REM 650
ENERGY AND MATERIALS MANAGEMENT AND POLICY

Course Outline: Fall 2013

Instructor: Mark Jaccard, Resource and Environmental Management, SFU

Tel: 778 782-4219 / 604 733-8317 E-Mail: jaccard@sfu.ca
Time: Wed (WMC 3535) & Fri (TASC2 8070) 2:30 – 4:30 Location: SFU Burnaby.

Course objective

This course takes an interdisciplinary approach to addressing sustainability issues in energy and materials. Because students may have backgrounds in diverse fields, such as engineering, natural sciences, economics and policy analysis, key concepts are introduced without requiring extensive background knowledge in any specific discipline. And while the course is focused on energy flows in society, the analytical approaches are equally applicable to material flows, and examples from this perspective will be provided. The course is applied, focusing on how research can contribute to issues of pressing concern to humanity – with special emphasis on the climate risk. There is also some focus on the communication of research findings to policy makers, media, industry, non-government organizations and the public at large, and the challenges for applied academics when confronted with arguments for engaging in some degree of social-political activism.

Key dimensions of the course include:

- Assessing how human-induced flows of energy and materials are, or might become, a challenge for sustaining the earth's life-support capability and the cohesion of human societies;
- Exploring thermodynamic, technological, geological and biological options for changing the character of these flows toward greater sustainability;
- Potential implications of these options from an ecological, economic and social perspective; and
- Institutional and policy mechanisms (local, regional, national, global) for advancing these options.

Course content

- Efforts to define sustainability from a thermodynamic, geophysical, ecological, and economic perspective (Georgescu-Roegen, Ayres, economic growth debates, etc.);
- Analytical techniques and concepts for goal setting with respect to energy and material sustainability (conservation and abatement cost curves, rebound effect, ecological footprint, etc.); and
- Assessing the effectiveness of alternative institutions and policies for initiating and implementing some of these techniques (policies for externalities, design of successful international energy-environment agreements, pursuit of energy access in developing economies, etc.).

Some of the questions explored in the course

- Can current or even substantially higher human-related flows of energy and materials be sustainable?
- Can non-renewable resource use be part of a sustainable energy and material system?
- Is energy return on energy invested a useful concept?
- Is peak oil an important concept?
- Is peak phosphorous an important concept?
- Is energy efficiency cheap?
- How do we define behavioral changes for sustainability and what is this potential?
- How do we compare and do trade-off analysis between renewables, nuclear and carbon capture & storage?
- How do we evaluate alternative policies for sustainability?

- Should policies be technology-neutral?
- What institutions and policy processes are needed for rapidly scaling-up renewables?
- Is carbon neutrality a useful target and are offsets a useful policy contribution?
- How do we assess geo-engineering as an option for addressing the climate change risk?
- How can we achieve the necessary global effort against the climate risk?
- What mechanisms within and between nations can rapidly provide energy access to 2 billion people?
- What is economic growth and can it be sustained indefinitely?
- Can international trade be sustainable?
- Is foreign investment good or bad for developing countries?
- How can research into human cognition help with policy design?
- What role, if any, for civil activism in advancing sustainability?
- If humans continue to fail to address the risk of global warming, then what?

Class format and prerequisites

The class format is primarily seminars, with some short lectures. The class size is limited to ensure that students can explore issues in depth. There are no prerequisites, but permission of the instructor is required. The class is on Wednesday and Friday afternoons, with the option to continue discussions in the pub after class.

Student Evaluation

- Book review or other assignment (max 6 pages, 12 pt font, 1.5 spacing) 20%
- Mid-term exam (1 hour) 20%
- Class participation (including 1 or more short presentations) 20%
- Term paper (max 12 pages, 12 pt font, 1.5 spacing) 40%

Readings and Lecture Slides / Notes

The readings are a mix of academic papers (some quite challenging), policy briefings, and more populist style writing in order to help students develop modes of communication appropriate to different audiences. The readings and lecture slides are available at http://research.rem.sfu.ca/downloads/REM-650

****

Course units and readings

1. Physical analysis of energy and materials (thermodynamic laws, resource stocks and flows)

Cleveland and Kaufman (2008) "Fundamental principles of energy," Encyclopedia of Earth

Ayres and Ayres (1998) "Background: industrial metabolism and materials flow analysis." Chapter 1 in Accounting for Resources, 1.

2. Defining and debating energy / materials sustainability

Daly (1995) "On Nicholas Georgescu-Roegen's contribution to economics: an obituary essay." Ecological Economics 13:149-154.

Ayres (1997) "Comments on Georgescu-Roegen." Ecological Economics 22:285-287.

Ayres (1999) "The second law, the fourth law, recycling and limits to growth." Ecological Economics 29:473-83.

Cleveland and Ruth (1999) "Indicators of dematerialization and the materials intensity of use." Journal of Industrial Ecology 2:3: **only pages** 15-18; 25-30; 38-39; 43-46.

Jaccard (2006) Chapter 1, Sustainable Fossil Fuels.

3. Integrating information on resources and technologies in energy / materials sustainability

Jaccard (manuscript, peak oil chapter) "We'll soon run out of oil anyway."

Jaccard (2006) Chapter 9, Sustainable Fossil Fuels.

Elser & Bennett (2011) "A broken biogeochemical cycle: phosphorus," 478: 29-31.

Ayres (2007) "On the practical limits to substitution" Ecological Economics 61:115-128.

Nordhaus (1992), An optimal transition path for controlling greenhouse gases." Science.
Rivers and Jaccard – Notes to accompany Nordhaus DICE model.
Neumayer (1999) "Global warming: discounting is not the issue, but substitutability is." Energy Policy 27:33-43.

4. Management and planning for energy / materials
Jaccard (2003) "Energy planning and management." In Encyclopedia of Life Support Systems.
Jaccard (2011) "Lecture notes and overheads – L6504-EM-Mgmt-Plan-Reg"
Jaccard, Melton and Nyboer (2011) "Institutions and processes for scaling up renewables." Energy Policy 39:4042-4050.

5. Debating the cost and effectiveness of energy efficiency
Linares & Labandeira (2010) "Energy efficiency: economics and policy." J. of Economic Surveys 24:3:573-592.
Owen (2010) "The efficiency dilemma," The New Yorker, Dec. 20/27: 78-85.

6. Debating the cost and effectiveness of renewables
Joskow (2011) "Comparing the costs of intermittent and dispatchable electricity generation technologies," Working paper, MIT.
Jaccard (manuscript, renewables chapter) "Renewables will outcompete fossil fuels."

7. Policies for energy / materials sustainability
Krugman (2010) "Building a green economy," New York Times, April.
Jaccard (manuscript, chapter on offsets) "Just become carbon neutral."
Rhodes and Jaccard (2013) "A tale of two climate policies." Canadian Public Policy.
Jaccard (manuscript, chapter on policies) "Overcoming our climate delusions."

8. Human cognition and sustainability prospects

Mooney (2011) "The science of why we don't believe science," Mother Jones, March.
Rees (2010) "What's blocking sustainability? Human nature, cognition and denial," Sustainability: Science, Practice and Policy 6(2):2-13.
Jaccard (manuscript, chapter on behavior) "Behavioral change is essential."

9. Sustainability imperatives and the role of the researcher

Hoffman & Jennings (2011) "Engaging the climate change debate: the voice and role of the social sciences."
Anderson and Bows (2012) "A new paradigm for climate change." Nature Climate Change.
Grantham (2012) "Be persuasive. Be brave. Be arrested (if necessary)." Nature.
Jaccard, (2013) "The accidental activist." The Walrus.
Keeling (2012) "Come hell and high water." Moral Ground.

****

Optional Topics
Depending on student preferences, additional readings may be assigned during the course for some or all of the following topics, and possibly other topics suggested by students:

- The economics of climate risk, or "Weitzman versus Nordhaus in the fat tail debate."
- Providing energy access for the world's poorest two billion.
- Strategies for achieving effective global action to prevent rapid climate change.
- Carbon capture and storage, geo-engineering, nuclear and other "risk vs risk dilemmas."
- Defining economic growth and assessing if or how it might be sustainable.
- Sustainability and the international trade of energy and goods.
- Communicating science, economics and policy to the public and politicians.