BBE 2201: Renewable Energy and the Environment

Course Syllabus

(3 credits – Meets Society and Technology Liberal Education Requirement)

Catalog Description:
BBE 2201 provides an overview of society’s energy needs, current energy sources, the developing and emerging renewable energy sources, and their economic, environmental, and societal implications.

Course Description:
There is a growing sense of national and global urgency regarding carbon and climate change with particular emphasis on our energy system. Unfortunately, the answers are not simple. In this course, students explore our wide range of traditional and renewable energy sources and how these options impact our environment and society. Students are also exposed to the complex and compelling ethical issues raised by global, national and local changes in how we produce and use energy.

This course informs and engages students to be thoughtful, rather than passive, consumers of energy. Students gain the knowledge necessary to be articulate in career, community, and personal arenas regarding renewable energy resources. In addition, students develop the ability to evaluate and respond to present and future technological changes that impact their energy use in the workplace, at home, and in the community.

Student Learning Outcomes:
Having successfully completed this course, students can:

- Identify and describe present energy use, trends, and impacts.
- Describe the diverse renewable energy technologies that are available to individuals, businesses, and communities.
- Understand how differing societal perspectives impact individual and community choices regarding renewable energy technologies.
- Analyze the potential challenges and opportunities with various renewable energies.
- Understand the environmental, technical, policy, and economic implications of each of the renewable energy opportunities.
- Develop the ability to make informed personal, career, and public decisions regarding energy use for today’s global world.

Course Format:
This course is completely online, providing student’s flexibility with their schedules. Each lesson is available approximately one week before the lesson due date and closed on the date stated in the lesson. A short introduction to each lesson and its topic is provided by the instructor. Students are then provided with a more in-depth analysis of the topic often by an expert in the field through a recorded lecture. Students further explore the topic through reading assignments and/or videos, and can venture deeper into areas of their interest through suggested additional readings. Each lesson ends with a short quiz related to the lesson as well as a writing assignment. Assignments, content, and delivery methods vary from lesson to lesson depending on the topic.
Credit Hours: 3. Meeting Society and Technology Liberal Education requirement

Prerequisites: None

Course Schedule:
- 29 lessons
- Fall/Spring Term: 2 lessons per week with due dates on Tuesday and Thursday
- Summer Term: 4 lessons per week with due dates Monday through Thursday

Course Instructors:
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Instructor Contact Information:
Please email bbe2201@umn.edu for any course communication between you and the course instruction team. This email is monitored and responded to regularly throughout the day and evening with typical response times of 12 hours or less.

Required text and readings:
All readings, videos, and other instructional materials are provided online via the Moodle website.

Software Requirements:
Chrome and Firefox are the browsers that work best with Moodle. Safari is acceptable also. Do not use Windows Internet Explorer as it generally does not work well for many Moodle features. In addition, you must be able to open the following file formats: .pptx, .ppts, .docx, .pdf files, .mov, and other video files. Each of these file types should be tested in the first lesson.

Technology Support: Moodle Help Desk: http://www1.umn.edu/moodle
Attendance and Participation Requirements:
This course is completely online. This allows students to access the lectures and complete their assignments when it is most convenient. The workload expectation for this course is approximately 9 hours per week averaged over the semester (per university policy). However, the pace of the class is set with lessons made available as the semester or summer term progresses with set deadlines and due dates for completion. There are no face-to-face requirements for the course.

Course Topics:

Unit 1, Energy Overview: Lesson 1-4 (2 weeks)
An introduction and overview of energy and the role of both fossil fuels and renewable energy options in society and the environment. Key concepts include:
- The carbon cycle - where carbon comes from (sources) and where does it go (sinks). The role of carbon in our atmosphere and ecosystem. Trends in atmospheric carbon.
- Life Cycle Assessment – an overview of the accounting system used to determine the relative contributions of carbon emissions from products and services. Several examples are provided with a focus direct and indirect carbon emissions with purchased products, food choices, and transportation, as viewed in terms of a personal carbon footprint.
- Climate change and weather - exploring the current science of climate change. What is the difference between natural climate cycles and current climate trends?
- Discussion of terms and units such as kinetic, potential, chemical and electrical energy, BTU, energy density, watts, kilowatts, and kilowatt hours.

Unit 2, Fossil Fuels: Lessons 5-11 (7 weeks)
A detailed look at our current fossil fuel based energy system with a review of technologies, trends, policies, and environmental implications for petroleum, natural gas, and coal. Key concepts include:
- Reserves/supply, exploration, extraction, refining, and distribution, and environmental impacts, social implications of petroleum, natural gas and coal.
- Environmental impacts with topics such as pipeline vs rail transportation, oil spills, fracking, and CO2 emissions.
- Transportation efficiency and conservation including fuel economy, efficiency measures, CAFÉ standards, alternative vehicles, economics implications, etc.
- Home energy efficiency and conservation concepts including heat loss and insulation in buildings, phantom power, lighting efficiency, appliance efficiencies, and home energy audits. (EISA, Energy Star, etc)
- Industrial and commercial energy use, conservation, and efficiency covering areas of heating, lighting, compressed air, motors, and manufacturing processes. Discussion includes relevant policies, programs, and other economic incentives. (NextGen, ISO 50001, Benchmarking)

Unit 3 Part 1, Biomass to Liquid Fuels: Lessons 12-17
An overview of biomass technologies and their current and future uses in society and a discussion of related policies, environmental concerns, and economic issues. Key concepts include:
- Challenges of integrating renewable fuels into our current transportation system
- Concepts of first generation, second generation, advanced biofuels and biomass refineries.
- Logistics of the biomass to fuel supply chain, net energy balance of these systems and how these
systems impact land use and the environment.

- Biological and chemical conversion of biomass to ethanol, biodiesel, and other fuels
- Progress on algae for fuel along with other designated biomass crops.
- Renewable Fuel Standard and other related policies.

**Unit 3 Part 2, Biomass/Waste to Energy: Lessons 18-20**

Biomass to energy conversion with a focus on waste products. With each of these technologies we include an overview of the technology, environmental controversies, economics, and policy drivers.

- Municipal waste to energy systems technologies. (WTE facilities)
- Anaerobic digestion technology to convert organic waste such as farm, food and wastewater to produce biogas.
- Wood waste and designated woody biomass crops and the conversion to combined heat and power.

**Unit 4, Renewables: Lessons 21-27**

This unit provides an in-depth study of the most popular renewable energy technologies and trends in the industry. With each of these energy sources we include an overview of the technology, economics, environmental implications of their use and expansion and related policies.

- Hydroelectricity: Hydroelectric dams and wave energy.
- Wind energy from both land and water based systems.
- Solar energy including solar thermal, solar photovoltaic, and concentrated solar power
- Nuclear energy: The technology, challenges, and the importance of this low carbon (yet not renewable) energy source in our energy system.
- Deep geothermal for electricity and heating.
- Ground source heat pumps for heating and cooling.
- Fuel cells – a brief description of operation and challenges.

**Unit 5, Policy and Community Engagement: Lessons 28 and 29.**

The final unit focuses on understanding the policy implications and political climate that impacts the development of renewable energy sources. Key concepts include:

- Policy options, market forces and economic drivers that effect energy in the US. With particular attention to the Minnesota Renewable Portfolio Standard, Next Gen Act, EISA, CPP
- Personal responsibility, life-long learning, and involvement through community-based energy organizations.
BBE 2201 Grading Breakdown:

<table>
<thead>
<tr>
<th>Description</th>
<th>Percent of Total Grade</th>
<th>Maximum Total Points Possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Quizzes</td>
<td>~ 1 per lesson</td>
<td>36%</td>
</tr>
<tr>
<td>Daily Assignments</td>
<td>~ 1 per lesson</td>
<td>32%</td>
</tr>
<tr>
<td>Do Something and Report it (DSARI)</td>
<td>An active energy-related project with report or presentation.</td>
<td>10%</td>
</tr>
<tr>
<td>DSARI Peer Review</td>
<td>Assess two of your peers' DSARI projects.</td>
<td>2%</td>
</tr>
<tr>
<td>Final Paper</td>
<td>Theme/conference paper on an energy topic related to major</td>
<td>10%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>Comprehensive, open-notes exam</td>
<td>10%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100%</td>
</tr>
</tbody>
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Grading Scale: This course offers both A–F and S/N grading options. If you are taking this course S/N, you must earn a C– or better (70%) to achieve a grade of S. If you are taking this course A–F, your grade is determined as follows:

<table>
<thead>
<tr>
<th>Percentage Achieved</th>
<th>Course Grade</th>
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</thead>
<tbody>
<tr>
<td>93.00-100.00</td>
<td>A</td>
</tr>
<tr>
<td>90.00-92.99</td>
<td>A–</td>
</tr>
<tr>
<td>87.00-89.99</td>
<td>B+</td>
</tr>
<tr>
<td>83.00-86.99</td>
<td>B</td>
</tr>
<tr>
<td>80.00-82.99</td>
<td>B–</td>
</tr>
<tr>
<td>77.00-79.99</td>
<td>C+</td>
</tr>
<tr>
<td>73.00-76.99</td>
<td>C</td>
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<tr>
<td>70.00-72.99</td>
<td>C–</td>
</tr>
<tr>
<td>67.00-69.99</td>
<td>D+</td>
</tr>
<tr>
<td>60.00-66.99</td>
<td>D</td>
</tr>
<tr>
<td>0.00-59.99</td>
<td>F</td>
</tr>
</tbody>
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Details of Course Assessments:
There are 29 lesson assignments over the course of the semester. In order to assess your knowledge of the lessons, quizzes and short reflections or forums are assigned for each lesson. These assignments become available when the lesson opens (approximately 1 week before the lesson is scheduled). In addition, there is a DO SOMETHING project, a final paper, and a final exam.

Lesson Assessment: Quiz (~36%): After every lesson is complete, there is a 10-15 point online quiz related to what you just learned. Quiz questions include, but are not limited to, multiple choice, T/F, short answer, matching, and essay. The quizzes are timed and you are allowed only one attempt. Expect approximately 29 quizzes over the course of the semester for a total of approximately 360 points (36%). Late quizzes will not be accepted. Once the quiz is closed, it is not possible to submit the quiz.

Lesson Assessment: Reflection or Forum (~32%): Every lesson also includes a 10-15 point writing
assignment. Typically, this involves a short reflection asking you to summarize or analyze the materials presented. These reflections typically require 200-250 words, unless specified otherwise. The grading for these reflections is as follows:

- We are looking to see if you answered all parts of the question. We expect original thoughts and synthesis of content into your writing. Point reductions are at the discretion of the grader.
- Late submissions are accepted, but receive a 1 point deduction for each day late.
- For more information on writing assignments and how to properly summarize without plagiarizing, see the Writing Expectations section on page 6 of this syllabus.

Due dates for all lesson assignments are listed in the Lesson title on the Moodle website where they are posted. For example, a due date of 09/07/2019 means that any lesson assessment (quiz, reflection or forum) must be submitted by 11:55 pm on 09/07/2019. Lessons open approximately one week before the due date so there is plenty of time to work ahead and ensure your assignments are turned in on time. It is recommended to work ahead a lesson or two to help avoid missing due dates due to emergencies (illness, computer failure, etc.)

Do Something and Report It (DSARI) Project (10%): DSARI Projects have been the most fun and beneficial assignment of the semester for students. For this 100 point assignment, you are required to participate in an energy-related activity (Do Something - related to topics covered in the course) and report back creatively to the class. This project allows us all to learn from each other. We expect you to spend about 10-15 hours of effort on this assignment. The project must show a clear connection to energy and you must DO an activity. Once assigned, the course website (block 30) contains details of the assignment, plus sample projects, project ideas, upcoming events, and other resources for the DSARI project.

Peer Review of Do Something and Report It (DSARI) (2%): In addition to submitting a DSARI project, you are required to assess two of your peers’ projects. This assignment is worth 20 points. These peer reviews are based on the rubrics listed in the DSARI assignment. Peer reviews are conducted in Moodle. Requirements for the peer review are clearly outlined in Block 30 on the course website.

Final Paper (10%): For this assignment you are asked to research a traditional or renewable energy topic related to your major and prepare a report. During this course, we only scratch the surface of many important energy topics, so we want you to learn how to review, discuss, and synthesize complex energy related topics and issues. Several final paper format options exist and, once opened, the course website (Block 31) contains the specific requirements, topic ideas, sample papers, writing guide, grading rubrics, guidelines for formatting, writing techniques, and citations. The expected length of the paper is approximately 2000 words.

Final Exam (10%): The final exam opens one to two weeks prior to the due date. It covers everything from Day 1 until the final lecture. It is worth 100 points. Question types include, but are not limited to, multiple choice, T/F, short answer, matching, quantitative, and essay. The exam is timed (3 hours).

Writing Expectations for the Course:
To meet the requirements for this online course, you must submit original work for all assignments. Original work involves reading, evaluating, synthesizing, and reporting in your own words. Cutting
and pasting or paraphrasing without citation is plagiarism, whether from the Web or any other source.

You are expected to follow established standards of academic integrity in this online course. You must cite all your references—whether from books, magazines, Web sites, or personal sources—to differentiate between your ideas and work and those of others. It is acceptable to reflect on and synthesize the ideas of other people, with proper citation of your sources. It is not acceptable to imply that those ideas are yours or to use them without attribution.

Your assignments should be free of errors in grammar, punctuation, spelling, and usage. Please take the time to edit and proofread carefully. If you have trouble identifying errors in your own writing, you might ask someone else to give your assignments a careful review before you submit them.

**Expectations for Writing Assignments**

The key to doing well on lesson assignments is to think critically about the reading/viewing material and make an honest effort to communicate your own ideas. Here are some general guidelines used in grading assignments.

- Address all parts of the question/assignment.
  - Some assignments are highly structured, while others have a more open format. Be sure that you have addressed all parts of the questions asked. Points are deducted if an omission is significant.

- Write in your own words.
  - We want to know what **YOU** think. Short quotes may be used, but are generally not necessary. Assignments that contain an excessive amount of quoted material may not receive full credit.
  - Cite statistics, claims, and ideas that you use in your reflection. Formal citations are not necessary, except in the final paper where formal citations are required, but you should provide some indication of the source of your information, such as a website reference.
  - Assignments which have been plagiarized will not be accepted. See the course policy on plagiarism for clarification (page 8).

- Submit work on time.
  - Late reflections and forums receive a 1 point deduction for each day late. The instructor may waive or extend deadlines under special circumstances (Example: the UMN Moodle site crashes).
  - Students may not re-submit writing assignments for additional credit after the deadline.

- Meet the targeted word count requirement for the assignment.
  - A “target” word count is suggested for each assignment, based on work required to do a good job answering the questions. We do not automatically deduct points for not meeting this target, but often it is a sign to instructors that you did not dig deep enough into the topic.

**University of Minnesota Center for Writing**

The University of Minnesota, Center for Writing provides information to all students about a wide range of writing assistance resources—including the online UMN Center for Writing where you can send your writing in for tutor review and feedback. This information can be found at: [www.writing.umn.edu](http://www.writing.umn.edu).
NOTE: The Center for Writing is NOT available during the summer term.

If you live in or near the Twin Cities, consider using the services of the student writing support offices, which offer free 45 minute consulting sessions, available by appointment or on a walk-in basis. Call 612-625-1893 or check the student writing support page for a list of these offices and their current hours of operation. If you live outside of the Twin Cities metro area and need writing assistance, you may also contact the UMN Center for Writing or check with local schools, libraries, or other community resources to find out if similar tutorial help is available to you.

To ask a UMN librarian a question about citations or anything else, go to: https://www.lib.umn.edu/#askalibrarian.

Student Academic Integrity and Scholastic Dishonesty:
Academic integrity is essential to a positive teaching and learning environment. All students enrolled in University courses are expected to complete coursework responsibilities with fairness and honesty. Failure to do so by seeking unfair advantage over others or misrepresenting someone else’s work as your own, can result in disciplinary action. The University Student Conduct Code defines scholastic dishonesty as follows:

- Scholastic Dishonesty: Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis.

- Plagiarism: As described in the UMN Student Conduct Code, plagiarism includes borrowing concepts, words, sentences, paragraphs, chapters, or entire articles from a source without proper acknowledgment. You must use quotation marks and citations to properly acknowledge your sources, including all material that you find on the Web. Plagiarism also refers to copying another student’s assignment and submitting it for grading as if it were your own. You are equally guilty of scholastic dishonesty if you allow another student to copy your assignment.

Within this course, a student responsible for scholastic dishonesty can be assigned a penalty up to and including an "F" or "N" for the course. If you have any questions regarding the expectations for a specific assignment or exam, ask.

More information on expectations and policy can be found at the Office for Student Conduct and Academic Integrity at the following website: www.oscai.umn.edu

Other University of Minnesota Policies & Resources can be found at the University-wide Policy Library: http://policy.umn.edu/