Environmental Sciences: The Energy Dilemma
JOHN ABBOTT COLLEGE

Program:	Science	Semester:	Winter 2018
Discipline:	Physics / Chemistry	Instructor:	
Course Code:	202-ENV-AB and 203-ENV-AB	Office:	
Competency code:	00UU, 00UV	Tel:	
Ponderation:	3-2-3	Office Hours:	
Credits:	$2\ ^{2}/_{3}$	Instructor:	
Pre-requisites:	202-NYB-05 & 202-NYA-05 203-NYA-05 & 203-NYB-05	Office: Tel: Office Hours:	

B: Introduction

Environmental Sciences: The Energy Dilemma is an Option Course in the Science Program, specifically designed to partially fulfill the requirements of objective **00UV**. As such it is normally taken by science students after they have completed at least two semesters of the program.

This course is about energy, the methods we use to extract and convert it, and the adverse environmental affects these practices have on our planet. The material wealth of modern western society, and of several prominent newly industrialized societies, is largely a result of our heavy use of fossil fuels since the beginning of the industrial revolution. We will begin by studying how we find, process and distribute these limited fuels. The repercussions of our heavy dependence on fossil fuels will be studied through the environmental impact of pollutants in our air and water. We will analyze climate change and its consequences both on ecosystems and on human societies. The green economy will be examined through alternative energy sources. From wind farms to solar arrays, the benefits and limitations of proven and emerging technologies will be discussed and debated.

This course can contribute to the Environmental Studies certificate. For more information, talk to the teacher or contact the certificate coordinator at envirostudies@johnabbott.qc.ca

Comprehensive Assessment and Integration in the Science Program

The Ministry of Education requires every student to pass a program comprehensive assessment and a program integrating activity (Exit Profile Competency 14: "to apply what has been learned to new situations" and Ministry objective 00UU: "to apply acquired knowledge to one or more subjects in the sciences"). The Ministry introduced these requirements because it recognized the importance of connecting the various components within each program.

The various competencies to be addressed in the Science Program are outlined in the outcomes and standards of the Science Program Exit Profile and are listed below. They are divided into two groups: those competencies that are taught and assessed in virtually every course in the program, and those that will be the primary focus of the option courses.

The following competencies are taught and assessed in most courses of the program:

3. To apply the scientific method.
4. To apply a systematic approach to problem solving.
5. To use appropriate data processing techniques.
6. To reason with rigour, i.e., with precision.
8. To learn in an autonomous manner.
13. To display attitudes and behavior compatible with the scientific spirit and method.
14. To apply what has been learned to new situations.

The following competencies will be the special focus of the option courses of the program:

7. To communicate effectively.
9. To work as a member of a team.
10. To recognize the links between science, technology and the evolution of society.
11. To develop a personal system of values.
12. To put into context the emergence and development of scientific concepts.

Rather than impose a major exam or paper at the end of the Science Program, or requiring a single course to fulfill these requirements, John Abbott College has integrated the fulfillment of these requirements into the option courses taken late in the program.

Some option courses in the Science program at JAC offers the opportunity to complete the Comprehensive Assessment. Passing the Comprehensive Assessment in any one of these courses will fulfill the CA requirements for obtaining a Science D. E. C. at JAC.

C: Course Objectives

OBJECTIVES **STANDARDS**

Statement of the Competency:

To explore the relationship between our dependency on fossil fuels as our energy sources and the resulting environmental consequences .(00UV)

General Performance Criteria:

- Appropriate choice of concepts, laws and principles
- Rigorous application of the concepts, laws and principles
- Appropriate use of terminology
- Adequate mathematical or graphical representation
- Coherence, rigour and justification of the problem-solving methods
- Respect for the scientific method and experimental protocol
- Justification of the method
- Critique of the credibility of the results
- Use of an interdisciplinary approach (00UU)

Elements of the Competency:

1. To apply the laws and principles of natural sciences to energy issues of our modern society.
2. To apply scientific principles in assessing ways of securing our society's energetic future.
3. To apply experimental techniques of the natural sciences to analyse environmental samples and build energy-generating devices.
4. To undertake an interdisciplinary project that integrates current learning and which demonstrates competence in three specific goals of the exit profile at the advanced level (00UU).

Specific Performance Criteria:

Specific performance criteria for each of the elements of the competency are shown in Section E along with the corresponding **Intermediate Learning Objectives.** *For the items in the list of learning objectives it is understood that each is preceded by:*

'The student is expected to .....'

D: Evaluation Plan

Evaluation	Tentative date	Weight	Elements of the Competency (p. 3)
Test 1	February 23	14%	1, 2
Test 2	April 3	16%	1, 2
Test 3	May 4	18%	1, 2
Laboratory work	Almost weekly	20%	3
Comprehensive Assessment Project	First half of April	15%	4
Assignments	Roughly 4 per term	17%	1, 2

Please Note:

- To pass the course, a student may not miss more than two laboratory sessions without a valid, fully documented reason.
- A student whose cell phone rings during the testing period may lose 5% on the test or quiz; if the student answers the call, a mark of zero is automatically awarded for the assessment.
- Late work will be marked as a zero unless otherwise specified in the assessment instructions.

E: Course Content

Tentative number of classes for each section is indicated in square brackets

1.0 Energy and Fossil Fuels [11]

1.1 The Need for Energy	1.1.1 Explain the energy requirements for human societies. 1.1.2 Discuss the evolution of energy sources from peat bog to nuclear reactor. 1.1.3 Compare the stored chemical energy in fossil fuels. 1.1.4 Compare the production cost and total output of various energy sources.
1.2 Energy Demands	1.2.1 Summarize pre-industrial revolution energy needs. 1.2.2 Explain the evolution of electricity for the masses. 1.2.3 Summarize the energy demand explosion which has accompanied widespread industrialization and urbanization.
1.3 Fossil fuels	1.3.1 Describe the formation of fossil fuels. 1.3.2 Discuss the prospecting for fossil fuels. 1.3.3 Discuss the extraction processes and transportation of fossil fuels.
1.4 Energy production from fossil fuels	1.4.1 Explain the inner workings of a power plant. 1.4.2 List the various fractions of oil and their uses for different energy needs. 1.4.3 Discuss the role of natural gas and coal in power generation.
1.5 Fossil fuels in the near future	1.5.1 Summarize global coal, oil and natural gas reserves 1.5.2 Discuss the extraction of tar sands and what role they play in situating Canada as an energy player. 1.5.3 Describe hydrocarbon recovery by hydraulic fracturation and analyze the benefits and problems associated with it.

2. **Environmental & Societal Consequences [7]**

2.1 Toxic pollution	2.1.1 Describe acid rain's formation, effects and control. 2.1.2 Discuss smog formation and its consequences.
2.2 Global Warming/ Climate Change	2.2.1 Describe what climate is and its parameters. 2.2.2 Explain what the greenhouse effect is. 2.2.3 Discuss how human activity is connected to climate change and the expected consequences of climate change both on ecosystems and on human societies. 2.2.4 Describe carbon sequestration and how it may or may not help minimize climate change. 2.2.5 Explain geo-engineering and how it might either minimize climate change or make matters worse.
2.3 Climate change Perception	2.3.1 Chronicle and critically evaluate competing claims as to the repercussions and severity of, and responsibility for, climate change.

3. **Alternative Energy Sources [9]**

3.1 Requirements of energy sources	3.1.1 Analyze and discuss the criteria—technical, ethical, and economic—on which an alternative energy source or project might be evaluated.
3.2 Hydroelectricity	3.2.1 Study the world's hydroelectric development potential. 3.2.2 Describe how a dam produces electricity. 3.2.3 Explain why hydroelectric power is not a perfectly 'green' energy source.
3.3 Other Renewable Energy sources	3.3.1 Examine the advantages and limitations of wind energy. 3.3.2 Study the various ways solar energy is collected. 3.3.3 List fringe renewable energy sources.
3.5 The Nuclear Debate	3.5.1 Examine a nuclear reactor. 3.5.2 Explain how nuclear waste is stored. 3.5.3 Discuss the future of nuclear energy.
3.6 Biofuels	3.6.1 Identify and describe the sources and natures of the major types of biofuels. 3.6.2 Discuss factors which impact the 'greenness' of biofuels.

F: Required Texts; Course Costs

There is no formal text book for this course. Course notes and worksheets will either be handed out in class or made available on Léa, as will laboratory materials. The student will be responsible for the printing of course materials (class and laboratory) when necessary.

Safety glasses must be worn at all times in the laboratory. Good quality safety glasses are available from the bookstore or from most hardware stores (approx. $8). Normal prescription glasses may be worn. A sturdy cotton lab coat is required (approx. $20).

G: Bibliography

Broecker, Wallace, and Kunzig, Robert, *Fixing Climate: What Past Climates Reveal About the Current Threat- and How to Counter It*, Hill and Wang, 2008, 253 pages.*

Flannery, Tim, *The Weather Makers*, Harper Collins Canada, 2006, 384 pages.

Goodell, J., *Big Coal: The Dirty Secret Behind America's Energy Future*, First Mariner Books, New York, 2006. 322 pages.

Houghton, John, *Global Warming: The Complete Briefing*, 5th ed., Cambridge University Press, Cambridge, 2015, 438 pages*

Mazur, Allan, *Energy and Electricity in Industrial Nations: The Sociology and Technology of Energy*, Routledge, London, 2013, 227 pages.*

Nikiforuk, A., *Tar Sands; Dirty Oil and the Future of a Continent*, Greystone Books, Vancouver, 2008, 214 pages.*

Oreskes, N., and Conway, E. M., *Merchants of Doubt*, Bloomsbury Press, New York, 2010, 355 pages.

Spelllman, Frank R., *Environmental Impacts of Renewable Energy*, CRC Press, Boca Raton, FL, 2015, 458 pages.*

Stephenson, Michael, *Shale Gas and Fracking: The Science Behind the Controversy*, Elsevier, Amsterdam, 2015, 154 pages.*

White, Rodney, *Climate Change in Canada*, Oxford University Press, 2010, 174 pages.*

*Available at the JAC Library.

H: Teaching Methods

The course will be 75 hours, divided into lecture and laboratory periods. There will two 1.5-hour periods per week, consisting of the introduction of new material and revision of previously learned material. In addition, preparation for upcoming laboratory sessions may be discussed during lecture time. There will be one lab per week, a two-hour session. Laboratory sessions may be used for workshops.

A special note concerning the use of chemicals: This course uses chemicals as part of its normal teaching practices. If any student has experienced allergic reactions in the past to any particular chemical or chemicals, he/she must inform the teacher. In the event that a student experiences an allergic reaction at the college, he/she should report to Campus Security immediately (local 7777, 514-398-7777).

I: Departmental Attendance Policy

Attendance is compulsory. If lectures are missed, it is the responsibility of the student to cover the material missed and be aware of any announcements made concerning assignments, tests or changes to the laboratory schedule. Students must attend the laboratory session in which they are officially registered. There may be workshops held during the laboratory period. Attendance at these workshops is required.

Cell phones and computers may only be used during class for pedagogical purposes

There will be no make-up tests, quizzes or laboratory periods. If a test or a deadline is missed due to illness, the instructor must be notified as soon as possible. A valid medical note is required to prove absence for a medical reason.

J: College Policies

Policy No. 7- IPESA, Institutional Policy on the Evaluation of Student Achievement (johnabbott.qc.ca/IPESA)

a) **Changes to Evaluation Plan in Course Outline** (Article 5.3 in IPESA)

Changes to the evaluation plan, during the semester, require unanimous consent from regularly attending students and approval by the department and the program dean .

b) **Religious Holidays** (Article 3.2.13 and 4.1.6)

Students who wish to observe religious holidays must inform their teacher of their intent in writing within the first two weeks of the semester.

c) **Student Rights and Responsibilities**

(Article 3.2.18) It is the responsibility of students to keep all assessed material returned to them and/or all digital work submitted to the teacher in the event of a grade review. (The deadline for a Grade Review is 4 weeks after the start of the next regular semester.)

(Article 3.3.6) Student have the right to receive graded evaluations, for regular day division courses, within two weeks after the due date or exam/test date, except in extenuating circumstances. A maximum of three (3) weeks may apply in certain circumstances (ex. major essays) if approved by the department and stated on the course outline. For evaluations at the end of the semester/course, the results must be given to the student by the grade submission deadline (see current Academic Calendar). For intensive courses (i.e.: intersession, abridged courses) and AEC courses, timely feedback must be adjusted accordingly.

d) **Academic Procedure: Academic Integrity, Cheating and Plagiarism** (Article 9.1 and 9.2)

Cheating and plagiarism are unacceptable at John Abbott College. They represent infractions against academic integrity. Students are expected to conduct themselves accordingly and must be responsible for all of their actions.

College definition of Cheating:

Cheating means any dishonest or deceptive practice relative to examinations, tests, quizzes, lab assignments, research papers or other forms of evaluation tasks. Cheating includes, but is not restricted to, making use of or being in possession of unauthorized material or devices and/or obtaining or providing unauthorized assistance in writing examinations, papers or any other evaluation task and submitting the same work in more than one course without the teacher's permission. It is incumbent upon the department through the teacher to ensure students are forewarned about unauthorized material, devices or practices that are not permitted.

College definition of Plagiarism:

Plagiarism is a form of cheating. It includes copying or paraphrasing (expressing the ideas of someone else in one's own words), of another person's work or the use of another person's work or ideas without acknowledgement of its source. Plagiarism can be from any source including books, magazines, electronic or photographic media or another student's paper or work.