence. Students should first notify the Pat Tillman Veterans Center of their activation and then the instructor to discuss options.

8. Policy regarding expected classroom behavior (e.g., use of pagers, cell phones, recording devices)

It is encouraged that you bring technology (cell phones, tablets and laptops) to class to help you take notes and do research, however please turn off cell phone ringers and do not use your phone to make personal calls in class or use any technology to use social media in class. Do not answer your phone in class. If you believe you are receiving an emergency call, please step outside to take it.

9. Academic Integrity and Copyright Laws

Academic Integrity

Students in this class must adhere to ASU’s academic integrity policy, which can be found at <https://provost.asu.edu/academic-integrity/policy>). Students are responsible for reviewing this policy and understanding each of the areas in which academic dishonesty can occur. In addition, all engineering students

are expected to adhere to both the ASU Academic Integrity [Honor Code](#) and the Fulton Schools of Engineering [Honor Code](#). All academic integrity violations will be reported to the Fulton Schools of Engineering Academic Integrity Office (AIO). The AIO maintains record of all violations and has access to academic integrity violations committed in all other ASU college/schools.

Specific academic integrity rules for this class are as follows: I sanction any incidents of academic dishonesty in my courses using University guidelines. Should you have any question about whether or not something falls subject to this clause, feel free to contact me or review the university policy on academic integrity at the above link. Per ASU policy, a student may not avoid the consequences of academic dishonesty by withdrawing from a course, and may be placed back in the course in order to face sanctions resulting from academic integrity violations. You are responsible for abiding by this policy.

Copyright

Course content, including lectures, are copyrighted materials and students may not share outside the class, upload to online websites not approved by the instructor, sell, or distribute course content or notes taken during the conduct of the course (see [ACD 304-06](#), “Commercial Note Taking Services” and ABOR Policy [5-308 F.14](#) for more information).

You must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student's original work, unless the students first comply with all applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement.

Each student is responsible for protecting their work and electronic files. Reasonable measures must be taken to ensure that others cannot copy written work or electronic files with or without your consent. Minimum measures include, but are not limited to, a password, PIN or biometric protected screen lock on your computer so that if you leave your computer unattended for a few minutes it cannot be accessed by others. Any sharing or copying of coursework (other than in-class groupwork) is in violation of the ASU Academic Integrity Policy and is assumed to be carried out by all parties involved. Your submitted work must be of your own creation, even if you discuss it with others.

10. Policy against threatening behavior, per the Student Services Manual, SSM 104-02

Students, faculty, staff, and other individuals do not have an unqualified right of access to university grounds, property, or services. Interfering with the peaceful conduct of university-related business or activities or remaining on campus grounds after a request to leave may be considered a crime. All incidents and allegations of violent or threatening conduct by an ASU student (whether on- or off-campus) must be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students.

11. Warning of Offensive Class Materials

If students deem some course content to be offensive, they are urged to bring this to the attention of the instructor in written or verbal form or, alternatively, to the unit chair or director.

12. Disability Accommodations

Suitable accommodations will be made for students having disabilities. Students needing accommodations must register with the ASU disabilities resource Center and provide documentation of that registration to the instructor. Students should communicate the need for an accommodation in sufficient time for it to be properly arranged.

11. Harassment and Sexual Discrimination

Arizona State University is committed to providing an environment free of discrimination, harassment, or retaliation for the entire university community, including all students, faculty members, staff employees, and guests. ASU expressly prohibits discrimination, harassment, and retaliation by employees, students, contractors, or agents of the university based on any protected status: race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, and genetic information.

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at <https://sexualviolenceprevention.asu.edu/faqs>.

Mandated sexual harassment reporter: As an employee of the University I am considered a mandated reporter and therefore obligated to report any information regarding alleged acts of sexual discrimination that I am informed of or have a reasonable basis to believe occurred.

ASU Counseling Services, <https://eoss.asu.edu/counseling>, is available if you wish to discuss any concerns confidentially and privately.

12. Other Items

Syllabus changes: Any information in this syllabus (other than grading and absence policies) may be subject to change with reasonable advance notice.

How Long Students Should Wait for an Absent Instructor: In the event the instructor fails to indicate a time obligation, the time obligation will be 15 minutes for class sessions lasting 90 minutes or less, and 30 minutes for class sessions lasting more than 90 minutes. Students may be directed to wait longer by someone from the academic unit if they know the instructor will arrive shortly.