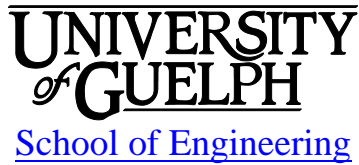


# ENGG\*3080 Energy Resources & Technologies

## Fall 2015



(Revision 0: September 10, 2015)

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## 1 INSTRUCTIONAL SUPPORT

### 1.1 Instructor

Instructor: Ryan Clemmer, Ph.D., P.Eng.  
Office: THRN 1337, ext. 52132  
Email: rclemmer@uoguelph.ca  
Office hours: Tuesdays 11:00 – 12:00 PM or drop-in

### 1.2 Lab Technician

Technician: Mike Speagle  
Office: THRN 3502, ext. 56803  
Email: mspeagle@uoguelph.ca

### 1.3 Teaching Assistants

<b>GTA</b>	<b>Email</b>	<b>Office Hours</b>
Hassan Al-Hachami	halhacha@uoguelph.ca	Available during lab times
Saki Honjo	shonjo@uoguelph.ca	Available during lab times

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## 2 LEARNING RESOURCES

### 2.1 Course Website

Course material, news, announcements, and grades will be regularly posted to the ENGG\*3080 Courselink site. You are responsible for checking the site regularly.

### 2.2 Required Resources

1. Kclickers for quizzes

### 2.3 Recommended Resources

1. R.A. Dunlap, "Sustainable Energy," SI Edition, Cengage Learning, 2015.
2. F.M. Vanek, L.D. Albright, & LT. Agnenent, "Energy Systems Engineering: Evaluation and Implementation", 2<sup>nd</sup> edition, McGraw-Hill, 2012.
3. G.J. Aubrecht, "Energy: Physical, Environmental, and Social Impact," 3<sup>rd</sup> edition, Pearson, 2006.
4. G. Boyle, "Renewable Energy: Power for Sustainable Future," 3<sup>rd</sup> edition, Oxford, 2012.

### 2.4 Additional Resources

**Lecture Information:** An incomplete set of lecture notes will be posted on Courselink prior to lecture. During lecture, additional notes and examples will be provided. It is expected that you will have a copy of the lecture notes for each class.

**Lab Information:** The lab manual and schedule for the laboratory exercises will be posted on Courselink. Be sure to read the appropriate lab section prior to attending the lab.

**Assignments:** An individual assignment will be posted on Courselink. It is expected that students research and write their assignments on their own. Discussing the merits and limitations of the various energy technologies with other students is acceptable.

**Exams:** Some sample exam questions will be posted. The solutions will also be posted for your convenience.

### 2.5 Communication & Email Policy:

Please use lectures and lab help sessions as your main opportunity to ask questions about the course. Major announcements will be posted to the course website. **It is your responsibility to check the course website regularly.** As per university regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

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## 3 ASSESSMENT

### 3.1 Dates and Distribution

<b>Assessment</b>	<b>Marking Scheme A</b>	<b>Marking Scheme B</b>
Quizzes	10%	0%
Assignment	5%	5%
Labs	20%	20%
Midterm	25%	30%
Final Exam	40%	45%
Total	100%	100%

The final grade will be the better of Marking Scheme A or Marking Scheme B.

**Quizzes:** (best 5 of 7)

Sept 22, in class  
Oct 1, in class  
Oct 15, in class  
Oct 27, in class  
Nov 12, in class  
Nov 24, in class  
Dec 3, in class

**Assignments:**

Assignment #1: Sept 24

**Labs:** See section 5.3 below for due dates

**Midterm Exam:** Tues Oct 20, 8:30 AM – 9:50 AM, in class (MCKN 121)

**Final Exam:** Wed Dec 9, 11:30 AM – 1:30 PM, Room TBA on Webadvisor

### 3.2 Course Grading Policies

**Quizzes:** There will be several i>clicker quizzes during the lectures throughout the semester as scheduled.

Students are expected to be present and use their own i>clicker during these quizzes. The quizzes are intended to help you better understand the course content and account for 10% of the course marks. Prior to the first quiz, you must register your i>clicker serial number by clicking on the “*Student i>clicker Registration*” link on the right side of the webpage:

**<http://www.tss.uoguelph.ca/lci/clickers/index.cfm>**

**Missed Assessments:** If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

**Accommodation of Religious Obligations:** If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor at the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml>

**Passing grade:** Students must achieve at least 50% of the marks assigned to the midterm and final exams in order for the labs and quizzes to be counted in the final grade. If you do not achieve at least 50% of the marks assigned to the midterm and final exams, the weighting of the lab reports and quizzes in your final grade will be zero. The individual assignment will count in the final grade no matter the outcome of the midterm and final exams. An overall final grade of 50% is required to pass the course.

**Lab Work:** You must attend and complete all labs. Doors to the lab will be closed 15 minutes after the scheduled lab time. **Students arriving after the lab doors are closed are considered absent.** If you miss a lab due to grounds for granting academic consideration or religious accommodation, arrangements must be made with the teaching assistant to complete a makeup lab **prior** to your scheduled lab. Unless academic consideration is granted, failure to complete a lab will result in a mark of zero for that lab report.

The laboratory work is group based. You will need to organize yourselves into **groups of three (3) or four (4) within your lab section by Friday, September 25<sup>th</sup>**. The sign-up sheets for lab groups will be available in the Sustainable Energy Lab in THRN 3404 during the introductory lab session. **You will not be allowed to conduct the labs unless you attend the safety session and sign a form indicating that you have done so.**

Each group will be responsible for conducting the labs and writing a single report for each lab. You will be equally responsible for your group's laboratory reports. Each group member must make a significant contribution to the writing of the lab report and sign the lab report cover page in order to receive a lab report mark. Lab reports will be marked and the marks posted on CourseLink. **Note that up to 20% of the lab mark may be deducted for poor lab report format, poor graph or table format, or poor English (spelling, grammar, etc.).** Any reports judged to be entirely unacceptable will be returned without marking for rewriting. Lab reports will be handed back to the group during the lab session after all reports for that specific lab have been handed in. If you have questions about your mark, see the GTA responsible for that lab and they will discuss it with you.

**Late Lab Reports:** There will be a late penalty of 20 %/day or part thereof for any late lab reports. That is, reports submitted within 24 hours after the initial due date will lose 20%, reports submitted between 24 and 48 hours after the initial due date will lose 40%, and so on. Lab reports are considered late if they are submitted after the specified time they are due.

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## 4 AIMS, OBJECTIVES & GRADUATE ATTRIBUTES

### 4.1 Calendar Description

The challenges of changing the global energy system to reduce dependence on finite fossil energy sources, and transition to environmentally sustainable energy sources, are examined. The reserves, consumption, applications and environmental and human impacts of oil, coal and natural gas usage are examined. The fundamental principles, applications and status of a range of renewable energy sources and technologies will be covered to provide a solid background for further study of sustainable energy.

*Prerequisite(s):* None

*Corequisite(s):* ENGG\*3260: Thermodynamics

### 4.2 Course Aims

Energy is essential for society to function. Some energy resources are inexpensive and reliable, but come with significant political and environmental concerns. Other energy resources are environmentally benign, but do not provide power when it is needed. The challenge is then harnessing and delivering the needed energy in a sustainable and reliable manner, particularly with a growing global population.

This course highlights the fundamental principles of traditional (oil, coal, natural gas, and nuclear) and renewable energy resources (solar, wind, water, biomass and geothermal), the technology used to convert energy resources into useful forms of energy, and the potential social, economic, and environmental impact of using a particular energy resource.

### 4.3 Learning Objectives

At the successful completion of this course, the student will have demonstrated the ability to:

1. Describe the local and global energy usage to meet society's energy requirements for electricity use and transportation through individual assignments
2. Summarize the fundamental principles of energy conversion from traditional energy sources such as oil, coal, natural gas, and nuclear, and alternative energy sources such as solar, wind, water, biomass, and geothermal through quizzes and exams
3. Recognize the merits and limitations of each energy resource in terms of reliability and sustainability through assignments, quizzes, and exams
4. Explain how the performance of photovoltaic cells, wind turbines, and fuel cells is affected by their operating conditions within lab report discussion
5. Evaluate the social, economic, and environmental impacts of energy usage and generation from various energy resources and technologies through class discussion, quizzes, and exams
6. Present, analyze, and discuss experimental data through well written lab reports

#### 4.4 Graduate Attributes

Successfully completing this course will contribute to the following CEAB Graduate Attributes:

<b>Graduate Attribute</b>	<b>Learning Objectives</b>	<b>Assessment</b>
1. Knowledge Base for Engineering	1, 2, 3	Quizzes, Exam
2. Problem Analysis	-	-
3. Investigation	4, 6	Labs
4. Design	-	-
5. Use of Engineering Tools	-	-
6. Individual and Teamwork	-	-
7. Communication	6	Labs
8. Professionalism	-	-
9. Impact of Engineering on Society and the Environment	3, 5	Assignments, Quizzes, Exams
10. Ethics and Equity	-	-
11. Environment, Society, Business, & Project Management	5	Assignments, Quizzes, Exams
12. Life-Long Learning	-	-

#### 4.5 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on CourseLink but these are not intended to be stand-alone course notes. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and labs.

#### 4.6 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

#### 4.7 Relationships with other Courses & Labs

##### Concurrent Courses:

**ENGG\*3260:** Topics include energy transfer and energy balance in closed and flow through systems, entropy analysis, and efficiencies.

##### Follow-on Courses:

**ENGG\*4230:** Energy Conversion, **ENGG\*4580:** Sustainable Energy System Design

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## 5 TEACHING AND LEARNING ACTIVITIES

### 5.1 Timetable

#### Lectures:

Tuesday		8:30 AM – 9:50 AM	MCKN 121
Thursday		8:30 AM – 9:50 AM	MCKN 121

#### Laboratory:

Monday	Sec 03	3:30 PM - 5:20 PM	THRN 3404
Wednesday	Sec 01	12:30 PM – 2:20 PM	THRN 3404
Friday	Sec 02	3:30 PM - 5:20 PM	THRN 3404

### 5.2 Lecture Schedule

Week	Lecture Topics	Learning Objectives
1	Introduction: Energy Systems & Sustainability	1
2	Fossil Energy Technologies: Oil, Gas, Coal Reserves	1, 2, 3, 5
3	Wind Energy	1, 2, 3, 4, 5
4	Solar Energy – PV Design	1, 2, 3, 4, 5
5	Solar Energy - Operation	1, 2, 3, 4, 5
6	Midterm Review	1, 2, 3, 5
7	Midterm	1, 2, 3, 5
8	Fuel Cell Technology	1, 2, 3, 4, 5
9	Nuclear Energy	1, 2, 3, 5
10	Hydropower, Tidal, and Wave Energy	1, 2, 3, 5
11	Biomass Energy	1, 2, 3, 5
12	Transportation	1, 2, 3, 5

### 5.3 Lab Schedule

A detailed lab schedule will be posted on Courselink. The table below summarizes when the labs are performed and when the corresponding reports are due. All lab reports must be submitted for marking in the assignment drop-off cabinet located in the engineering alley by the Machine Shop (THRN 1015). For the weeks students are not in the lab, they are expected to be writing their lab report, or preparing for their next lab exercise. The GTA will be available during the lab time to answer questions.

<b>Lab</b>	<b>Groups</b> (for all sections)	<b>Lab Performed</b>	<b>Report Due Date</b>
Lab Safety	1-4	Sep 21 – Sep 25	
	5-6	Sep 21 – Sep 25	
Wind Energy Lab	1-4	Sep 28 – Oct 2	Oct 19 – Oct 23
	5-6	Oct 5 – Oct 9	Oct 26 – Oct 30
Solar Energy Lab	1-4	Oct 26 – Oct 30	Nov 9 – Nov 13
	5-6	Nov 2 – Nov 6	Nov 16 – Nov 20
Fuel Cell Energy Lab	1-4	Nov 9 – Nov 13	Nov 23 – Nov 27
	5-6	Nov 16 – Nov 20	Nov 30 – Dec 4

### 5.4 Other Important Dates

- Thursday, September 10, 2015: First day of class
- Monday, October 12, 2015 Holiday: No classes scheduled
- Tuesday, October 13, 2015: Fall Study Break Day – No classes scheduled
- Friday, November 6, 2015: 40<sup>th</sup> class day, last day to drop
- Friday, December 4, 2015: Last day of class



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## 6 LAB SAFETY

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

### 6.1 Sustainable Energy Lab Safety

This section outlines some of the safety related procedures and information for use in the Sustainable Energy Lab in THRN 3404. Safety in the laboratory is critical. **You will not be allowed to conduct the labs unless you attend the safety session and sign a form indicating that you have done so.** If you have any concerns or comments related to safety in this laboratory you can reach Mike Speagle, at ext. 56803, in THRN 3502.

1. Be prepared. You should download and print a copy of the ENGG\*3080 Lab Manual from Courselink. Be sure to carefully read the specific manual section before you go to perform each of the laboratory exercises.
2. You must do as instructed by the laboratory demonstrator. If you are not sure about something ask the demonstrator. Inform the demonstrator if you become aware of a potential hazard.
3. Food and beverages cannot be stored or consumed in this laboratory
4. Safety glasses are mandatory for all experiments. You will not be allowed to perform an experiment without them.
5. Proper footwear is mandatory for all the experiments. This means no open toed shoes or sandals.
6. The fire extinguisher, first aid kit, and phone are located at the front of the lab (THRN 3404). Dial ext. 52000 in case of emergencies.
7. All accidents should be reported to the demonstrator.

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## 7 ACADEMIC MISCONDUCT

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member.

### 7.1 Resources

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

A tutorial on Academic Misconduct produced by the Learning Commons can be found at:

<http://www.academicintegrity.uoguelph.ca/>

Please also review the section on Academic Misconduct in your [Engineering Program Guide](#).

The School of Engineering has adopted a Code of Ethics that can be found at:

<http://www.uoguelph.ca/engineering/undergrad-counselling-ethics>

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## 8 ACCESSIBILITY

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability for a short-term disability should contact the Centre for Students with Disabilities as soon as possible.

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## 9 RECORDING OF MATERIALS

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

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## 10 RESOURCES

The Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs:

<http://www.uoguelph.ca/registrar/calendars/index.cfm?index>