San José State University
Environmental Studies Department
Energy & the Environment ENVS/ENGR 119

Course and Contact Information

Instructor:	Benoit Delaveau, M.S, CEM, BEAP
Office Location:	WSQ115A (Not opened - COVID-19 campus policy)
Email:	benoit.delaveau@sjsu.edu (Use Canvas messaging)
Office Hours:	Office Hours: ALWAYS book me on: https://calendly.com/benoit-delaveau
Class Days/Time:	See your section on Canvas
Classroom:	See your section on Canvas
Prerequisites:	Passing the WST http://testing.sjsu.edu/wst/
GE/SJSU Studies Category:	Area R: Earth & Environment http://info.sjsu.edu/static/catalog/sjstudies.html

Faculty Web Page and MYSJSU Messaging

You are responsible for **daily** checking with the messaging system through MySJSU and Canvas. All course materials such as the syllabus, calendar, assignments, readings, and handouts are posted to canvas: https://sjsu.instructure.com. Log in with your SJSU One account info. For assistance see: http://www.sjsu.edu/at/ec/support/

Course Description

In this course you will be introduced to the nexus of social, technical, and environmental challenges to providing sustainable energy supplies and patterns of use. You will learn physical principles underlying power generation, conventional forms of energy and their social and environmental impacts, sources of renewable energy, and means to transition to more sustainable energy sources. The political, economic, cultural, historical, and policy dimensions of energy procurement, generation, and consumption will show how energy issues are entangled in deeper social and environmental contexts. Human civilization cannot continue using fossil fueled based energy at our present rate of consumption; we must look for ways to decrease and decarbonize our energy use.

This course is divided into five parts. Part 1 reviews energy generation and consumption patterns and the scientific principles related to energy, heat, and work. Part II of this course explores various sources of energy from conventional forms of energy generation and their social and environmental impacts. Part III focuses on renewables including solar, wind, biomass, wave, tidal, hydroelectric, and geothermal. Part IV centers on questions about making infrastructure more sustainable: food systems, transportation, and buildings. In part V, we will synthesize planning efforts and proposals for making sustainable energy transitions.

Course Goals

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

- Understand the nexus of energy challenges and relevant economic, social, and environmental issues.
- Describe the physical principles related to the energy, heat, power, and work
- Complete basic calculations / conversions in energy, heat, power, and work
- Describe the scientific properties and spatial distribution of conventional and renewable energy sources
- Analyze the relative energy use in U.S. to other nations, and the forces that shift the mix of energy sources over time under Climate Change and resource scarcity pressures.
- 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 energy options
- Utilize tools to evaluate an energy option and assess alternatives.

GE Learning Outcomes (GELO)

SLO1: Students will be able to demonstrate an understanding of the methods and limits of scientific investigation. SLO 1 will be assessed in assignments 1, 2, 3 and the final research report.
SLO2: Students will be able to distinguish science from pseudo-science. SLO 2 will be assessed in assignments 2, 3, and 4.
SLO3: Students will be able to apply a scientific approach to answer questions about the earth and environment. SLO 3 is assessed in the final research report and assignments 2, 3, and 5.

Course Learning Outcomes (CLO)

See "Course Goals" above.

Required Texts/Readings

Textbook: Energy for Sustainability: Technology, Planning, Policy 2nd Edition by John Randolph PhD, Gilbert M. Masters ISBN-13: 978-1597261036 ISBN-10: 1597261033 – Available at the university store or Amazon.com http://a.co/3UHwc5e
Link to SJSU library reserve:
https://sjsu-primo.hosted.exlibrisgroup.com/primo-explore/fulldisplay?docid=01CALS_ALMA71454831110002901&context=L&vid=01CALS_SJO&search_scope=EVERYTHING&tab=everything&lang=en_US

Other Readings: Articles and handouts are posted to canvas: https://sjsu.instructure.com/

Library Liaison

Peggy Cabrera <Peggy.Cabrera@sjsu.edu> https://libguides.sjsu.edu/prf.php?account_id=41832

Course Requirements and Assignments

Dropping and Adding: Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, … Refer to the current semester's Catalog Policies.

Grading: Use the percentages below and your scores to monitor your grade. Real time grade will be available along the semester on Canvas.

Credit-hour statement: This three-unit course requires a minimum of 9 hours per week to complete class-related readings and assignments (roughly 2.5 hours in class and 6.5 hours outside class per week.) More details about student workload can be found in University Policy S12-3 at http://www.sjsu.edu/senate/docs/S12-3.pdf

Academic integrity: As part of the GE program, strict enforcement of SJSU Academic integrity rules will be enforced. See the University Policy at https://ischool.sjsu.edu/sites/main/files/file-attachments/academic_integrity_policy_f15-7_0.pdf?1539701808

Online tools and conduct

Technology Requirements: Students are required to have an electronic device other than a smartphone like a laptop, desktop or tablet, with a camera and a microphone. SJSU has a free equipment loan program available for students. Students are responsible for ensuring that they have access to reliable Wi-Fi during tests. If students are unable to have reliable Wi-Fi, they must inform the instructor, as soon as possible are at the latest one week before the test date to determine an alternative. See Learn Anywhere website for current Wi-Fi options on campus.

Proctoring Software and Exams: Exams and Quizzes will be proctored in this course through Respondus Monitor and LockDown Browser. Please note it is the instructor's discretion to determine the method of proctoring. If cheating is suspected the proctored videos may be used for further inspection and may become part of the student's disciplinary record. Online Exams

Testing Environment Setup:

● No earbuds, headphones, or headsets visible.
The environment is free of other people besides the student taking the test.
● If students need scratch paper for the test, they should present the front and back of a blank scratch paper to the camera before the test.
● No other browser or windows besides Canvas opened.
● A workplace that is clear of clutter (i.e., reference materials, notes, textbooks, cellphone, tablets, smart watches, monitors, keyboards, gaming consoles, etc.)
● Well-lit environment. Can see the students' eyes and their whole face. Avoid having backlight from a window or other light source opposite the camera.
● Personal calculators are permitted.
Students must:
● Remain in the testing environment throughout the duration of the test.
● Keep full face, hands, workspace including desk, keyboard, monitor, and scratch paper. Stay in full view of the webcam

Recording Zoom Classes: This course or portions of this course (i.e., lectures, discussions, student presentations) will be recorded for instructional or educational purposes. The recordings will only be shared with students enrolled in the class through Canvas. The recordings will be deleted after 10 days. All recording are only available to registered students in the class.

Students are not allowed to record without instructor permission: Students are prohibited from recording/taking screen captures of all class activities (including class lectures, office hours, advising sessions, etc.), are prohibited of distributing class recordings, or posting class recordings. Materials created by the instructor for the course (syllabi, lectures and lecture notes, presentations, etc.) are copyrighted by the instructor. This university policy (S12-7) is in place to protect the privacy of students in the course, as well as to maintain academic integrity through reducing the instances of cheating. Students who record, distribute, or post these materials will be referred to the Student Conduct and Ethical Development office. Unauthorized recording may violate university and state law. It is the responsibility of students that require special accommodations or assistive technology due to a disability to notify the instructor.

Online Classroom Protocol

- You are expected to come to every class on time.
- Only SJSU registered students are allowed in the Zoom classroom (use your MySJSU Zoom account)
- Your profile name must be the first name, familly name that match SJSU record
- Camera ON is strongly recommended.
- Mic should be OFF.
- Classroom participation gives 2pts in participation grade. If you choose to not participate verbally, you can use the Canvas discussion board opened for the week and ask your question in writing.
- To participate, please use the "raise the hand" on Zoom and wait for the instructor to give you the floor.
- Inappropriate, un respectful, offensive, slur… comments or chat entries will be sanctioned appropriately.
- No cell phone, no side playing on your computer, no emailing, or text messaging during class. If you need to be engaged in these activities, please disconnect from the Zoom session and excuse yourself. You may later on refer to the session recording to get the lecture content.

University Policies

Academic integrity
Your commitment, as a student, to learning is evidenced by your enrollment at San Jose State University. The University Academic Integrity Policy F15-7 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. Visit the Student Conduct and Ethical Development website for more information.
See here for other campus wide policies http://www.sjsu.edu/gup/syllabusinfo/

Grading – Exams
10% weekly Quizzes (about 12 mini-exams, in class, Canvas based and protored) Quizzes are based on key concepts from either (1) the lecture slides (2) the assigned chapter of the text book (3) the assigned readings. Quizzes takes a maximum of 10 minutes of class time, and are always proctored using a Lockdown browser, with the student camera ON during class time.

10% online participation. The class will meet 28 times over the semester on Zoom. Each session, students are eligible to earn 2 participation points by asking a question once a week, bringing a comment to the class discussion, or being the "voice" of their working group. The recording of the lecture will be the proof material regarding the fairness of these point distribution. Follow you class participation grade after each lecture and make sure you are rewarded for doing your part. If you choose to not participate live during the Zoom lecture, you can also get a 2pt discussion grade per week by writing your entry on the week Canvas discussion board (or replying to another student entry).

20% Assignments: As part of the activities in this class, you will complete 3 graded assignments. Late assignments are ALWAYS accepted following these penalty rules: 1 week after due date of unexcused delay -25%, 2 weeks after due date -50%.
Assignment 1 – Unit conversions, power energy, energy/GHGs (SLO 1)
Assignment 2 – Energy and GHG problem sets (SLO 1 & 2)
Assignment 3 – Carbon footprint calculator (SLO 1, 2, & 3)

20% Midterm: Both the midterm and the final exams will be open notebook (your personal typed or handwritten notes). The exams will include short answers and essay questions. Your notebook could contain lecture notes and short annotations on the readings, but all will have to be printed out as the exam proctor software will ban access to all of your computer content. You must bring a calculator to the examinations. You will not have access to any electronic devices (other than a calculator and your Zoom locked down computer for proctor). 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% Final Exam: There will be a comprehensive final exam. Same rules as Midterm exam (see above).

20% Final Research Paper: Students will individually write a research paper related to a book review related to renewable or conventional energy technologies. Each student are choosing a book of their choice from list available at the start of the semester. More details on this assignment will be available on the course website.

Determination of Grades
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 72–75
C- 69–71
D+ 67–68
D 64–66
D- 60–64
F < 60

- NO Extra Credit available (given the workload to deal with in this class).

Grading Information for upper division GE courses (R, S, V)

"Passage of the Writing Skills Test (WST) or ENGL/LLD 100A with a C or better (C- not accepted), and completion of Core General Education are prerequisite to all SJSU Studies courses. Completion of, or co-registration in, 100W is strongly recommended. A minimum aggregate GPA of 2.0 in GE Areas R, S, & V shall be required of all students."

Primary sources for your Final Paper
(choose one book to read over the semester - most can be checked at SJSU library)

"Big Coal, The Dirty Secret Behind America's Energy Future" by Jeff Goodwell
"Dark Money, The Hidden History of the Billionaires Behind the Rise of the Radical Right" by Jane Mayer
"Energy, The Making of the Atomic Bomb, a Human History" by Richard Rhodes
"The Water Will Come, Rising Sea, Sinking Cities and the Remaining of the Civilized World" by Jeff Goodwell
"Cadillac desert: The American West and it's Disappearing Water" by M. Reisner
"Colossus. Hoover Dam and the Making of the American Century" bu Michael Hiltzik
"Green Illusions, the Dirty Secret of Clean Energy and the Future of Environmentalism" by Ozzie Zehmer
"Autonomy, The Quest to Build the Driverless Car and How it Will Reshape our World" by Lawrence D. Burns
"Faster, Higher, Farther. The (Clean Diesel) Volkswagen Scandal" by Jack Ewing
"High Voltage. The Fast Track to Plug-in the Auto Industry" by Jim Motavalli
"Bottled Lightning. Superbatteries, Electric cars and the New Lithium Economy" by Seth Fletcher
"The Great Transition, Shifting from Fossil Fuels to Solar and Wind Energy" by Lester R. Brown
"Reinventing Fire. Bold Business Solutions for the New Energy Era" by Amory B. Lovins
"Solar Power. Innovation, Sustainability and Environmental Justice" by Mulvaney
"A fierce Green Fire" by Philip Shabecoff
"Toward a Zero Energy Home. A complete Guide to Energy Self-Sufficiency at Home" by David Johnston & Scott Gibson
"Let it Shine, The 6,000-year Story of Solar Energy" by John Perlin

Course Schedule

Due to the possibility of changes, always refer to the electronic schedule on Canvas

Energy & the Environment ENVS/ENGR 119 Sec. 3, Fall 2020
Course Schedule

This schedule is subject to change with fair notice. If necessary, the electronic schedule available on Canvas will be updated along the semester on a week to week basis.

(Read = readings, Question = question to think about and answer from the reading, Keywords & concepts = make sure to have a clear understanding of these after class)

8/19 **Part 1. Energy Science Fundamentals - Syllabus + Reading + Quiz 1**

Read (in-class): Vaclav Smil. 2006. Energy. Encyclopedia of World History. Berkshire Publishing.

Q. *What are the key shifts in the evolution of energy use? What changed with the shift from biomass to fossil fuels?*

Keywords & concepts: Energy use in historical/evolutionary perspective, mass and energy flows through ecosystems, energy v. power, stationary and mobile prime movers, energy conversions/conversion efficiencies, primary energy supplies, energy types (mechanical, thermal, chemical, solar, nuclear, electrical).

8/24 **Energy, Society, Environment and Climate Change + Quiz 2**

Introduction to the challenges and dilemmas related to energy and its impacts on the environment. Course and syllabus overview, logistics.

Read (at home): John Randolph and Gilbert Masters. 2011. Energy for Sustainability. Chapter 1 and 2 (p. 3-70).

Read (in-class): Bill McKibben, B. 2012. "Global Warming's Terrifying New Math." *Rolling Stone.* July 24, 2012.

Q. *What are the three numbers to know about fossil fuels and climate change and what do they represent?*

Keywords & concepts: Environmental impacts of energy choices, GHGs quotas to avoid dangerous climate change.

8/26 **Energy Unit & Conversion + Workshop on assign#1 type of problems**

Read (at home): John Randolph and Gilbert Masters. 2011. Energy for Sustainability. Chapter 4, Section 4.1 to 4.3.2 (p., 117–125), section 4.4 to 4.5.2 (p. 127–134) and section 4.8 to end of chapter (p. 157-164).

Q. *What are the differences between forces and energy? What are the key forms of energy? How is electricity made?*

Q. *What units do we use to measure power and energy? How are basic unit conversions calculated?*

Keywords & concepts: First and 2nd laws of thermodynamics, Energy Density, Entropy, Stocks and Flows, Energy units; efficiency.

8/31 **Part II: Energy systems - Coal Energy (lecture)**

Read (at home): John Randolph and Gilbert Masters. 2011. Energy for Sustainability. Chapter 9, Section 9.1 to 9.4.7 (p., 359–274), section 9.5 to 9.6 (p. 376–382).

Q. *How coal is related to the US electricity supply?*

9/2 **Coal Energy (Q/A) + Quiz 3**

Read (in Class)*: Jeff Goodell, 2007. Chapter. The Saudi Arabia of Coal. Big Coal: The Dirty Secret Behind America's Energy Future. NY: Mariner Books, p. 3-20.*

Q. *What state and more specifically coal reserve, is considered the Saudi Arabia of coal? What portion of coal supply does it provide to the USA?*

Keywords & concepts: Coal: regions, uses, sources, formation, Carboniferous period, labor hazards, noxious gases, mountain top removal, coal surface mining. China, export terminals, coal-to-liquids, syngas, clean coal, CCS

9/9 **Group Workshop on assignment #1** - **Assignment 1 due + Final Paper List explained**

9/14 **Natural gas Energy (Lecture)**

Read (at home): Vaclav Smil. 2012. Placing American gas boom in perspective. *The American.* May 3, 2012.

Q. *What are the claims and counter-claims about the American gas boom?*

Keywords & concepts: politics of reserve estimates, Marcellus Shale, impacts to water, natural gas and energy security.

9/16 **Natural gas Energy + Quiz #4**

Read (in Class): Chris Mooney. 2011. The Truth About Fracking. *Scientific American.* November: 80–5

Q. *What are the key scientific debates around fracking? What do we know and not know?*

Keywords & concepts: natural gas production, horizontal slant drilling, hydraulic fracturing, shale, water impacts, risks to drinking water, heating value, chemical energy, heat of combustion

9/21 **Petroleum Energy (Lecture) - Assignment 2 due**

Read (at home): John Randolph and Gilbert Masters. 2011. Energy for Sustainability. Chapter 13, Transportation Energy and efficient vehicles. p. 491-519

Read (in class): Vaclav Smil. 2011. America's oil imports: A self-inflicted burden. *Annals of the Association of American Geographers* 101:1-4.

Q. *What are the factors that drive America's excessive consumption of petroleum?*

Keywords & concepts: Oil & petroleum consumption & production trends, oil impacts, unit: tons of oil equivalent, air pollution & photochemical smog from combustion

Additional, optional information

Global Air Pollution Down to the Neighborhood Level: http://www.citylab.com/weather/2015/08/mapping-global-air-pollution-down-to-the-neighborhood-level/400337/

9/23 **Petroleum Energy + Quiz #5 + Final Paper Student presentation (4 students)**

Read (in class): Jeremy Miller. 2011. The Colonization of Kern County: A story of oil and water. Orion Magazine. January/February.

Q. *What are the largest oil fields in California?*

9/28 **Clean Vehicles: EVs & Hydrogen (Lecture)**
Read (at home): John Randolph and Gilbert Masters. 2011. Energy for Sustainability. Chapter 13, Transportation Energy and efficient vehicles. p.519-538

Q*. What are the primary obstacles to widespread EV adoption?*

Q*. Depending on the feedstock for making hydrogen fuel, it could have substantial benefits or very limited benefits if at all. What are the primary challenges to making hydrogen fuel sustainable?*

Keywords: BEV, Hybrid cars, CAFÉ

9/30 **Clean Vehicles: EVs & Hydrogen + Quiz 6 + Final Paper Student presentation (4 students)**

Read (in class): tbd

10/5 **Carbon Footprint (Lecture)**
Read: Jessica Grady-Bensona and Brinda Sarathyb. 2015. Fossil fuel divestment in US higher education: student-led organising for climate justice. *Local Environment*.

Q. *What factor have helped and hindered divestment movements at US institutions of higher education?*

Keywords & concepts: Carbon Emissions Factor, divestment movement

10/7 **Carbon Footprint + Workshop on Assignment #3 + Quiz 7**

10/12 **Nuclear Power (Lecture) + Assignment 3 Due**
Read (at home): John Randolph and Gilbert Masters. 2011. Energy for Sustainability. Chapter 9, Nuclear Power. p.374-376

Read (in class): Charles Perrow. 2013. Nuclear Denial: From Hiroshima to Fukushima. Bulletin of the Atomic Scientists. 65(5).

Q. What is being denied with nuclear denial?

Keywords & concepts: Sources of nuclear power, nuclear waste, low level radiation, yellow cake, Uranium 235/U238.

10/14 **Nuclear Power + Quiz 8 + Final Paper Student presentation (4 students)**

Read (in-class): Philippe Boudes. "Nuclear Power" In Mulvaney 2011. *Green Energy: An A-to-Z Guide.* SAGE

Q. Is Nuclear a Green, Sustainable, or Renewable Energy?
Read: Alexander Cockburn. 2011. In Fukushima's Wake: How the Greens Learned to Love Nuclear Power. *New Left Review* 68: 75–79.

Q. Why do the greens love nuclear power? What are the consequences of their support for nuclear?

Keywords & concepts: Yucca Mountain, passive design, Chernobyl, Three Mile Island, sources of nuclear fear.

10/19 **Hydro-Power (Lecture)**

Read (at home): John Randolph and Gilbert Masters. 2011. Energy for Sustainability. Chapter 4, Section 4.3.3. p., 125–127.

Q. *How do you estimate the power output of a hydro-electric system?*

Read: Paul Robbins 2012. "Hydro-Electric Power." In Mulvaney 2012. *Green Energy: An A-to-Z Guide.* SAGE Publications.

Q. *What are the different kinds of hydro-electric power systems?*

Keywords & concepts: Hydro-electric power, challenges building dams, different kinds of dams.

10/21 **Hydro-Power + Quiz 9 + Final Paper Student presentation (4 students)**

Read: Marc Reisner. 1993. Chapter 4. An American Nile. Cadillac Desert: The American West and its Disappearing Water. Penguin, New York.

Q. What were some of the challenges encountered at Boulder Canyon?

10/26 **Midterm Review Session Workshop**

10/28 **Midterm Exam (protored on Canvas, live)**

11/2 **Part III. Renewable energy, Wind Energy (Lecture)**

Read (at home): John Randolph and Gilbert Masters. 2011. Energy for Sustainability. Chapter 12. Pp. 461-482

Q. *How is the potential wind power output calculated for a specific site and turbine?*

Keywords & concepts: Wind Power Basics, Power potential

11/4 **Wind + Quiz 10**

Read (in class): Roopali Phadke. 2013. Public Deliberation and the Geographies of Wind Justice. *Science as Culture* 22(2): 247–255.

Q. *How can the social gap in renewable energy be overcome?*

Keywords & concepts: Wind Power, siting challenges, ecological compatibility, the social gap in renewable energy

11/9 **Solar Energy Passive design (Lecture) + Assignment 4 due**

Read (at home): John Randolph and Gilbert Masters. 2011. Energy for Sustainability. Chapter 7.

Q. *Explain passive design for buildings.*

Keywords & concepts: insolation, insulation, solar path, HDD

11/16 **Solar Energy Photovoltaic systems (lecture)**

Read (at home): John Randolph and Gilbert Masters. 2011. Energy for Sustainability. Chapter 11.

Q. *How do photovoltaics generate electricity?*

Keywords & concepts: Solar Photovoltaic (PV) Energy, Solar Thermal Energy, insolation

11/18 **Solar Energy Workshop + Quiz 11 + Final Paper Student presentation (4 students)**

Read (at home): John Randolph and Gilbert Masters. 2011. Energy for Sustainability. Chapter 11.

Q. *How do photovoltaics generate electricity?*

Keywords & concepts: Solar Photovoltaic (PV) Energy, Solar Thermal Energy, insolation

11/23 **Life Cycle Assessment (Lecture)**

Read (at home): John Randolph and Gilbert Masters. 2011. Energy for Sustainability. Chapter 5. Energy Analysis and Lifecycle Assessment.

Q. *What is EROI and how do you calculate it?*

Keywords & concepts: Life Cycle Analysis, EROI, EPBT for PV and Wind

11/30 **Biofuels, low carbon and carbon negative fuels (Lecture)**

Read (at home) : John Randolph and Gilbert Masters. 2011. Energy for Sustainability. Chapter 14. Biofuels Biomass and other alternative fuels.

Keywords & concepts: Second, Third Generation biofuels, water use, water quality.

12/2 **Biofuels, low carbon and carbon negative fuels + Quiz 12 + Final Paper Student presentation (4 students)**

Read (in class): M. Fatih Demirbas. 2011. Biofuels from algae for sustainable development. *Applied Energy* 88: 3473–3480.

Q. *What are the advantages and disadvantages of biofuel production using microalgae?*

Keywords & concepts: Second, Third Generation biofuels, water use, water quality.

12/7 **Energy Efficiency and Conservation Final paper due**

Read (at home): John Randolph and Gilbert Masters. 2011. Market transformation to sustainable energy. Ch. 16

Read (in class) : Tom Dietz. 2015. Altruism, self-interest, and energy consumption. Proceeding of the National Academies of Sciences. 112(6): 1654–1655.

Q. *What motivates people to conserve energy?*

Keywords & concepts: Energy use & conservation

Review session final exam (?)

Final exam:

https://www.sjsu.edu/classes/final-exam-schedule/fall-2020.php

ENVS/ENGR 119-01 (MW 10:30-11:45am), Monday December 14, 9:45am-Noon

ENVS/ENGR 119-02 (MW Noon-1:15pm), Wednesday December 9, 9:45am-Noon