

After completing this course, students will be able to:

- develop and evaluate plans for the deployment and adoption of sustainable energy technologies
- assess the social, technical, economic, and environmental dimensions of sustainable energy deployment
- present persuasive project plans to audiences from government, academia, civil society, and industry
- bridge engineering and policy perspectives in a collaborative setting

2. Course Structure and Content

This course is principally oriented around the development of a student-driven group project. There are four key deliverables associated with this project: (1) a preliminary presentation and discussion; (2) a final in-class presentation; (3) a presentation to the broader community at the Sustainable Energy Showcase; and (4) a formal written report. The development of group projects will be complemented by lectures, class discussions, and a mid-term assignment.

3. Requirements

The final mark will be made up of the following:

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| • Preliminary presentation and discussion of the project | 15% |
| • Project abstract | 05% |
| • Final in-class presentation of the project | 15% |
| • Presentation at the Sustainable Energy Showcase | 05% |
| • Written project report | 35% |
| • Midterm exam (take home) | 15% |
| • Class participation | 10% |

3.1 Preliminary presentation and discussion of the project

In weeks 6 and 7, project teams will deliver 25-minute presentations outlining the preliminary findings and anticipated direction of their projects. Presentations will cover the selected technology/technologies and provide a preliminary assessment of the technical, economic, environmental, and policy dimensions of the project. This will be followed by a 20-30-minute discussion. This discussion will be based on the presentation as well as 1-2 relevant readings (on related projects, for instance) that the team will assign one week prior. Project teams are advised to prepare 3-4 questions to guide the discussion. Taken together, the goal at this stage is to crystallize the project proposal and set the direction for future work. Project groups will be assessed based on the structure of the presentation, the quality of the selected readings, and the discussion that follows.

3.2 Project abstract

In week 7, project teams will submit the title of their projects along with 150-word abstracts describing the problem their project targets and its promise in addressing it. These will be widely distributed as part of a poster used to promote the Sustainable Energy Showcase.

3.3 Final in-class presentation of the project

During weeks 11-13, project teams will deliver 20-minute presentations covering the economic, technical, policy, and environmental dimensions of their proposed projects. Each presentation will be followed by a roughly 20-minute question and answer period. At this stage, the sustainable energy project proposals must be fully envisioned, compelling, and rich in details. Presentations will be assessed based on their content, clarity, structure, and format.

3.4 Presentation at the Sustainable Energy Showcase

Taking into account instructor and student feedback from the in-class final presentation, groups will deliver a revised version of their project presentations at the Sustainable Energy Showcase (date and location TBD). Participants at this event will include the broader community of scholars, practitioners, and students in the sustainable energy field. Presentations should be 20 minutes each and will be followed by a question and answer period. Presentations will be assessed by external faculty at the event.

3.5 Written project report

Guidelines for developing the project report will be discussed in class and posted to cuLearn. Several projects developed in previous years will also be posted to cuLearn and discussed in class. Written reports are due on April 6th, 2017.

The written report will be graded according to:

- Structure and readability
- Discussion of technical, social, economic, and environmental aspects
- The identification of and proposed engagement with stakeholders and competing interests
- The assessment of opportunities (e.g., how the project meets public interest criteria or a market niche) and risks
- Integration with and barriers posed by existing policies
- Persuasiveness of the proposal

Some suggested topic areas include:

- Power and renewable energy:
 - Solar thermal or electric
 - Wind power
 - Tidal and Ocean power
 - Energy storage
 - Biofuels
 - Nuclear
 - Hydro (large scale / micro / run of river)
 - Geothermal
- Energy exploration and production
 - Oil sands
 - Hydrogen production
 - Shale gas production
 - Biofuel production from biomass
- Energy utilization

- Advanced lighting technologies
- Microgrids / distributed generation / remote communities
- Smart grids / network optimization
- Advanced building materials
- Advanced HVAC systems
- Waste energy recovery
- Natural resources management emissions reduction (e.g. mining, forestry)
- Energy efficiency (e.g. green buildings, industry, residential)
- Transport
 - Electrification of transportation
 - Hybrid vehicles
 - Alternative fuels (ethanol, biofuel, compressed liquid gas, hydrogen, etc...)
 - Alternative power plants and infrastructure

3.6 Midterm

The take-home mid-term exam will consist of a briefing note together with a technical appendix. More information will be provided in weeks 5 and 6.

3.7 Class participation

Participation will be assessed based on: (1) the quality and frequency of student contributions to class discussion; (2) engagement and preparedness at in-class team meetings; (3) status report presentations delivered as part of team meetings; and (4) involvement in planning the Sustainable Energy Showcase.

COURSE SCHEDULE

Lecture	Topic Description	Articles
Jan 5, 2017	<p>Introduction to the course (Alex and Daniel)</p> <p>Lecture: Sustainable energy transitions, complex systems, and cross-disciplinary challenges in confronting wicked problems (Daniel)</p> <p>Send Alex and Daniel an email containing your top three topic choices and a note about which disciplinary stream you are in (policy or engineering) by January 9.</p>	<p><u>Recommended reading:</u> Frankfurt School-UNEP Centre, Bloomberg New Energy Finance, 2016. Global Trends in Renewable Energy Investment 2016. Frankfurt School of Finance & Management, Frankfurt.</p> <p>IPCC, 2014. Climate change 2014: Mitigation of climate change: Working Group III contribution to the Fifth assessment report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.</p> <p>REN21, 2016. Renewables 2016: Global status report. Renewable Energy Policy Network for the 21st Century, Paris.</p>
Jan 12, 2017	<p>Lecture: Economics of sustainable energy (Alex)</p> <p>Initial team meeting</p>	<p><u>Required reading:</u> McKinsey & Company, 2009. Pathways to a low-carbon economy: Version 2 of the global greenhouse gas abatement cost curve.</p>
Jan 19, 2017	<p>Lecture: Project valuation (Alex)</p>	<p><u>Recommended reading:</u> OECD, 2016. Green investment banks: scaling up private Investment in low-carbon, climate-resilient infrastructure, Green Finance and Investment. OECD Publishing, Paris.</p>
Jan 26, 2017	<p>Seminar: Review of previous projects Students will prepare to engage in a lively discussion on the 2-4 selected project reports from previous years. To facilitate discussion, project groups will deliver brief (5-8 minute) presentations on each of the assigned reports, covering strengths, limitations, and other relevant observations. As part of this, teams will be expected to draw lessons for their own projects as well as bring 3 questions for discussion.</p> <p><u>Suggested questions to orient presentations:</u> -What is the problem / market niche the project aims to address? -What technological and business solutions are offered to appeal to this niche? -How is the project embedded in a socio-political context? Is this convincing? -Is the economic rationale compelling and why? -How is policy used to bridge identified market gaps? -What lessons can you draw for your own project?</p> <p>Team meeting (if time permits)</p>	<p><u>Required reading:</u> 2-4 project reports from previous years will be posted to cuLearn</p>
Feb 2, 2017	<p>Lecture: Engaging with the socio-technical dimensions of sustainable energy innovation (Daniel)</p> <p>First three teams to post readings for class discussion</p>	<p><u>Required reading:</u> Rosenbloom, D., Meadowcroft, J., 2014. Harnessing the Sun: Reviewing the potential of solar photovoltaics in Canada. Renewable and Sustainable Energy Reviews 40, 488–496.</p> <p>Sovacool, B.K., 2009. Rejecting renewables: The socio-technical impediments to renewable electricity in the United States. Energy Policy 37, 4500–4513.</p>

Feb 9, 2017	<p>First three teams to present preliminary overviews and readings in class</p> <p>Last three teams to post readings for class discussion</p>	TBD by first three teams
Feb 16, 2017	<p>Last three teams to present preliminary overviews and readings</p> <p>Project 150 word abstract and title due</p> <p>Mid-term distributed</p>	TBD by last three teams
Feb 23, 2017	Reading week	
Mar 2, 2017	<p>Guest speaker(s): Lawrence Keyte (Polar Knowledge Canada) and Scott Macdonald (Carleton University)</p> <p>Team meeting</p> <p>Mid-term due</p>	
Mar 9, 2017	<p>Guest speaker(s): Carla Miner (Sustainable Development Technology Canada)</p> <p>Team meeting</p>	
Mar 16, 2017	First two teams to deliver final presentations	
Mar 23, 2017	Next two teams to deliver final presentations	
Mar 30, 2017	Final two teams to deliver final presentations	
April 6, 2017	<p>Make-up class (if necessary)</p> <p>Written report due</p>	
TBD	<p>Sustainable Energy Showcase</p> <p>Formal presentations to outside community. The location and date are TBD (typically the first or second week of April)</p>	

Grading

In graduate school, expectations about analytical abilities and performance are higher than in undergraduate work, and what is an acceptable grade is also different. Whereas a C+ is a passing grade in undergraduate studies, it is not in graduate school. We have expanded upon the grading system outlined in the Graduate Calendar in order to give you a fuller description of standards. This explanation is intended to provide clarification of the Graduate Calendar and in no way overrides it.

Carleton University uses a 12 point grading scale from A+ (12, or 90-100%) to D- (1, or 50-52%). Normally, students do not get credit for courses with a grade less than B-. The School of Public Administration has adopted the following point equivalencies and interpretation for letter grades definitions of letter grades.

A+	12	Outstanding. For written work, virtually publishable. Demonstrates evaluative judgement and mastery of technical as well as literary aspects of writing.
A	11	Excellent. Demonstrates superior grasp of material and capacity to understand and extend underlying patterns.
A-	10	Very good. Demonstrates clear grasp of material, its component parts, and capacity to analyze their relationships to each other.
B+	9	Good. Demonstrates basic understanding of material and ability to apply concepts. Written work is competent.
B	8	Satisfactory, but below average. Demonstrates comprehension of material with some limited ability to apply concepts.
B-	7	Adequate, but less than average. Demonstrates comprehension and understanding, with limited capacity for application.
C+	6	Less than adequate. A final grade of C+ is not normally sufficient for credit.
C to D-		Grades in this range indicate work that is passable in some respects but that does not meet the standards of graduate work. An example would be an assignment completed to the expectations of a senior undergraduate course.
F		Failure. Did not meet minimal requirements.

Grades of A- or B+ should be considered as good, solid performances that hover around the average for this level. Grades will be awarded as letter grades, but I will calculate your final grades as the weighted mean of the grade point equivalencies. Example: A- on an exam worth 30%; A on participation worth 20%, and B+ on a paper worth 50%;

A-	10 x .30 = 3.00
A	11 x .20 = 2.20
B+	<u>9 x .50 = 4.50</u>

Final 9.70 or B+

The letter grade will correspond to the interval in which the numerical grade falls (eg., anything between 9.0 and 9.9 = B+)

Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

Pregnancy obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details visit the Equity Services website: <http://www2.carleton.ca/equity/>

Religious obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details visit the Equity Services website: <http://www2.carleton.ca/equity/>

Academic Accommodations for Students with Disabilities: The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable) at <http://www2.carleton.ca/pmc/new-and-current-students/dates-and-deadlines/>

You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at <http://www2.carleton.ca/equity/>

The University's Policy on Plagiarism:

Plagiarism is an instructional offence that occurs when a student uses or passes off as one's own idea or product work of another person, without giving credit to the source. The punishments for plagiarism at Carleton are significant. You could fail the course, or, under certain circumstances, be expelled from the university.

If you are using someone else's words—in a quotation—refer to the source in a footnote or bracketed reference. If you are paraphrasing someone else's text (that is, not quoting directly, but closely following the line of argument), refer to the source just as you would for a quotation, except that quotation marks are not used. If you are using someone else's ideas, acknowledge this in a footnote, or by a clear reference in the text of your essay.

Material copied from the Internet must be treated like material from a book or any other source. If you are quoting a source you found on the Internet, use quotation marks and refer to the location of the item (name the website; identify the electronic journal and issue, etc.) just as you would for a quotation from printed material. If you are paraphrasing material or borrowing ideas from an Internet source, the source must be identified in a footnote, just as a quotation would be. Excellent software is available for locating material that might have plagiarized from the Internet, and it will be used.

For further information, please refer to the section entitled "Instructional Offences" in the Graduate Calendar for university regulations.

Instructional Offences:

The Senate of the University has enacted the following regulations for instructional offences at the graduate level:

Any student commits an instructional offence who:

- (a) cheats on an examination, test, or graded assignment by obtaining or producing an answer by deceit, fraud, or trickery, or by some act contrary to the rules of the examination
- (b) submits substantially the same piece of written work to two different courses. Minor modifications and amendments or changes of phraseology do not constitute a significant and acceptable reworking of an essay or paper
- (c) contravenes the regulations published at an examination or which are displayed on the reverse side of a properly authorized examination booklet
- (d) commits an act of plagiarism. Plagiarism will be deemed to have occurred when a student either:

- (i) directly copies another's work without acknowledgement; or
 - (ii) closely paraphrases the equivalent of a short paragraph or more without acknowledgement; or
 - (iii) borrows, without acknowledgement, any ideas in a clear and recognizable form in such a way as to present them as the student's own thought, where such ideas, if they were the student's own, would contribute to the merit of his or her own work
- (e) disrupts a class or other period of instruction if he or she:
- (i) is a registered member of the class or period of instruction
 - (ii) is warned to discontinue any act or behaviour reasonably judged by the instructor of the course or period of instruction to be detrimental to the class, and having ignored such warning is ordered by the instructor to leave and refuses to leave
- (f) Any student found in violation of these regulations may be:
- (i) expelled
 - (ii) suspended from all studies at the University
 - (iii) suspended from full-time studies; and/or
 - (iv) awarded a reprimand
 - (v) refused permission to continue or to register in a specific degree program, but subject to having met all academic requirements shall be permitted to register and continue in some other program
 - (vi) placed on academic probation
 - (vii) awarded a Fail or Absent in a course or examination

Allegations of instructional offence may be investigated by instructors and/or departmental chairs and, in all cases, will be reported to the faculty dean. The dean will promptly advise, in writing, the student and the University Ombudsperson of the allegation and of the student's rights. The dean will review the allegation and if not resolved at that level, the allegation becomes subject to final disposition by a tribunal appointed by the Senate. Information about procedure governing tribunals is available from the Clerk of the Senate, Room 607, Robertson Hall.