

Sustainable Operations and Production
College of Business
Alliant International University

"If the wars of this century were fought over oil, the wars of the next century will be fought over water."
Ismail Serageldin, Vice President, World Bank. 1995.

David A. Bainbridge, Associate Professor Office: B-1

The course

This course reviews the foundations and principles of sustainable business operations and production processes. It reviews the options and opportunities for improved management of resources, particularly water, energy, minerals, and common industrial materials. The goal of this course is to help you develop a better understanding of ecological economics, the approaches that can be used to manage resources sustainably, and the insight and knowledge needed to create new business applications and opportunities by increasing eco-effectiveness. Class activities will include lecture and discussion, role playing, and simulations of meetings involving complex management problems. Skill development in research, analysis, and communication are key elements of this course.

The world's 20 million businesses must be redesigned to fit into the landscape without harming the environment or human health. The basic approach is to reshape industrial, manufacturing, distribution sales, and recycling as a closed system much like a natural living ecosystem. Materials, energy and water and other resources are used, reused and eventually recycled with minimal leakage into the environment or movement into landfills. The rapid growth of the internet and global connectivity has made this much more practical. Users and waste generators can link up in a local, regional, national and global webs. Individual companies, like organisms in an ecosystem, can work for their own survival and prosperity while benefiting people and the environment.

The goal is to help students develop a sufficient understanding of water, energy, and resources issues to successfully manage their energy and water budgets in commercial buildings, industrial facilities, residential buildings and other operations. These skills will also help shape and develop green business applications and improve the management of their communities, countries, and the world. These are key challenges for the next 50 years!

Required texts:

Water Wars by Vandana Shiva and ***Energy Efficiency*** from UNEP

Materials: dial type kitchen thermometer with probe (from grocery store about \$10)

Labs may require additional materials.

Recommended additional reading

Norris, G.A., F. Della Croce, and O. Jolliet. 2003. Energy burdens of conventional wholesale and retail portions of product life cycles. *Journal of Industrial Ecology* 6(2):59-69.

Graedel, T.E. and B.R. Allenby. 2002. *Industrial Ecology*.

Socolow, R., C. Andrews, F. Berkhout and V. Thomas, eds. 1997. *Industrial Ecology and Global Change*.

Allenby, B.R. and D.J. Richards eds. 1994. *The Greening of Industrial Ecosystems*,

Frosch, R.A. and N.E. Gallopoulos. 1989. Strategies for manufacturing. *Scientific American* 261: 144-152.

Curran, M.A. 1993. Broad-Based Environmental Life Cycle Assessment. *Environmental Science and Technology*. 27(3):430-436.

Porter, M.E. and C. van der Linde. 1995. Green and competitive. *Harvard Business Review*, Sept. Oct.: 120-

McDonough, W. and M. Braungart. 2002. *Cradle to Cradle*.

Gleick, P. annual. *The World's Water*.

Reisner, M. 1986. *Cadillac Desert*.

Hillel, D. 1994. Rivers of Eden: Struggle for Water and Quest for Peace in the Middle East.
 Hundley, N. 1992. The Great Thirst.
 Butti, K. and J. Perlin. 1980. A Golden Thread.
 Elizabeth, L. and C. Adams. 2000. Alternative Construction: Contemporary Natural Building Methods.
 Pacey, A. and A. Cullis. 1996. Rainwater Harvesting.
 van Dresser, P. 1977. Passive Solar House Basics. Givoni, B. 1969. Man, Climate and Architecture.
 Stewart, B. 1992. Improved Wood, Waste and Charcoal Burning Stoves.
 Olgyay, V. and A. 1976. Solar Control and Shading Devices.
 Niles, P., K. Haggard, and P. Cooper, eds. 1980. California Passive Solar Handbook.
 Schmitz-Gunther, T. L.E. Abraham and T.A Fisher. 1998. Living Spaces: Sustainable Building and Design.

WEB resources

International Society for Industrial Ecology
 United States Society for Ecological Economics – membership free for students
 U.S. Dept of Commerce http://www.osec.doc.gov/eda/html/2b2_5_eco-industdev.htm
 Lifecycle and EcoIT <http://www.pre.nl/>
 ICC Business Charter for Sustainable Development
http://www.iccwbo.org/sdcharter/charter/about_charter/about_charter.asp
 The Step-by-step Sustainability Scheme. International Network for Environmental Management (INEM) and German Environmental Management Association (B.A.U.M.)
http://www.inem.org/htdocs/articles/sustainability_scheme.html
 Business and sustainable development <http://iisd.ca/business/>
 Eco-efficiency - creating more value with less impacts, WBCSD, 2000
<http://www.wbcscd.ch/newscenter/reports/2000/EEcreating.pdf>
 Eco-efficient service http://www.wupperinst.org/Projekte/SuE/HTMLtexts/Pages/t_2_5.html
 Eco-efficiency of regions [www.seri.at/SERI_next/projects/eco-efficiency-regions/ download/eeregion2.pdf](http://www.seri.at/SERI_next/projects/eco-efficiency-regions/download/eeregion2.pdf)
 The National Center for Eco-Industrial Development <http://www.cornelldailysun.com/articles/1202/>

Course Schedule (*subject to change*)

1. Eco-effective operations and production – The triple bottom line. True cost, life cycle cost, MIPS, MFA, and ecological footprints. The critical resources – energy, water, minerals. Strategic materials. Substitution and elasticity. Global change and investing for the future. The race to the bottom.
2. What do we use water for -- water assessment quiz. The water cycle, water statistics. Demand exceeds supply. Water quality and quantity. Water recycling and reuse. The great unknowns--the need for research. San Diego, Jordan. .Reading: Shiva preface/intro
3. Water economics -- uses, sources, and conflicts, the Western U.S. The economics of water. How price determines efficiency. Metering, marketing schemes to improve consumer understanding, and efficiency. New and traditional sources of water (fog catchers, dew ponds, etc), rainwater harvesting, desalinization, water reuse. Shiva 2,3,4
4. Efficient use of water in industry, hotels and restaurants, schools, and homes. Water harvesting and reuse, water treatment and recycling (biological water treatment, solar disinfection, etc.) WATER LAB. Shiva 5,6, Start energy book—read it all.

5. What do we use energy for? What do we need energy for? Energy assessment quiz. An introduction to energy. A brief history of energy use - from hunter gatherer to industrial revolution to today. The energy crisis in Greece and Rome. The solar city of Olynthus. Energy use in selected countries today. A first look at energy costs and subsidies. The environmental costs of energy use - fuelwood, hydro, coal, oil, gas, nuclear, solar.
6. Energy use and efficiency, conservation and consumption, Renewable and non-renewable sources of energy. Energy quality and demand, energy storage and loss. The world energy crises. Energy use in San Diego. Why are even modern homes pathetically inefficient? Why are our buildings at AIU so poor? Daylighting. Solar design in one day – passive solar heating and natural cooling. .SOLAR COOKER LAB.
8. Energy economics. Environmental effects of our dependence on fossil fuels, global warming and global change. Local environmental effects from nitrogen pollution. More information on the ecological costs of massive hydropower projects. Energy use in commercial buildings and industry. A visit to Knights Foundry (video).Optimizing efficiency by integrated design. Thermal analysis of building or commercial complex - .SOLAR HOUSE LAB.
9. Community design for energy efficiency. Where does energy go? Bikes, busses, cars, trucks, trains, and planes. What can be done about it? The success of Curitiba. The campus community re-imagined/rebuilt. Redeveloping a village in the US, the third world.
10. Sustainable energy futures. Solar, wind, geothermal, biomass, biogas, microhydro, hydrogen, fuel cells, biodiesel, alcohols, geothermal, tidal, OTEC, etc..True costs and subsidies.
11. Other critical resources, MIPS and MFA. Renewable and non-renewable resources. Strategic resources. Platinum, oil, gold, sand and gravel, etc. Wood, food, oils, resins. Wastes as resources.
12. Industrial ecology. Rethinking and remaking society for eco-efficiency and eco-effectiveness. Factor 10.
13. Sharing and equity, international agreements, and international cooperation on water, energy, and mineral resources.
14. The critical challenges ahead. Opting out of the race to the bottom. The transition to a sustainable operations and production. Presentations.
15. Review and exam.

Course requirements and grading.

... Grad students

Research profile (word search and hits, notes, web reviews)	10	5
1500 word research paper - fully referenced with citations and word count	10	
Midterm – multiple choice and essay (from lectures, discussions and books)	10	
Workshops – outside depends on clear weather		
solar house	10	
solar cooker	10	
Building thermal analysis	10	
Water system lab – in class	10	
<i>6999 students only, detailed EcoBusiness Plan</i>		10
Presentation of a short talk on research paper or critical topic	10	5
Class participation – discussions and simulations are critical and require reading assignments (attendance is expected, more than 2 unexcused absence will result in penalties, typically		

additional assignments)	10	
Final exam—essay, definitions, problems	10	
	Total..100	100

Assignment #1: RESEARCH, NOTES, WEB

This is training for effective library and internet research. Conducting research effectively and managing information well is essential to succeed in most careers. Research helps you find out how, why, what, where, and when.

Step 1: Choose a research topic.

Step 2: Develop a short list of key words for the search - include as first section.

Step 3: Start with the excellent resources of the AIU library (or use resources at a UC or CSU library).

List results of your search for your key words with hits per database for 10 databases, try to find full text on line. For example I did a quick search on biodiesel. OCLC WorldCat 150, Wilson select 60, Eco 20, Econlit 4. AGRICOLA 124, PapersFirst 263 (a hot topic), LexisNexis 125, Newspaper source 144, Business Source premier 31 scholarly and 179 magazine, BusinessIndustry 67.

Step 4. The California Digital Library - Searchlight

List results of your search for your key words in Searchlight for several of the databases. For example for Biodiesel EPA 299, GPO Patents 71, GAO 7.

Step 5. Melvyl

Provide a list of books on your topic you find in Melvyl with shelf numbers and full citation detail. Biodiesel 8 hits.

Step 6. Web Crawl. Use at least 2 search engines.

List your search results. You must use at least two different search engines in your web search profile. You must identify the search engine, provide the URL for the web search page, the search terms you use and the number of hits. Chronicle the terms you added to reduce the number to a manageable number of sites to review.

Step 7. Sample Notes

You must turn in your notes from at least two of your key sources: one from the library or a scientific journal and one from the web. Include all relevant citation information. Notes should be in your words not copied from text or book directly.

Step 8. Two internet site reviews on sustainable production and operation.

1. Screen Design and Layout
2. Information Design
3. Text as a Graphic Element
4. Copy
5. Navigation Scheme
6. Stylistic Unity
7. Graphics and music
8. Colors
9. Usability
10. Links

Overall: Information quality and authority

Assignment #2. Research paper, 1500 words (+ or - 50 words)

Typed 1.5 or double spaced in 12 point Times or similar font, 1.25 inch margin on the left and 1 inch margins on all other sides. Except in cases where original investigations are done, your paper will be a report on investigations by others so you must be sure to give credit where it is due with proper citations and references.

The penalties for plagiarism are spelled out in the student handbook--zero for the assignment plus other penalties if serious.

You should use at least **five reputable business magazines or papers or five scholarly papers or books** for your paper, you may use up to five internet sources in addition to the "permanent" references. Use professional journals (on-line in many cases, see for example Greener Management International), magazines and newspapers (the Economist, Wall Street Journal), government documents, and scholarly books as primary source materials. When you use an investigator's data, state his/her ideas, paraphrase his/her conclusions, or quote him/her directly, cite the reference as follows at the end of the sentence the first time their work is used in a paragraph (Altieri, 1995). Follow the reference format information for the Journal of Ecological Economics (find it on-line).

No footnotes, use direct quotations rarely and only when they are essential to your argument. In most instances you should paraphrase the information from your sources, giving credit to authors by citing their paper or book.

The individual paper topic must be about sustainable operations and production issues. If you can't think of a topic or are unsure if it is appropriate I will be happy to assist you. Remember to consider what economic factors have led to the problem? What environmental and social costs are involved? What has been suggested as a solution?. For example: Green hospitals, Management of hospital waste, Paper making with water efficient processes, no chlorine, and alternative fibers, Ecomposite materials for buildings, industrial ecology for Kenya, etc.

GRADING for PAPERS (Papers can be corrected and resubmitted for regrading until finals week)

1) Innovation and thoughtfulness	20
2) Analysis/understanding	20
3) Structure and order, focus	10
4) Grammar	10
5) Style-is it engaging, readable	20
6) Citations correctly used	10
7) Quality of citations and searches	10
<u>Total score possible</u>	<u>100 points</u>

Deductions for spelling errors or wrong words	-5 points for each word
Deductions for incorrect margins	-5
Too many or too few words	-5 for each 10 words
No page numbers (handwritten doesn't count)	-20
Inappropriate topic (doesn't answer question asked) ...	up to -30
Plagiarism (inappropriate copying of web page or other paper - no points for paper, no rewrite)	

Yes indeed – students can and do get negative scores so edit carefully and get in on time so you can get it back in time to rewrite.

In class assignments

Thinking fast and writing and communicating clearly are required in business and essential for selling ideas. In class assignments will include writing effective e-mails and memos, business plan outlines, and marketing outlines. (these are counted in the participation section of grading)

Lab assignments – will generally be completed in class. Current expectations are for:

#3 solar house 10

#4 solar cooker	10
#5 water systems	10

These will require a short write-up, data analysis (temps), and sketches. What was tried, what worked and didn't.

Assignment #6. Building thermal analysis **10**

A thermal analysis of a simple building, your apartment, or home will be done using forms and materials from class.

Assignment for graduate students only. **10**

Prepare a business plan for an ecobusiness opportunity you have seen from this class.

Be realistic, document claims, reference articles and reviews, be flexible, optimistic, highlight your unique characteristics. A short version might only include: 1,4,5,7,8,9

A typical business plan might include....

1. Introduction –cover letter, cover sheet, table of contents
2. Executive summary – two to four pages to convince someone to read the whole thing
3. The business environment – where your company/product/service fits, trends for sector, opportunities, future
4. The business profile – what you will do, who you are and why it makes sense, organization, operation, legal base (patents, copyrights, etc.)
5. The market -- consumers/clients (who, how many), competitiveness with competing products or services, geographic area, ability to meet needs, retention and recruitment of more consumers/clients
6. Anticipated challenges and resource requirements – competitors, your edge, weakness to overcome, protection of ideas or design, staffing, training, depth of management
7. Marketing – selling the product or service, publicity, promotion, merchandizing, market research
8. Financial projections – past, profit and loss, balance sheet, cash flow
9. Implementation
10. Resource needs (if seeking funding or cooperation)

Appendices

Assignment #7. Presentation

Presenting ideas is critical in business and community life. Your short talk can cover your research paper or any other topic of relevance for class. Choose something of interest for your classmates. Expect to talk for about 10 minutes. Turn in your ppt, OH transparencies or display. Start using PowerPoint if you have not used it before. Your time as presenter is valuable - make sure it counts. More details will be provided in class.

Final exam

Covering the entire course, essay, definitions, problems.

Course goals for understanding

- 1. Demonstration of a global outlook and understanding of the meaning of sustainability.*
- 2. Understanding of the interconnectedness and interdependence of individuals and cultures.*
- 3. Skill in critical thinking to assess the quality of information and its importance.*
- 4. Effective interpersonal communication with oral, written, quantitative, and computer skills.*
- 5. Understanding of the interdisciplinary nature of knowledge.*
- 6. Understanding of resource issues and implications for the future.*

Course objectives

- 1. Integrate each student's unique experiences and background into this class.*
- 2. Understand the interaction of cultures (developed/less developed), the economy, the environment, and historical and future development patterns. Relate environmental constraints to development patterns and sustainability.*
- 3. Develop increased respect and understanding of "others" and especially the skill and intelligence needed for subsistence and survival in difficult and changing environments.*
- 4. Apply critical analysis skills to interpreting current world challenges.*
- 5. Interpret and present important information for other classmates.*
- 6. Understand the inter-relatedness of all things and the importance of systems thinking to solve complex problems and develop sustainable solutions.*
- 7. Learn to work well with teams in analyzing and presenting discussions and displays of important concepts and papers.*
- 8. Provide a meaningful project at the end of the class to help prepare for a sustainable future.*

Course assessment – graded A-F

- 1. Class understanding, essays, presentation, essay questions and exam questions. Expectations for points and grades will be clearly spelled out in class with examples. If in doubt – ask!!*
- 2. Class participation, research papers, exams.*
- 3. Communication - analysis and presentation of a paper to class (seminar style), in class assignments.*