

Course Syllabus

BBE 2201: Renewable Energy and the Environment

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

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Catalog Description:

Tired of high energy bills? Should you be investing in solar energy? What is the real connection between climate change and energy? What is wrong with our current energy system? Do we have enough oil? What really is “renewable energy” and why is it important to society? Can algae really be used for fuel? These, and so many more topics, are part of the course discussion. Throughout the semester we will present various aspects of renewable energy including the technologies, policies, and the social, environmental, and economic effects of using renewable and non-renewable sources. Please check out the [public course website](http://bbe2201.cfans.umn.edu/) (<http://bbe2201.cfans.umn.edu/>) for more information and to find out what your peers are saying about it.

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.

Liberal Education Component:

“Liberal Education is an approach to learning that empowers individuals and prepares them to deal with complexity, diversity, and change. It provides students with broad knowledge of the wider world (e.g. science, culture, and

society) as well as in-depth study in a specific area of interest" (aacu.org). BBE2201 is focused on our energy system, but energy cannot be discussed in isolation. Energy touches on a wide variety of topics including science and technology, environment, policy, economics, and ethics. You will be required to remember some 'energy facts', but primarily we teach you how to think more broadly seeing the connections of our everyday activities to energy and evaluating options for better decision-making. For instance, we will illustrate to you how a wind turbine works, but spend more time talking about how they fit into the bigger energy picture and why they may or may not be important to society. Learning about energy requires asking questions, discovering connections, weighing options, and finding solutions that meet multiple objectives or result in multiple benefits. This course will provide you ample opportunity to address energy considerations in nearly every lesson. The world is a complex place with no easy answers for any question or controversy. Methods you will use to think about energy in this course are applicable for dealing with other complex questions facing the world.

Technology and Society Theme:

Our food, water, and energy systems make up the biggest challenges our planet has ever faced. Our energy system is at the core of these three issues. In addition, because of our reliance on fossil fuels, our energy system is at the forefront of the critical problem of climate change. As a student you will discover these connections and learn how to critically evaluate the options that are available. You will discover that there are no simple solutions or solutions that don't have some negative consequences. We are facing a real crisis (ie., carbon/climate change) at this time in human history and we can all make an impact or contribution. No matter what your major or path in life you choose, you can play a role in our future energy system.

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 world.

Course Format:

This course is completely online, providing students flexibility with their schedules. Each of the 28 lessons are available approximately one week before the lesson due date and closed on the date stated in the lesson. A short written 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 through materials supplied by the instructors in written form or recorded lecture, by experts in the field (typically other campus faculty but sometimes business leaders), and occasionally, YouTube videos such as Ted Talks. Students further explore the topic through reading assignments and/or additional videos, and can venture deeper into areas of their own interest through suggested optional readings. Each lesson ends with a short quiz (or quizzes) related to the lesson as well as a writing assignment (reflection). Assignments, content, and delivery methods vary from lesson to lesson depending on the topic.

Credit Hours and Time Commitment (3 credits):

Based on University of Minnesota criteria, a 3-credit course requires student effort of 105 hours per semester (7.5 hours/week x 14 weeks). This requirement is fulfilled through 28 online lectures and required readings for each lesson followed by a corresponding quiz and writing assignment (about 2.5 hours per lesson or 5 hours per week). In addition, there is an experiential learning project, a final research paper, and a final exam. These additional items will require an additional 35 hours of your time (an additional 2.5 hours per week). This student engagement requirement is significant but we hope that every minute spent on this course is valuable.

Prerequisites: None

Course Schedule (28 lessons):

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

Course Instructors:

- **David Schmidt**, M.S., P.E. Department of Bioproducts and Biosystems Engineering, Phone: 612-625-4262, Email: [schmi071@umn.edu \(mailto:schmi071@umn.edu\)](mailto:schmi071@umn.edu)
- **Cindy McComas**, M.S. CE, Adjunct Associate Professor, Department of Bioproducts and Biosystems Engineering, Phone: 651-231-2868, Email: [mccom003@umn.edu \(mailto:mccom003@umn.edu\)](mailto:mccom003@umn.edu)

Instructor Contact Information:

Please email [bbe2201@umn.edu \(mailto:BBE2201@umn.edu\)](mailto: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 2 hours or less during business hours and 12 hours on weekends and evenings.

Office Hours:

There are no official office hours, since communication for this on-line course is largely through email. However, instructors are happy to meet with you if needed. Just contact them via email or phone to set up a date/time to meet.

Required Text and Readings:

All readings, videos, and other instructional materials are provided online via the Canvas website.

Software Requirements:

Chrome and Firefox are the browsers that work best with Canvas. Safari is acceptable also. Do not use Windows Internet Explorer as it generally does not work well for many course features. In addition, you must be able to open the following file formats: .pptx, .ppts, .docx, .pdf files, .mov, and other video files.

Technology Support:

Canvas Help Desk (bottom left red bar on canvas page) or UMN Canvas Support at ([canvas@umn.edu \(mailto:canvas@umn.edu\)](mailto:canvas@umn.edu))

Attendance, Participation, and Disability Policy:

This course is completely online. This allows students to access the lectures and complete their assignments when it is most convenient. The pace of the class is organized 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.

To make up work due to absence or illness, you **MUST** have a justified, excused letter from the doctor to receive an extension for lesson deadlines missed. To secure an excused absence, you must, to the best of your ability, contact the instructor before missing lesson deadlines to explain why you will be absent, request an excused absence, and have a legitimate reason for absence as defined by the University of Minnesota. You must provide written documentation as soon as is reasonably possible. According to UMN policy, **legitimate absences** (<https://policy.umn.edu/education/makeupwork>) are for:

- Verified illness
- Participation in athletic events or other group activities sponsored by the University
- Serious family emergencies
- Subpoenas
- Jury duty
- Military service
- Religious observances

Disability Accommodations and Mental Health Considerations

The University of Minnesota views disability as an important aspect of diversity, and is committed to providing equitable access to learning opportunities for all students. The Disability Resource Center (DRC) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations.

- If you have, or think you have, a disability in any area such as, mental health, attention, learning, chronic health, sensory, or physical, please contact the DRC office on your campus (UM Twin Cities - [612.626.1333](tel:612.626.1333)) to arrange a confidential discussion regarding equitable access and reasonable accommodations.
- Students with short-term disabilities, such as a broken arm, **can** often work with instructors to **minimize** classroom barriers. In situations where additional assistance is needed, students should contact the DRC as noted above.
- If you are registered with the DRC and have a disability accommodation letter dated for this semester or this year, please contact us early in the semester to review how the accommodations will be applied in the course.
- If you are registered with the DRC and have questions or concerns about your accommodations please contact your (access consultant/disability specialist).
- Additional information is available at the DRC website: <https://diversity.umn.edu/disability/> (<https://diversity.umn.edu/disability/>)

We care about your mental health. As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. We also understand that course requirements can have an impact on your mental health. These mental health concerns or stressful events may lead to diminished academic performance or reduce your ability to participate in daily activities. University of Minnesota services are available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of

confidential mental health services available on campus via www.mentalhealth.umn.edu
(<http://www.mentalhealth.umn.edu>).

Course Topics:

Unit 1. Energy Overview: Lesson 1-4

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 5-12

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, including the policy implications and political climate that impacts the development of various energy sources. Key concepts include:

- Reserves/supply, exploration, extraction, refining, and distribution, 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
- 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. (Next Generation Energy Act, ISO 50001, benchmarking)
- Policy options, market forces and economic drivers that effect energy in the US, with particular attention to the Minnesota Renewable Portfolio Standard, Next Generation Act, EISA, CPP

Unit 3. Biomass to Liquid Fuels: Lessons 13-17

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 4. 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 5. Renewables: Lessons 21-28

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. We wrap up with exploring community-based energy organizations.

- Hydroelectricity: Hydroelectric dams and wave energy
- Solar energy including solar thermal, solar photovoltaic, and concentrated solar power
- Wind energy from both land and water based systems
- 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 operations and challenges
- Personal responsibility, life-long learning, and involvement through community-based energy organizations

Grading Breakdown:

	Description	Percent of Total Grade	Maximum Total Points Possible
Daily Quizzes	~ 1-2 per lesson	36%	360
Daily Assignments	~ 1 per lesson	32%	320
Do Something and Report it (DSARI)	An active energy-related project with presentation.	10%	100
DSARI Peer Review (DSARI)	Assess two of your peers' DSARI projects.	2%	20

Final Paper	Topic-based research paper on an energy topic related to major major	10%	100
Final Exam	Comprehensive, open-notes exam	10%	100
TOTAL		100%	1000

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:

Percentage Achieved	Course Grade
93.00-100.00	A
90.00-92.99	A–
87.00-89.99	B+
83.00-86.99	B
80.00-82.99	B–
77.00-79.99	C+
73.00-76.99	C
70.00-72.99	C–
67.00-69.99	D+
60.00-66.99	D
0.00-59.99	F

Details of Course Assessments:

There are 28 lesson assignments over the course of the semester. In order to assess your knowledge of the lessons, quizzes, and short reflections are assigned for each lesson. Expect to put in some time on this course and learn about energy. Based on guidance from the University of Minnesota, a 3 credit course requires 7.5 hours per week of student engagement. For this online course, you do not have to come to class, so this time can be used toward tackling the lesson assignments.

The lesson 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 (~33%): After every lesson is complete, there is a ~10 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. You are allowed only one attempt for each quiz. Expect approximately 28 quizzes over the course of the semester for a total of approximately 360 points (36%). Late quizzes are accepted but receive 10% off for each day late, calculated hourly.

Lesson Assessment: Reflection (~35%): Every lesson also includes a ~12-13 point writing assignment. Typically, this involves a short reflection or forum asking you to summarize or analyze the materials presented. These writing assignments typically require 200-250 words, unless specified otherwise. Instructor feedback is provided for reflections but not for forum postings. Turn-It-In is used to assess original writing—this can be used as a tool for you as you use reference material and put this material in your own words. 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 10% point deduction for each day late, calculated hourly.
- For more information on writing assignments and how to properly summarize without plagiarizing, see the Writing Expectations section later in this syllabus.

Due dates for all lesson assignments are listed in the Lesson titles in the modules, in the Canvas Calendar, and on the To Do list on the home page. For example, a due date of 09/07/2020 means that any lesson assessment (quiz, reflection or forum) must be submitted by 11:59 pm on 09/07/2020. 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, an energy audit (Do Something - related to topics covered in the course) and report back creatively to the class in a YouTube video. 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 (Module 29) contains details of the assignment, plus sample projects, presentation format, 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 Canvas. Requirements for the peer review are clearly outlined in Module 29 on the course website.

Final Research 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. Module 30 contains the specific requirements, topic ideas, sample papers, writing guide, grading rubrics, guidelines for formatting, writing techniques, and citations. The expected minimum length of the paper is 2000 words. **Note that this paper is due at the end of the semester (along with many other papers you may need to complete in other courses), but you have one month to complete it and can turn it in early!**

Final Exam (10%): The final exam opens around 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.

Note that BBE2201 is NOT a Writing Intensive Course, even though it has a number of writing assignments, including a reflection for each lesson, plus a 2000 word final paper. However, this course is not a writing intensive course, and does not meet the following requirements for a writing intensive course:

- *Complete 10-15 pages of polished writing*
- *Writing instruction as part of the course*
- *At least one writing assignment must be revised and resubmitted incorporating feedback from the instructor*

Expectations for Writing Assignments

There is a lot of writing in this course, but we believe writing to learn is a good teaching and learning tool. 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. Very short quotes may be used, but are generally not encouraged or necessary. Assignments that contain an excessive amount of quoted material will not receive full credit. Keep your similarity score below 30%!
- 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 below for clarification. Here is some **[guidance on citing your work properly](#)**.

Submit work on time.

- Late assignments receive a 10% point deduction for each day late. The instructor may waive or extend deadlines under special circumstances.
- Students **may not re-submit writing assignments** for additional credit after the deadline.

Meet the targeted (minimum) word count requirement for the assignment.

- A “target” or minimum 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>** (**<https://www.lib.umn.edu/#askalibrarian>**)

Student Conduct and Plagiarism:

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 and plagiarism 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

Date	Details
	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 (http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student_Conduct_Code.pdf), 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 (<http://www.oscai.umn.edu/>)

Other University of Minnesota Policies & Resources can be found at the University-wide Policy

Library: <http://policy.umn.edu/> (<http://policy.umn.edu/>)