

Sustainable Energy Strategies, Environmental Studies Department, San José State University
ENVS 133, Section 01, Spring 2015

Instructor: Dustin Mulvaney, Ph.D.
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Email: dustin.mulvaney@sjsu.edu
Office hours: Thursday 1:30–2:50 PM or by appointment
Days/Time: Tuesday, Thursday 3–4:15 PM
Classroom: Clark Hall 111, Incubator Classroom
Prerequisites: ENVS 119 (no exceptions)
www.turnitin.com class ID: 7570266 password: envs133

MySJSU Messaging: You are responsible for regularly checking with the messaging system through <http://my.sjsu.edu>

Where are the assignments, readings, & handouts? Canvas <https://sjsu.instructure.com>

How do I turn in papers? This will be identified in the syllabus. In general, *typed* papers will be submitted via www.turnitin.com, *handwritten & mathematical* work will be submitted on paper. Canvas may also be used in some occasions.

Course Description: This course will provide students with a comprehensive overview of energy efficiency, energy conservation, and energy generation opportunities for transitioning to a sustainable energy economy. Students will learn about metrics and assessment tools to evaluate alternative modes of transportation, transportation fuels, electricity infrastructure, designs in the build environment and other green infrastructures and their impacts on greenhouse gas emissions, land use, ecological systems, air pollutants, and environmental justice. Students will learn about the biophysical constraints and opportunities for sustainable energy based on Earth's resources. The class will also explore how concepts from environmental sociology, political ecology, and science & technology studies help us understand, explain, and advocate for energy transitions. Topics include solar, wind, geothermal, bioenergy, storage (fuel cells, batteries), and electricity transmission/integration. Existing energy options are unsustainable (for reasons covered in ENVS 119), so pursuing sustainable energy options will be critical to the long-term survival and prosperity of human civilization.

Course Goals and Student Learning Objectives

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

- Understand the opportunities for renewable and alternative energy deployment.
- Understand and assess the renewable energy resource base on Earth.
- Describe basic principles to improve efficiency and design of energy delivery, recognize opportunities to reduce energy consumption, and promote sustainability.
- Assess basic economic, government policy, and social equity dimensions of alternative energy options

Required Text David JC MacKay. 2009 *Sustainable Energy—without the hot air*. UIT Cambridge Ltd. Download pdf of book for free at: <http://www.withouthotair.com> Or, buy from [Amazon](#) or [Barnes and Noble](#). Other readings are on the course schedule.

Environmental Studies Library Liaison Peggy Cabrera, peggy.cabrera@sjsu.edu

Classroom Protocol: You are expected to come to every class on time. Coming into class late is a disturbance to others. Classroom participation is 20% of your grade, and classroom disturbance will be reflected in participation scores. **No cell phone, emailing, or text messaging during class.** If you need to make a phone call or send an email, please excuse yourself from class.

Dropping and Adding: Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's [Catalog Policies](#) section. Add/drop deadlines can be found on the [current academic calendar](#) and you should refer to the [Late Drop Policy](#). Students should be aware of the current deadlines and penalties for dropping classes. Information about the latest changes and news is available at the [Advising Hub](#).

Course Requirements & Assignments: SJSU classes are designed such that in order to be successful, it is expected that students will spend a minimum of forty-five hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, and so on. More details about student workload can be found in [University Policy S12-3](#) at <http://www.sjsu.edu/senate/docs/S12-3.pdf>

GRADING is based on.

10% Participation. Share your thoughts about the readings, ask thoughtful questions, answer discussion prompts. Keeping good notes about the main points or views taken by authors is a good means a facilitating a sustained discussion. You will also be asked to work in small groups now and then in class, and you will be expected to be a contributing member to your group.

30% Assignments: There will six assignments that must be completed.

1. A1 – Assignment 1 – [Biofuels, Sustainability, & Social Justice](#)
2. A2 – Assignment 2 – [Carbon Debt Calculator](#)
3. A3 – Assignment 3 – [Well-to-Wheel Analysis](#)
4. A4 – Assignment 4 – [Biomass & power density/electricity footprint](#)

5. A5 – Assignment 5 – [Solar Energy Lab](#)
6. A6 – Assignment 6 – [Ocotillo Express Wind Controversy](#)
7. A7 – Assignment 7 – [Wind, Water, & Sunlight strategies](#)
8. A8 – Assignment 8 – [Energy for Solar Hot Water](#)

20% Exam: The midterm exam will be open notebook. The tests will include short answer, multiple choice, problem sets, and essay questions. However, you will not have access to any electronic devices (other than a calculator) and you will not have access to the Canvas site. You must bring a calculator to the examinations. To study for the tests, you should review the readings, course lecture notes, homework, and learning objectives well in advance of the test date. The midterm will include material covered during the first portion of the class. We will include both multiple choice and problems related to the scientific principles of energy, heat, and work. You are encouraged to review the problems sets before the midterm.

20% Group Research Project: Students will develop a research project related to renewable or conventional energy technologies. More details on this assignment will be available on the course website.

20% Individual Research Project: An individual research project on a sustainable energy strategy or source.

Course Grading

The course grade will be determined based on a total 100 possible points. Accumulated points that fall within the grade scale below determine your semester grade.

A+ 97–100	A 92–96	A- 89–91	B+ 86–88	B 81–85	B- 79–80	C+ 76–78
C 72–76	C- 69–71	D+ 67–68	D 64–66	D- 60–64	F < 60	

University policy on academic integrity

Your commitment as a student to learning is evidenced by your enrollment at San Jose State University. The [University’s Academic Integrity policy](#) requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of [Student Conduct and Ethical Development website](#).

Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person’s ideas without giving proper credit) will result in a failing grade and sanctions by the University. For this class, all assignments are to be completed by the individual student unless otherwise specified. If you would like to include your assignment or any material you have submitted, or plan to submit for another class, please note that SJSU’s Academic Policy S07-2 requires approval of instructors.

Campus policy in compliance with the American Disabilities Act

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with the Accessible Education Center (AEC) www.sjsu.edu/aec to establish a record of their disability.

Other Campus Resources

- **Computer labs** for student use are available in the **Academic Success Center** www.sjsu.edu/at/asc located on the 1st floor of Clark Hall and on the 2nd floor of the Student Union. Additional computer labs may be available in your department/college. Computers are also available in the Martin Luther King Library. A wide variety of audio-visual equipment is available for student checkout from Media Services located in IRC 112.
- **Peer Connections** <http://peerconnections.sjsu.edu> is located on the 1st floor of Clark Hall in the Academic Success Center as well as in Room 600 in the Student Services Center. It is designed to assist students in the development of their full academic potential and to inspire them to become independent learners. Peer Connections’ tutors are trained and nationally certified by the College Reading and Learning Association (CRLA). They provide content-based tutoring in many lower division courses (some upper division) as well as writing and study skills assistance. Small group, individual, and drop-in tutoring are available. Peer Connections is staffed with Peer Mentors who excel in helping students manage university life, tackling problems that range from academic challenges to interpersonal struggles. On the road to graduation, Peer Mentors are navigators, offering “roadside assistance” to peers who feel a bit lost or simply need help mapping out the locations of campus resources. Peer Mentor services are free and available on a drop –in basis, no reservation required. <http://www.sjsu.edu/muse/peermentor>
- The **SJSU Writing Center** is located in Room 126 in Clark Hall and is staffed by professional instructors and upper-division or graduate-level writing specialists from each of the seven SJSU colleges. Writing specialists have met a rigorous GPA requirement, and they are well trained to assist all students at all levels within all disciplines to become better writers. The [Writing Center](#) also has resource on their website.

ENVS 133 – Sustainable Energy Strategies, Spring 2014 Schedule (subject to change with fair notice)

<i>Date & Deadlines</i>	<i>Lecture Topic & keywords</i>	<i>Read before class</i>
1/23	Introduction, green sheet, decarbonization, prime movers, final converters	Green sheet available on canvas. Download book & all articles for the class.
1/28	Motivations for sustainable energy, sustainability, Anthropocene	(1) MacKay, p. 1–18 (2) Hajer, et al. 2012. Shifting Gear: Beyond Classical Mobility Policies and Urban Planning. Ch 7 in <i>Keep Moving, Towards Sustainable Mobility</i> . (3) Yates. 2012. http://www.iasc-culture.org/THR/THR_article_2012_Summer_Yates.php
1/30	Sustainable transportation, automobility, EVs, hybrids	(1) MacKay 29–30, 118–29, 131–4 (2) IEA. 2013. Success factors for hybrid and electric vehicle deployment.
2/4 A1 due	Bioenergy pathways	(1) Wolfson 275–286. (2) Sheehan. 2009. Biofuels and the conundrum of sustainability. <i>Current Opinion in Biotechnology</i> 20: 318–24.
2/6	Hydrogen fuel cells	(1) MacKay 129–31 (2) Hwang. 2013. Sustainability study of hydrogen pathways for fuel cell vehicle applications. <i>Renewable and Sustainable Energy Reviews</i> 19: 220–9.
2/11	Bioenergy: fossil energy ratio, EROI	(1) Murphy & Hall. 2010. EROI (2) Scarlot & Dellemand. 2011. Recent developments of biofuels/bioenergy sustainability certification: A global overview <i>Energy Policy</i> 39: 1630–46.
2/13 A2 due	Biofuels, sustainability metrics and indicators, land use, water, carbon debt, indirect impacts	(1) Delucchi 2010 Annals of the New York Academy of Sciences.pdf (2) Scheffran. 2010. Criteria for a Sustainable Bioenergy Infrastructure and Lifecycle.
2/18	LCFS, RSF2, CAFÉ, sustainability certifications	(1) Sperling & Yeh. 2009. Low Carbon Fuel Standard (2) Sheehan. 2009. Sustainable Biofuels.
2/20	Bioenergy: Algae, biochar	(1) Mathews. 2008. Carbon-negative fuels. <i>Energy Policy</i> 36: 490–5. (2) Lehmann. 2007. Bio-energy in the black. <i>Frontiers in Ecology and the Environment</i> 5(7) 381–7. (3) Zhu et al. 2014. Microalgal biofuels: Flexible bioenergies for sustainable development. <i>Renewable and Sustainable Energy Reviews</i> 30: 1035–46. OPTIONAL: NREL Scientists Find Key Function for Ferredoxins in Algae Hydrogen Production http://www.nrel.gov/news/press/2014/8301.html
2/25 A3 due	WTW analysis, methanol economy	
2/27	Renewable Electricity, Power Density, energy density, Biomass Electricity	(1) Smil, 2010, Power Density Primer Parts 1–5, pages 1–18. (2) MacKay 283–288, 103–112 (3) Olhrogge et al. 2009. Driving on Biomass. <i>Science</i> 324: 1019–20
3/4	Solar PV Electricity, efficiency, power density, PV module types, storage and transmission options	(1) MacKay 38–49, (2) Zweibel Mason Fthenakis 2007.pdf
3/6 A4 due	Solar Energy Lab	Solar Energy Lab instructions.
3/11	Cogeneration	Tour of cogeneration facility at SJSU
3/13 A5 due	Wave and Tidal power, obstacles to deployment	MacKay 73–76, 307–321
3/18	Geothermal Energy	(1) MacKay 96–100, (2) Dickson and Fanelli, 2004
3/20	Wind Energy, social gap	(1) Tabassum-Abbasi et al. 2014. (2) MacKay 32–35, 60–68, 263–69
4/1 A6 due	Ocotillo Express	Readings on assignment sheet.
4/3	EXAM	Bring calculator, open notebook, writing tool
4/8	Electricity storage & transmission	(1) MacKay 177–203, (2) Talbot. 2008. Lifeline for Renewable Power. http://www.technologyreview.com/featuredstory/411423/lifeline-for-renewable-power/page/1/
4/10	Research day	Work in class on group projects.
4/15	Sustainable Fossil Fuels? Nuclear Power, Hydro	MacKay 55–57, 161–177, 322–327
4/17 A7 due	Wind, Water, & Sunlight strategies	Delucchi 2011. Wind, Water, and Solar Power for the World. http://spectrum.ieee.org/energy/renewables/wind-water-and-solar-power-for-the-world/0 Assignment 7 readings: Jacobson Delucchi 2011 WWS part 1.pdf

		Delucchi Jacobson 2011 Energy Policy Part 2.pdf Jacobson et al 2014 California WWS CaliforniaWWS.pdf
4/22	Embodied energy, LCA for buildings	(1) MacKay 322–327 (2) Hosanky. 2011. Green Building Materials. In Mulvaney. <i>Green Energy: An A-to-Z Guide</i> Sage. http://knowledge.sagepub.com/view/greentechnology/n58.xml
4/24	Home Energy Rating Systems, Heating, cooling, lighting, electricity use	(1) MacKay 50–55, 57–60, 68–71, 140–157, 289–386 (2) Goodier. 2011. Home Energy Rating System. In Mulvaney. <i>Green Energy: An A-to-Z Guide</i> Sage. http://knowledge.sagepub.com/view/greenenergy/n71.xml
4/29	Household behavior	(1) Dietz, et al. 2009. Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions. <i>Proc. of the National Academy of Sciences</i> 106(44): 18452–6. http://dx.doi.org/10.1073/pnas.0908738106 (2) Dietz. 2010. Narrowing the US energy efficiency gap. <i>Proceedings of the National Academy of Sciences</i> 107(37): 16007–8. http://dx.doi.org/10.1073/pnas.1010651107
5/1 A8 due	Solar Hot Water Heating, Maximum collector temperature, simple economic payback time, solar energy factor, annual operating costs	(1) MacKay 38–9 (2) Environment California. <i>Hot Water Heating</i> http://www.environmentcalifornia.org/sites/environment/files/reports/CAE%20Solar-Water-Heating.pdf
5/6	Energy in Water, Ag, Industry	California Energy Commission. http://www.energy.ca.gov/process
5/8	Rare Earth Elements	(1) Hurd et al. 2012 Energy Critical Elements for Sustainable Development. <i>MRS Bulletin</i> 37: 405–10. (2) Jenkins, 2013, New Rush for Rare Earth Elements, Desert Report http://www.desertreport.org/wp-content/uploads/2013/02/DR_Spring_2013.pdf
5/13 FINAL PAPER due	Final Paper Due	Final Paper due
5/21	Group Presentations 2:45–5pm, same room, 12-15 minute presentations	