NRES 442/642: Sustainable Energy: Resources, Technologies, and Policies

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Spring 2021
University of Wisconsin-Stevens Point
College of Natural Resources

3 credits
Class Room: CANVAS Zoom (Virtual)
Tues & Thu 12:30-1:45 pm

INSTRUCTOR

Office: TNR 180B; Meeting hours: T 10-11 am, Th 3- 4 pm or by appointment
Zoom : https://uwsp.zoom.us/j/7153462359
Ph. 715-346-2359; Email: shiba.kar@uwsp.edu (preferred method of contact)

COURSE DESCRIPTION AND OBJECTIVE

Can technology solve energy problem to secure a sustainable future? Finding potential sustainable energy solutions warrants assessment of current and potential energy technologies, resources and integrated policy approach. Energy technologies ranging from extraction, conversion, storage, distribution, and use of various energy resources have a significant impact on our living standards, economy and environment. However, often, there are concerns about lack of strong policy support to improve, innovate and implement technologies for efficient use of different energy resources. In this course, we examine the energy challenges from technology, resources, and policy perspectives. Course goals include (1) evaluate scientific and engineering potential and challenges of current and future energy technologies in relation to various available energy resources, and (2) analyze the connections and challenges between energy technologies, resources and policies in existing energy landscapes to ensure sustainable energy supply for our current and future generations. Lecture and discussion topics include energy resources and technology, energy carriers, energy management and storage, energy efficiency technologies in transportation, buildings and industries, energy- land use nexus, integrated policy for future energy technology.

In this course, students will investigate status and challenges of current energy technologies and resources and utilize various tools to formulate a portfolio of policies for each sustainable technology to drive deployment. The class will become familiar with the breadth of energy technology-policy discussion and challenges through development of assessment tools, methods and perspectives to analyze them. The students will develop skills with hands-on training on alternative energy technology and have enhanced understanding of opportunities and policy challenges of large-scale adoption and implementation of the renewable technologies.

COURSE LEARNING OUTCOME

Upon successful completion of this course, you will be able to:

1. Evaluate status and challenges of current energy resources and technologies.
2. Identify and address policy challenges for better integration of energy technologies and resources.
3. Examine and apply a comprehensive energy-planning framework that considers various energy resources, technologies and policy challenges from local to international levels.
4. Collaborate with peers in a team environment and apply diverse sets of ideas, values, beliefs, and world views.
5. Communicate ideas in writing and orally to your peers formally and informally.

INSTRUCTOR'S TEACHING APPROACH

I strongly believe that excellent teaching facilitates lifelong learning and inspires intellectual exchanges that help create a better and informed society. My strategies about teaching include creating a trustworthy and enjoyable teaching-learning environment to nourish the learning process, challenging student curiosity and be challenged, and applying practical examples and experiences from interdisciplinary perspectives that are necessary to solve real-world problems. I believe the purpose of teaching is not to teach students how to memorize facts, or how to come up with right answers; rather understanding the concepts being examined. I look forward to seeing my students become competent natural resource and energy professionals with sound scientific knowledge, skills and real-world experience to better serve the society and contribute to achieving sustainability goals.

READINGS AND OTHER COURSE MATERIALS

There is no required textbook for the course. I have carefully selected the readings and other learning materials to represent the best available science and information on the topics we will be discussing. The readings will form the basis for our discussions and debates in class. I expect you to complete the assigned readings before coming to class and be able to explain, interpret, apply, analyze, and evaluate the material in the class, exams and other assignments. I will post PDF copies of the readings and links to websites and videos in CANVAS. The readings are a work-in-progress and I may amend and/or supplement the list throughout the semester. I will use lectures to emphasize and facilitate your learning on key concepts and theories, but I expect you to learn more from the readings and assignments.

EVALUATION

This course will rely upon a variety of evaluation methods to provide you an opportunity to understand and synthesize semester's work, and achieve the expected learning outcomes:

Assignments/Exams	**Points**	**Due date/ week** (All assignments must be submitted to CANVAS unless otherwise stated)
Class participation/reflections	30	Throughout the semester
Weekly discussion and reflections	50	Throughout the semester
Home energy survey report and team presentation	50	Week 3
Leading discussion (30+30+30 points)	90	Week 2 to 8
Midterm exam	30	Week 8
MREA assessment	50	Week 9 to 12
Group project -Draft submission (30 points) -Project Report (50 points) -Presentation (50 points) -Team collaboration (20 points)	150	 Week 12 Week 14 Week 15 Week 15
Final exam	50	Finals week
Total	**500**	

Final grades will be based on the percentage of the total 500 points that you earn on your assignments. The grading scale listed below indicates what percentages are required to earn a certain grade. The percentage decimal points will be rounded up to the closest number in the grading range. Grades will not be curved.

93-100 =A	87-89 = B+	77-79 = C+	67-69 = D+
90-92 = A-	83-86 = B	73-76 = C	60-66 = D
	80-82 = B-	70-72 = C-	00-59 = F

I will post the grades and feedback in CANVAS with each assignment so that you can track your progress as the course goes along. If at any point you have questions or concerns about your grade or any of your assignments, send me an email (writing "NRES 442" in subject line), I am happy to help!

1. Class attendance and participation (30 points)

Attendance of class lectures and active participation in class discussion is mandatory. For days when you are unable to attend a lecture in synchronously, use the asynchronous participation discussion thread CANVAS to earn participation points.

2. Weekly discussion and reflections (50 points)

There will be a weekly discussion thread in CANVAS. You will be asked to post key takeaways from each week's assigned readings, lectures and discussions. You can also consider to post questions, comments, news, events, photos, videos, and other relevant topics and issues of the week that help increase our understanding of energy resources, technologies and policies.

3. Home Energy Survey class presentation and report (50 points)

To gain some first-hand experience in identifying and analyzing various energy technologies and resources, you will conduct a home energy survey as a team. Each student will do at least 2 household energy surveys- one from your own family household and another household of your choice. The survey will include various types of energy devices/technologies, appliances, equipment, electronics, automobiles or other machineries that are used at the household level. You will make an inventory list, identify most and least energy consuming devices/technologies/ appliances/ electronics/equipment, and analyze their sources of energy resources. Explore what alternative energy efficient technologies and sources of energy could be used but currently are not being used. Also, list if there are any energy-related incentives that households are aware of and/or receiving now. Then state what kind of incentives could help the households switch to more sustainable alternative energy sources and technologies. Each team will present their comparative survey findings to class and will submit a team report (1,000 words, single space) on the survey.

4. Leading discussions (30+30+30= 90 points)

As a group, you will be assigned three different energy technology topics and you will lead discussions during class in 3 different weeks. We will discuss this in the first week and each group will be assigned the topics and weeks they will be leading the discussion. Your discussion should include a brief (about 20 minute) Powerpoint overview of the energy technology, details on the energy resources and mechanism involved, status, challenges and promise of the energy

technology. You must submit the powerpoint slides in Canvas before the discussion class. Your group will also come up with a series of questions and innovative group-exercise to involve the class and discuss (about 20 minutes).

5. Mid-term Exam (total 30 points)

Midterm exam will focus on class lectures and reading materials delivered and discussed until the week before the exam. More details on the exam will be shared as class progresses.

6. MREA Assessment (50 points)

You will learn more in detail on Solar and Wind energy technologies through several online modules, guest lecture and a full-day hands-on workshop at MREA (Midwest Renewable Energy Association). There will be several quizzes and a test on learning from the workshop that would total 50 points. With ongoing COVID-19 pandemic situation, we might consider gaining all learning and skills through online modules only. More details will be provided as we progress through those modules and the workshop.

7. Group Project Assignment (150 points)

I will assign you to a group for the semester in first few weeks of the class. I expect you to actively collaborate with your team and work on group project including presentation and report writing. The purpose of this assignment is to enhance your understanding on various energy resources, technologies and solutions. This would give you an opportunity to summarize what you have learned throughout the semester and apply a comprehensive energy planning framework that considers energy resources, technologies and policy challenges. Your group must select a community (municipality/county) as a case and will collaborate and investigate various types of energy sources/technologies that would help the community move towards energy sustainability. You will also consider energy efficiency, green building and design, smart grid, microgrid and storage technology and policy solutions. You will compare and analyze various energy technologies, identify barriers and challenges in adopting them, relate how energy policy could play an effective role to integrate various sources of energy and technology to secure a sustainable energy future. Each group will submit a draft report and make a group presentation to share their findings and policy recommendations with the class. The group should incorporate suggestions from the instructor and other students in class when writing a detailed project report (about 3,000 words, single space). I will provide more details on the assignment when introducing this in class.

No Late Assignments are expected. To receive full credit, all assignments must be uploaded to the drop-box on the course CANVAS site or otherwise turned into me prior to the stated date (by 5 pm). Assignments turned in after the deadline will be considered late and will be subject to 10% per day late penalty. For example, a 50-point assignment that is two days late will, at most, be worth 40 points. Written work presented in an improper manner (see plagiarism discussion below) will result in you having to rewrite the assignment, and/or a reduction in points earned.

8. Final exam (50 points)

The final exam will be based on class lectures and reading materials covered throughout the semester. More details on the exam will be shared as class progresses.

ACADEMIC INTEGRITY

I do not tolerate plagiarism or cheating. Plagiarism of any type in your work is academic misconduct and unacceptable – consequences for plagiarism may range from an oral reprimand to expulsion from the University. Plagiarism is defined as deliberate or accidental use of ideas, research or words of another person without fully attributing them to their original sources. According to the *Merriam-Webster Online Dictionary*, to "plagiarize" means 1) to steal and pass off (the ideas or words of another) as one's own 2) to use (another's production) without crediting the source 3) to commit literary theft 4) to present as new and original an idea or product derived from an existing source. Obvious examples of plagiarism include turning in someone else's work as your own, cutting and pasting website text into a paper, or failing to properly cite another author's work. Less obvious forms of plagiarism involve paraphrasing the work of another author (or student) by simply rearranging a few words. All work must be your own. Do not copy or hand in the work of other students, authors, sources. When using other sources in your writing, be sure to credit those sources both within the text and at the end of your reports/papers. If you have any questions about what constitutes plagiarism, please review the resources available at http://library.uwsp.edu/guides/vrd/plagiarism.htm and talk with me.

All assignments submitted via a dropbox in CANVAS are automatically linked to turnitin.com (software designed to detect plagiarism). I have set up the drop box to allow you to submit assignments multiple times after reviewing the score provided by the TURNITIN software. Please designate the one you want me to grade by starting the document title with the word "Final". If it appears to me that potential plagiarism or academic misconduct has occurred, I will initiate the disciplinary process outlined in Chapter 14 of the University of Wisconsin System Code. If the potential plagiarism or academic misconduct has occurred in relation to a group project, I will initiate the disciplinary process for all the students in the group.

ACCESSIBILITY STATEMENT

If you have a learning or physical challenge which requires classroom accommodation, please contact the UWSP Disability Services office with your documentation as early as possible in the semester. 103 Student Services Center, (715) 346-3365; TTY (715) 346-3363; www.uwsp.edu/special/disability/studentinfo.htm

TENTATIVE CLASS SCHEDULE

The instructor reserves the right to make changes to the syllabus and schedule when necessary to meet the learning needs of the students, compensate for canceled classes or other unforeseen circumstances.

Week/Date	Topics	Readings & Assignments
Week 1: Jan 26-28	Introduction, review syllabus, & icebreaker An overview on energy resources and technologies	**Introduce course syllabus; Form groups and assign leading discussion topics** Energy Resources: http://energy.gov/science-innovation/energy-sources DOE Energy Technology Transitions https://energy.gov/technologytransitions/office-technology-transitions **Introduce Home energy survey**
Week 2: Feb. 2-4	Coal resources and technology Petroleum resources and technology	DOE Coal: https://www.energy.gov/coal Fossil fuels and fossil energy (ester et a. 2012, Ch. 8)- supplemental reading DOE Oil: https://www.energy.gov/oil Oil Prices: What's Behind the Volatility? https://www.nytimes.com/interactive/2016/business/energy-environment/oil-prices.html?_r=0
Week 3: Feb 9-11	Natural gas resources and technology Nuclear resources and technology	**Groups present home energy survey observations** Natural gas abundance https://www.nytimes.com/2014/12/23/science/natural-gas-abundance-of-supply-and-debate-.html?_r=0 Natural gas technology http://naturalgas.org/environment/technology/#resources Sustainable energy: Nuclear? http://www.world-nuclear.org/information-library/energy-and-the-environment/sustainable-energy.aspx **Due: Home energy team survey report Thursday.**
Week 4: Feb 16-18	Solar energy and technology Wind resources and technology	Renewable Energy sources: http://energy.gov/science-innovation/energy-sources/renewable-energy Types of Renewable Energy: https://www.eia.gov/energyexplained/?page=renewable_home

Week 5: Feb 23-25	Hydropower technology Tide and wave energy resources and technology	**Introduce group project assignment** DOE Water: https://www.energy.gov/science-innovation/energy-sources/renewable-energy/water
Week 6: Mar. 2-4	Geothermal energy resources and technology Wood energy resources and technology	DOE Geothermal: https://www.energy.gov/science-innovation/energy-sources/renewable-energy/geothermal Bioenergy technologies https://www.energy.gov/eere/bioenergy/bioenergy-technologies-office
Week 7: Mar 9-11	Biogas technology Biofuels resources and technology	Biogas Technology http://www.epa.gov/agstar/documents/chapter1.pdf Biofuels technology http://www.advancedbiofuelsassociation.com/page.php?sid=2&id=5 Where are we with algae biofuels? http://www.biofuelsdigest.com/bdigest/2014/10/13/where-are-we-with-algae-biofuels/
Week 8: Mar 16-18	**Mid-term Exam** Summarize and discuss all energy technologies	**Exam in CANVAS** Hydrogen fuel basics: https://www.energy.gov/eere/fuelcells/hydrogen-fuel-basics
Spring Break!		
Week 9: Mar. 30-Apr. 1	Green building and sustainable design Transportation and energy storage technologies	Green building: http://www.epa.gov/greenbuilding/ Future of sustainable design: http://www.forbes.com/sites/rahimkanani/2014/03/07/the-future-of-sustainable-design/ Industrial energy efficiency: http://www.energystar.gov/buildings/facility-owners-and-managers/industrial-plants Vehicle technologies http://energy.gov/eere/vehicles/vehicle-technologies-office DOE Storage: https://www.energy.gov/science-innovation/electric-power/storage

Week 10: Apr 6-8	MREA Solar online module 1 MREA Solar online module 2	**Introduce online modules** **Group project work**
Week 11: Apr 13-15	MREA Wind technology module 1 MREA Guest speaker- Nick Hylla, TBD	**Review module learnings; Group project work**
Week 12: Apr 20-22	**Whole day** hands-on energy workshop at MREA (Apr 17, TBD) (No classes this week, meet Friday for workshop at MREA)	**MREA Test/assessment** **Group project draft due Thursday**
Week 13: Apr 27-29	Grid systems and microgrid technologies Energy and land use	Electricity basics: https://www.energy.gov/ne/downloads/lesson-2-electricity-basics Smart Grid: http://energy.gov/oe/services/technology-development/smart-grid Outka 2012 J. of land use Article: Energy-land use nexus Energy, water and land: http://nca2014.globalchange.gov/report/sectors/energy-water-and-land
Week 14: May 4-6	Energy technologies and policies Policies for better integration of energy resources and technologies	**Discussion on group presentation** Littlefield 2013. Security, independence, and sustainability: Imprecise language and the manipulation of energy policy in the United States, *Energy Policy*. Manley et al. 2013. A survey of energy policy priorities in the United States: Energy supply security, economics, and the environment, *Energy Policy*. **Due: Group project paper Thursday**
Week 15: May 11-13	Group presentation Group presentation/wrap- up	**Group 1 and 2** **Group 3 and 4**
Final Exam: Available in CANVAS 5/18 @ 6 am to 5/20 @ 6 am		