

SYLLABUS

Economy, Technology, and Sustainability

ECON4250

STSS4960

Fall 2017

Monday and Thursday, 2 - 3:50 pm

Sage 2112

Professor Faye Duchin

Rensselaer Polytechnic Institute

Department of Economics

3408 Sage

Tel.: 276-2038

duchin@rpi.edu

Office hours: Tuesdays 10 am – 12 noon and by
appointment

1. Course Description and Student Learning Outcomes

This course identifies critical challenges to sustainable economic development on local to global scales and focuses on ways of addressing them. We examine options surrounding water, food, materials and energy, technological alternatives, consumption behavior, public policy, and civil society institutions. Each student will conduct independent research on a subject area of his or her choosing, report progress on it in an oral presentation, and write up the study as a term paper.

Learning Outcomes

Students who successfully complete the course will demonstrate *factual knowledge* about the interaction between economics and the material world and about alternative ways of dealing with the associated challenges to sustainability. You will be able to *exercise critical judgment* in evaluating the concerns, assumptions, and methods reflected in the assigned and other readings. You will display what you have learned by *formulating a research question* and advancing your *skills for locating relevant published materials* to help you develop your response. You will gain experience *expressing your ideas and conclusions orally, in writing, and through active participation* in seminar discussions.

The syllabus describes course materials in Section 2, the class schedule in Section 3, and an overview of assignments and grading criteria in Section 4. Sections 5 and 6 describe the formats for the oral presentation and term paper. Resources that may prove useful are identified in Section 7, and important policy issues are discussed in Section 8. Appendix A is a list of the course readings. Appendices B and C provide more detail about the presentation and paper. The last page is a calendar that also serves as an overview of the course.

2. Course Materials

Assigned Readings are indicated by date in the Class Schedule. A full listing can be found in Appendix A. The papers are in the Library Reserve Readings at <http://www.lib.rpi.edu/cgi-bin/crsind.pl/ECON425001> and are available from the LMS site.

We will view three films in class: Merchants of Doubt (2015), Poisoned Waters (2009), and Food Inc. (2008). The film projections are indicated by date in the Class Schedule.

3. Class Schedule

1. Thursday, August 31

Course Overview

Monday, September 4, Labor Day, no classes

Economics: September 7, 11, 14

2. Thursday, September 7

Backhouse and Medema, “Definitions of Economics”

17 Sustainable Development Goals:

<http://www.un.org/sustainabledevelopment/sustainable-development-goals/>

Also browse the rest of the site:

<http://www.un.org/sustainabledevelopment/development-agenda/>.

Group activity and sign up for presentation

3. Monday, September 11

Daly, “Economics in a Full World”

Boulding, “The Economics of the Coming Spaceship Earth”

Group activity and sign up for presentation.

4. Thursday, September 14

Scott, Capitalism and democracy

Group activity and final day to sign up for presentation.

Technology: September 18, 21, 25

5. Monday, September 18

Frosch and Gallopoulos, “Strategies for Manufacturing”

Tutorial on online research: bring your laptop.

6. Thursday, September 21

Chertow and Ehrenfeld, “Organizing Self-Organizing Systems: Towards a Theory of Industrial Symbiosis”

Film 1: “Merchants of Doubt,” 2015 part 1 (45 minutes)

7. Monday, September 25

Graedel, Urban mining

Film 1: “Merchants of Doubt,” 2015 part 2 (45 minutes)

Discussion of Film 1

Sustainability: September 28; October 2, 5

8. Thursday, September 28

Kakabadse, Arctic; Pool, Antarctic

Lecture: Effective oral presentation and paper proposal

9. Monday, October 2

Tollefson, Amazon deforestation; Schiffman, Rainforest threats resume
Presentation day #1

10. Thursday, October 5

Brown et al., extreme weather and water utilities; Lubchenko et al., National
Oceanic and Atmospheric Administration (NOAA) and extreme weather
Presentation day #2

Monday, October 9, Columbus Day, no classes

11. Tuesday, October 10 (Monday schedule)

EXAM #1

Lifestyles: October 12, 16, 19

12. Thursday, October 12

Rees, Urban sustainability
Presentation day #3

13. Monday, October 16

Schor, J., “Sustainable Consumption and Worktime Reduction”
Presentation day #4

PAPER PROPOSAL DUE

14. Thursday, October 19

O’Reilly and Louis, Sanitation in rural India
Presentation day #5

Water: October 23, 26, 30

15. Monday, October 23

Akpınar Ferrand and Cecunjanin, Rainwater harvesting
Film 2: “Poisoned Waters” 2009 part 1 (60 minutes)

16. Thursday, October 26

Al-Jayyousi, Greywater reuse
Film 2: “Poisoned Waters” 2009 part 2 (60 minutes)
Discussion of Film 2

17. Monday, October 30

von Sperling, Hydropower in Brazil
Lecture: Writing the Research Paper

Energy: November 2, 6, 9, 13

18. Thursday, November 2

Smil, “The Long Slow Rise of Solar and Wind”
Presentation day #6

19. Monday, November 6

Mah et al., Smart power grid in Japan
Presentation day #7

20. Thursday, November 9

Presentation day #8
Film 3: Food Inc. 2008 part 1 (45 minutes)

21. Monday, November 13

Coelho, S. and J. Goldemberg, "Energy Access: Lessons Learned in Brazil and Perspectives for Replication in other Developing Countries"
Film 3: Food Inc. 2008 part 2 (45 minutes)
Discussion of Film 3

Agriculture and Food: November 16, 20, 27

22. Thursday, November 16

Lane and Jarvis, Agricultural biodiversity
Presentation day #9
PAPER DUE

23. Monday, November 20

Springer and Duchin, Feeding ten billion people
Presentation day #10

November 22 - 26, Thanksgiving Break

24. Monday, November 27

Grewal and Grewal, Urban food self-reliance
Presentation day #11

Resources: November 30; December 4, 7

25. Thursday, November 30

Graedel and Erdmann, Metal scarcity
Presentation day #12

26. Monday, December 4

Amezaga et al., Sustainable mining
Presentation day #13

27. Thursday, December 7

Grosjean et al., Lithium reserves and future use
Presentation day #14

28. Monday, December 11

EXAM #2

4. Assignments and Grading

Grades will be based on class participation, two exams, an oral presentation, and a research paper. There may be additional brief assignments in the course of the term. They will not be graded but will count toward participation.

Participation	10%
Exam #1	20
Exam #2	20
Presentation	25
Term Paper Proposal	S/U (Participation)
Term Paper	25
TOTAL	100%

Class Participation

I expect you to do the assigned reading before class and come to class prepared to discuss what you find important or controversial in the paper. I would like to have everyone's active participation in class discussions. Some people need a few minutes to collect their thoughts before joining the discussion: that is why you should organize your thoughts before class. The readings are quite short because I expect you to start research on your term paper from the beginning of the semester.

Exams

There will be two in-class exams, on **Tuesday, October 11 (Monday schedule)**, and on **Monday, December 11**. Each exam will consist of short essays based on the readings, lectures, films, and class discussions up to the day of the exam. If you cannot be in class on the day of an exam, you need to let me know in advance. In this case, the missed exam may be substituted by a writing assignment.

Presentation and Research Paper

Each student will formulate a research question, locate published articles to help answer it, and submit a Term-Paper Proposal on the topic. The proposal is due on **Monday, October 16**. The idea is to pick a research question that *really* interests you. The Proposal should provide a working title for the paper. It should state the research question, describe the motivation for the research, and identify the main objectives for the paper including some possible answers to the research question. It should be about 3 pages of text plus a tentative List of References with at least five entries to articles you have read and found relevant. Please submit electronically and bring to class in hard copy. If you wish to change your research question after the proposal is approved, please submit a revised proposal. I will not accept a paper if I have not previously approved the proposal for it.

The Term Paper is due on **Thursday, November 16**. It should be 10-15 pages of text (double-spaced) and include at least two tables and/or figures and about 6-10 relevant references in a standard format. See guidelines for writing the paper in Appendix B. Please submit electronically and bring to class in hard copy.

Each student will make an Oral Presentation on the research question, based on the Proposal and my feedback on it, and lead a discussion on the subject. The presentation is intended to provide you with constructive critique on your research and with experience presenting, while also being instructive for the rest of the class. There will be one or two presentations of around 20 minutes on each scheduled day, each followed by 10 minutes of discussion that you lead. A report on the presentation is due by midnight on the day of the presentation. See Appendix C for guidelines on preparing the oral presentation and report.

Mid-Semester Assessment. Your performance in the first exam and the paper proposal serve as mid-semester indications of your progress. I will also inform you at mid-semester of any concerns about your attendance or participation in class.

5. Resources

This is a communication-intensive course, and I am available to provide you with extensive feedback on content and assistance on locating sources and organizing ideas for your oral presentation and writing assignments. I welcome you to come to my office hours, schedule a meeting with me, and consult by e-mail.

RPI's Center for Communication Practices is an extremely valuable resource. The CCP offers professional online resources and personal assistance: <http://www.ccp.rpi.edu>. Contact the Director of the CCP, Dr. Barbara Lewis, for a meeting. Consult the online Resources for Writers for advice on citations and referencing for published and Internet materials.

6. Policy Issues

Attendance is not optional: You are expected to attend all classes unless you have an excused absence and to participate actively. Attendance will be taken, and points may be deducted for unexcused absence.

Laptop Policy. You will make intensive use of your computer outside of class to access required readings and to locate materials for your oral presentations and your paper. However, we will not use a laptop during class with one exception: on Monday, September 18, we will spend some time doing literature searches with Google Scholar and RensSearch. Using a laptop inhibits your active participation in class discussions and is disruptive for others. Please take notes, but manually.

Considerateness. Please do not come late to class, as it is disruptive for everyone. Please turn your cell phone off when you are in class.

Academic Honesty. Student-teacher relationships are built on trust; in particular teachers must trust that the assignments that students turn in are their own work. The 2014-2016 *Rensselaer Handbook of Student Rights and Responsibilities* defines various forms of Academic Dishonesty, and you should make yourself familiar with these. Copying someone else's work is a very serious offense and will be treated accordingly. Both plagiarism and other acts of academic dishonesty (such as submitting the same paper to two courses) will, if detected, be prosecuted according to the university guidelines as described in the *Handbook* and in this class will receive a grade of F for the paper or presentation in question. You should write a paper using your own ideas and your own words. If you are making use of someone else's exact words, you must use quotation marks and indicate the source with a citation to a reference. If you are paraphrasing someone else's words, you need to cite the source and provide a reference. If you are unsure whether quotes or a citation are necessary, it is better to err on the side of caution and provide a reference. Failure to follow these guidelines constitutes plagiarism. If you have any question concerning this policy, please ask for clarification before submitting the assignment.

Appendix A. List of Readings (available as Library Reserve Readings, accessible through LMS)

Akpinar Ferrand, E. and F. Cecunjanin, 2014. "Potential of Rainwater Harvesting in a Thirsty World: A Survey of Ancient and Traditional Rainwater Harvesting Applications," *Geography Compass*, 8(6): 395–413.

Al-Jayyousi, O. R., 2003. "Greywater reuse: towards sustainable water management," *Desalination*, 156(1): 181-192.

Amezaga, J. M., Rötting, T. S., Younger, P. L., Nairn, R. W., Noles, A. J., Oyarzún, R., and Quintanilla, J., 2010. "A Rich Vein? Mining and the Pursuit of Sustainability," *Environmental science & technology*, 45(1): 21-26.

Backhouse, R.E. and S.G. Medema, 2009. "On the Definition of Economics," *Journal of Economic Perspectives*, 23(1): 221-233.

Basten, S., W. Lutz, and S. Scherbov, 2013. "Very Long Range Global Population Scenarios to 2300 and the Implications of Sustained Low Fertility," *Demographic Research*, 28(30): 1145-1166.

Boulding, Kenneth E. 1966. "The Economics of the Coming Spaceship Earth," In H. Jarrett, ed., *Environmental Quality in a Growing Economy*, John Hopkins University Press, pp. 3-14.

Brown, E. E., Ternieden, C., Metchis, K., Beller-Simms, N., Fillmore, L., and Ozekin, K., 2013. "Emergency response or long-term resilience? Extreme events challenge water utilities and their communities," *American Water Works Association*, 105(8):38-40.

Chertow, M. and J. Ehrenfeld, 2012. Organizing Self-Organizing Systems: Toward a Theory of Industrial Symbiosis, *Journal of Industrial Ecology*, 16(1): 13-27.

Coelho, S. and J. Goldemberg, 2013. "Energy Access: Lessons Learned in Brazil and Perspectives for Replication in other Developing Countries," *Energy Policy*, 61: 1088-1096.

Daly, H. 2005. "Economics in a Full World," *Scientific American*, 293(3): 100-107.

Edwards, P., in press 2015. "Aquaculture environment interactions: Past, present and likely future trends," *Aquaculture*. Online at http://ac.els-cdn.com/libproxy.rpi.edu/S0044848615000605/1-s2.0-S0044848615000605-main.pdf?_tid=3645c04c-2818-11e5-83f9-00000aab0f01&acdnat=1436652196_d7a340f92822c6ea35a4db3a61480d65.

Frosch, R. and N. Gallopoulos, 1989. "Strategies for Manufacturing," *Scientific American*, 261: 144-160.

Graedel, T. E., 2011. "The prospects for urban mining," *The Bridge*, U.S. National Academy of Engineering, 41(1): 43-50.

Graedel, T.E. and L. Erdmann, 2012. Will Metal Scarcity Impede Routine Industrial Use? *Material Research Society Bulletin*, 37: 325-331.

Grewal, S. S., & Grewal, P. S., 2012. "Can cities become self-reliant in food?" *Cities*, 29(1): 1-11.

Grosjean, C., Miranda, P. H., Perrin, M., and Poggi, P., 2012. "Assessment of world lithium resources and consequences of their geographic distribution on the

expected development of the electric vehicle industry,” *Renewable and Sustainable Energy Reviews*, 16(3): 1735-1744.

Kakabadse, Y., 2015. “Frontier Mentality Has No Place in the Arctic,” *Harvard International Review*, 36(3): 55-59.

Lane, A., & Jarvis, A., 2007. “Changes in climate will modify the geography of crop suitability: agricultural biodiversity can help with adaptation,” *International Crops Research Institute for the Semi-Arid Tropics eJournal*, 4(1): 1-12. Referenced July 11, 2015 at <http://www.icrisat.org/Journal/SpecialProject/sp2.pdf>.

Lopez-Morales, C. and F. Duchin, 2015. “Economic Implications of Policy Restrictions on Water Withdrawals from Surface and Underground Sources,” *Economic Systems Research*, 27(2): 154-171.

Lubchenko, J., and T.R. Karl, 2012. “Extreme weather events,” *Physics Today*, 65(3): 31-37.

Mah, D. N. Y., Wu, Y. Y., Ip, J. C. M., & Hills, P. R., 2013. “The role of the state in sustainable energy transitions: A case study of large smart grid demonstration projects in Japan,” *Energy Policy*, 63: 726-737.

O’Reilly, K., & Louis, E., 2014. “The toilet tripod: Understanding successful sanitation in rural India,” *Health & place*, 29: 43-51.

Pool, R., 2014. “The changing face of the white continent,” *Engineering & Technology*, 9(10): 43-45.

Rees, W.E., 2007. “Getting Serious About Urban Sustainability,” Planning Sustainable Cities Lecture Series, University of Calgary, February 12.

Schiffman, R., 2015. “Rain-Forest Threats Resume.,” *Scientific American*, 312(6): 24 (+ 3 photos).

Schor, J., 2005. “Sustainable Consumption and Worktime Reduction,” *Journal of Industrial Ecology*, 9(1-2): 37-50.

Scott, B., 2012. “Capitalism: The Indirect Economic Governance of a Visible Hand,” *Challenge*, 55(4): 5-23.

Smil, V., 2014. “The Long Slow Rise of Solar and Wind,” *Scientific American*, 310(1):52-57.

Springer, N. and F. Duchin, 2014. “Feeding Nine Billion People Sustainably: Conserving Land and Water through Shifting Diets and Changes in Technologies,” *Environmental science & technology*, 48(8): 4444-4451.

Tollefson, J., 2015. “Stopping Deforestation: Battle for the Amazon, Nature, 520(7545): 20-23.

von Sperling, E., 2012. “Hydropower in Brazil: overview of positive and negative environmental aspects,” *Energy Procedia*, 18:110-118.

Appendix B. Guidelines for Writing a Research Paper

- Develop a numbered outline to help you scope out the paper.
- Start paper with a title on a cover page. End it with a list of references.
- Use sources to inform your statements; document them through in-text citations to references. Use independently located resources as well as course materials including seminar discussions.
- Divide the paper into sections. Give each section a heading, and number the sections. Use larger font and bold type for the headings.
- The Term Paper should include quantitative information and at least two tables or figures.
- The first section and heading should provide an Introduction. It should concisely summarize the main points you will proceed to make.
- Other sections should follow in logical order. Each heading should give a good description of the contents of that section. Each section should address the issue raised by the heading. Check your logic: the text needs to deliver on promises.
- Be explicit about logical transitions: the first sentence of a new paragraph should pick up on the point made by the last sentence in the preceding paragraph.
- Insert in-text citations to your references for quotes and for use of factual information or ideas.
- The last section should serve as a Conclusion that follows logically from the Introduction.
- Include a List of References at the end. They should be in this form: author (alphabetized, last name first), date, title, source, volume, number of pages, URL if relevant.
- Proofread and revise your paper several times before submitting it to catch and correct careless errors. Proofread also to reorganize, revise arguments, and refine wording. Consider asking someone else to read it and give you feedback.
- All written assignments should be both submitted electronically and brought to class in hard copy.
- Consult with Dr. Barbara Lewis the Center for Communication Practices (meetings are in Folsom Library; they can be scheduled online).
- Grading will be based on content and on writing quality. Good content requires a good thesis or research question and effective use of relevant and informative sources. Good writing requires a well-planned structure for the paper, a logical flow of ideas from one section to the next, adequate citations and good quality references, and the absence of careless errors.

Appendix C. Guidelines for the Oral Presentation

We will have an oral presentation, sometimes two, during the second hour of class on each of fourteen days. Sign up early to get your choice of date.

You are expected to prepare a Power Point presentation of 15-20 minutes duration about your research topic. The focus of your presentation will depend on your topic and whether you present earlier or later in the term. Your objectives are to present and motivate your choice of topic and to elicit advice from your colleagues and from me that will help you progress. Then you will lead a class discussion of 10-15 minutes on the topic. The Power Point presentation needs to be based on research, and the last slide should show your sources. You should prepare thoughtful questions in advance to guide the discussion period.

By the end of the day of your presentation, you need to send me a Report on it that includes: a cover page (with title, your name, date, etc.), a paragraph summarizing the presentation, and a paragraph summarizing the class discussion. Send me the Power Point presentation (including the slide with your references) along with the Report.

If you have already gotten my feedback on your paper proposal by the time of your oral presentation, I expect your presentation to reflect that feedback.

- Start with a cover slide with a title.
- Present your research question.
- Put your work into a broader context.
- Do not read slides.
- Make eye contact.
- Let the seminar participants know what to expect:
 - State your research question early and clearly.
 - Indicate what you have learned so far.
 - Identify the challenges you are still facing.
- Do not clutter slides
 - Make use of the title of a slide to introduce information.
 - Use bullet points, not full sentences
 - Make the points informative, concise, grammatically parallel.
 - Make use of sub-points (indented).
- Develop argument logically.
- Be concrete wherever possible (give cases, examples).
- Document individual slides.
- Include list of references at the end.
- Proofread.
- Rehearse.

						Prese-
				Reading	Activity	tation
1	August	Thursday	31	Overview of course		None
2	September	Thursday	7	Backhouse and Medema, SDGs (economics)	Group, sign-ups	None
3		Monday	11	Daly (ecological economics), Boulding (spaceship earth)	Group, sign-ups	None
4		Thursday	14	Scott (capitalism and democracy)	Group, sign-ups	None
5		Monday	18	Frosch and Gallopoulos (strategies for manufacturing)	Library session	None
6		Thursday	21	Chertow and Ehrenfeld (eco-industrial parks)	Film 1: Merchants of Doubt (1)	None
7		Monday	25	Graedel (urban mining)	Film 1: Merchants of Doubt (2) Discuss film	None
8		Thursday	28	Kakabades (Arctic), Pool (Antarctic)	Lecture on paper and presentation	None
9	October	Monday	2	Tollefson (Amazon deforestation), Schiffman (threats resume)		1
10		Thursday	5	Brown et al. (weather and water utilities), Lubchenko and Karl (NOAA and extreme weather)		2
11		Tuesday	10		Exam #1	None
12		Thursday	12	Rees (urban sustainability)		3
13		Monday	16	Schor (work time reduction for sustainable consumption)	Paper Proposal Due	4
14		Thursday	19	O'Reilly and Louis (sanitation in India)		5
15		Monday	23	Apkinar Ferrand and Cecunjinan (rainwater harvesting)	Film 2: Poisoned Waters (1)	None
16		Thursday	26	Al-Jayyousi (grey water reuse)	Film 2: Poisoned Waters (2) Discuss film	None
17		Monday	30	von Sperling (hydropower in Brazil)	Lecture on research paper	None
18	November	Thursday	2	Smil (long slow rise of renewables)		6
19		Monday	6	Mah et al. (smart grid in Japan)		7
20		Thursday	9	NONE	Film 3: Food Inc. (1)	8
21		Monday	13	Coelho and Goldemberg (energy in developing countries)	Film 3: Food Inc. (2) Discuss film	none
22		Thursday	16	Lane and Jarvis (agric. biodiversity)	Paper due	9
23		Monday	20	Springer and Duchin (global agriculture)		10
24		Monday	27	Grewal and Grewal (food self-reliance)		11
25		Thursday	30	Graedel and Erdmann (metal scarcity)		12
26	December	Monday	4	Amezega et al. (sustainable mining)		13
27		Thursday	7	Grosjean et al. (future of lithium)		14
28		Monday	11		Exam #2	