Course Description: This interdisciplinary course surveys energy technologies, resources, economics, environmental impacts, and public policies, with an emphasis on renewable energy and energy efficiency for the power, transport, and building sectors. Comparative assessments among clean energy technologies and conventional fossil fuel technologies lead to analysis of policy options at local, national, and international levels. Options for long-term sustainable energy futures for New Zealand and globally are discussed.

Course Objectives: The course is intended to provide a broad overview of sustainable energy concepts and issues. By the completion of the course, students will be able to demonstrate an understanding of (a) key concepts in understanding energy technology, economics, environmental impacts and policy; (b) how to evaluate and compare renewable and fossil-fuel-based supply technologies and energy-efficiency options; (c) the need for public policy and different perspectives on policy solutions, both in New Zealand and internationally; and (d) how to think realistically about sustainable energy futures.

Prerequisites/Further Information: As this is a graduate level course, a Bachelor’s degree is a general pre-requisite, but there are no particular course prerequisites. Simple quantitative calculations on assignments are suitable for students from a variety of backgrounds. Please contact the instructor in advance with any concerns about level of preparedness or for further information about the course.

Workload: Course is 15 points. Students are expected to undertake up to 150 hours work, including classes, reading, and assignment preparation.

Time/Location: Class sessions occur over five weeks, 14 August to 23 August, and 11 September to 27 September, Wednesdays and Fridays, 9:30-12:20, Railway West Wing 315 (Pipitea Campus, Wellington Railway Station building entrance on Featherston). Assignments and assessment period end 20 October 2013.

Coordinator/instructor: Dr. Eric Martinot, martinot@isep.or.jp [VUU contact details to be added when available.]

Instructor Office Hours: Open drop-in hours during weeks of class sessions are to be advised [times and location]. Additional hours by appointment. Classroom consultations immediately after class sessions are also available. Additional consultations on research papers scheduled for each student 23-27 September to discuss and confirm research paper topics.
Readings: Assigned readings include articles, reports and book chapters taken from a variety of literature. For some readings, only specific sub-sections of an article are assigned (see notes in brackets [] in reading list), although the entire article is recommended. Readings are distributed electronically, with the exception of one required book that must be purchased, Amory Lovins and Rocky Mountain Institute, Reinventing Fire. Additional handouts provided during class and supplemental readings are also available. Most supplemental readings are available for download at http://www.martinot.info/ENVI529-2013, with file naming convention according to primary author’s last name and year of publication. Note that some of these readings are copyright and provided for educational purposes only; you may not make these materials available to other persons, nor make a further copy for any other purpose. Additional supplemental hardcopy books are on closed reserve or 3-day loan at the Commerce Library (2nd floor of Railway West Wing building).

Course Blackboard: Announcements, copies of lecture slides and assignments, additional readings, and other materials will be posted to Blackboard. (Students accessing Blackboard for the first time who experience log-on problems should contact Kate King, Graduate Program Administrator, Cotton 311, Kelburn campus, 04-463-6108.)

Assignments: Course work includes four assignments containing mixed numeric problems and essay questions and a final research paper. The final research paper of approximately 4500-6000 words is due by 20 October at noon, emailed to me (the instructor). Students are free to choose a research paper topic of interest, but the topic must be policy-related or policy-relevant – no purely technical papers allowed. The research paper must include an abstract and references and citations. Further guidance on the research paper will be provided in class. Assignments 1-4 are due in class on the dates indicated in the class schedule. Work handed in late without extensions or extenuating circumstances will be penalized. The maximum penalty will be 5% of the assessment task’s possible marks, for every day late.

Research Paper Consultations: At least one in-person consultation with me is required on the research paper. Consultations arranged by appointment for the period 23-27 September.

Grading: Grade based on four assignments (45%), research paper (45%), and participation (10%).
<table>
<thead>
<tr>
<th>Class</th>
<th>Date</th>
<th>Topic</th>
<th>Assignments Due</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>14 Aug</td>
<td>Course introduction. Energy's role in social, economic, and sustainable development. Conventional energy technologies and resources. Oil, gas, coal, electric power, vehicle fuels. Energy units and conversion efficiencies.</td>
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<tr>
<td>2</td>
<td>16 Aug</td>
<td>Renewable energy technologies for buildings (including heating/cooling), power generation, transport, and agriculture. Advanced technologies including clean coal, energy storage, and smart grids. Energy units and conversions continued.</td>
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<tr>
<td>4</td>
<td>23 Aug</td>
<td>Environmental comparisons and climate change impacts. Environmental impacts and comparisons across a range of energy supply technologies. Human health impacts. Environmental assessment chains.</td>
<td>Assignment #1</td>
</tr>
<tr>
<td>5</td>
<td>11 Sep</td>
<td>Economic analysis and comparisons. Life cycle analysis, financial analysis, cost of conserved energy, and externalities. Cost assessment of supply technologies vs. energy-efficiency.</td>
<td>Assignment #2</td>
</tr>
<tr>
<td>6</td>
<td>13 Sep</td>
<td>Economic analysis and comparisons (continued) and justifications for public policy intervention. Learning curves and cost trends. Market failures and barriers, subsidy justifications. Project development and finance.</td>
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</tr>
<tr>
<td>7</td>
<td>18 Sep</td>
<td>Policy options. Emissions limits and fees, incentives for energy efficiency, demand-side management, electric utility regulation and restructuring, other tax and incentive policies.</td>
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<tr>
<td>8</td>
<td>20 Sep</td>
<td>Policy options (continued). Renewable energy policies, including feed-in tariffs, portfolio standards, targets, tax incentives, and biofuels mandates. International policies for climate change and energy security. Local policies.</td>
<td>Assignment #3</td>
</tr>
<tr>
<td>10</td>
<td>27 Sep</td>
<td>New Zealand’s sustainable energy future. What mix of technologies and policies is possible or desirable? New Zealand’s energy strategy to 2050. Consideration of transport, buildings, and bulk power generation.</td>
<td>Assignment #4</td>
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<tr>
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<td>20 Oct</td>
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<td>Research paper due 12 noon (by email)</td>
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**PRIMARY READINGS**


<table>
<thead>
<tr>
<th>Date</th>
<th>Readings</th>
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<tbody>
<tr>
<td>14 Aug</td>
<td>Randolph and Masters, Chapter 2</td>
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<td></td>
<td>GEA, Chapter 1</td>
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<td></td>
<td>Lovins, Chapter 1</td>
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<td></td>
<td>Greenpeace, Chapters 8 and 9.1-9.2</td>
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<tr>
<td>16 Aug</td>
<td>Randolph and Masters, Chapter 10</td>
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<td></td>
<td>GEA, Chapter 15</td>
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<tr>
<td></td>
<td>Greenpeace, Chapter 9.3</td>
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<tr>
<td>21 Aug</td>
<td>Lovins, Chapters 2 and 3</td>
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<tr>
<td></td>
<td>Greenpeace, Chapters 10 and 11</td>
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<tr>
<td>23 Aug</td>
<td>GEA, Chapters 3 and 4</td>
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<tr>
<td>11 Sep</td>
<td>Boyle, Everett, and Ramage (2003), pp. 477-516</td>
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<td></td>
<td>Kammen and Pacca (2004)</td>
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<td></td>
<td>Owen (2004)</td>
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<td>GEA, Chapter 6.5</td>
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<tr>
<td>13 Sep</td>
<td>GEA, Chapter 6.6-6.7</td>
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<td>Greenpeace, Chapter 3</td>
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<td>18 Sep</td>
<td>Randolph and Masters, Chapter 17</td>
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<td></td>
<td>Greenpeace, Chapter 1</td>
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<td></td>
<td>GEA, Chapters 22-25</td>
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<tr>
<td>20 Sep</td>
<td>[Same readings as for 18 Sep]</td>
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<tr>
<td>25 Sep</td>
<td>GEA, Chapter 16</td>
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<td></td>
<td>Lovins, Chapters 5 and 6</td>
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<tr>
<td></td>
<td>Greenpeace, Chapters 2, 4, and 5</td>
</tr>
<tr>
<td>27 Sep</td>
<td>[To be taken from supplemental readings]</td>
</tr>
</tbody>
</table>
SUPPLEMENTAL READING LIST

1. SUSTAINABILITY AND CONVENTIONAL ENERGY TECHNOLOGY AND RESOURCES


Energy Units and Conversions


Other Supplemental Materials


World Bank. 2010. World Development Indicators 2010 (Washington, DC), 464 pp. [The most comprehensive collection of data on population, energy, environment, and economy available.]


2. RENEWABLE ENERGY AND ADVANCED ENERGY TECHNOLOGIES


3. ENERGY EFFICIENCY AND ALTERNATE VEHICLE TECHNOLOGIES


Lovins AB, Datta EK, Bustnes OE, Koomey JG, Glasgow NJ. 2005. “Saving Oil” and “Substituting for Oil” in Winning the Oil Endgame (Snowmass, CO: Rocky Mountain Institute), pp. 43-122.


4. ENVIRONMENTAL COMPARISONS


5. ECONOMIC ANALYSIS AND COMPARISONS, PART 1


6. ECONOMIC ANALYSIS AND COMPARISONS, PART 2


7. POLICY OPTIONS, PART 1


8. POLICY OPTIONS, PART 2


**Supplemental Materials – Policy Impact Analysis**


**9. SUSTAINABLE ENERGY FUTURES [Provisional]**


**Supplemental Materials – Integrated Perspectives**


**Supplemental Materials – Advanced Power Grids and Energy Storage**


Supplemental Materials – Advanced Vehicles


10. NEW ZEALAND’S SUSTAINABLE ENERGY FUTURE [To Be Updated]


Chapman, R. 2008. ‘Transitioning to Low-Carbon Urban Form and Transport in New Zealand.”’ Political Science 60 (June): 89-98.


Chapman, R. 2013. The way to go? American or German solar incentive models. Solar Action Bulletin, SAB94(June), 8-9


GENERAL UNIVERSITY POLICIES AND STATUTES

Students should familiarise themselves with the University’s policies and statutes, particularly the Assessment Statute, the Personal Courses of Study Statute, the Statute on Student Conduct and any statutes relating to the particular qualifications being studied; see the Victoria University Calendar or the University’s policy website,

http://www.victoria.ac.nz/home/about/policy

Student and staff conduct

The Statute on Student Conduct together with the Policy on Staff Conduct ensure that members of the University community are able to work, learn, study and participate in the academic and social aspects of the University’s life in an atmosphere of safety and respect. The Statute on Student Conduct contains information on what conduct is prohibited and what steps are to be taken if there is a complaint. For information about complaint procedures under the Statute on Student Conduct, contact the Facilitator and Disputes Advisor or refer to the statute on the Victoria policy website at:

http://www.victoria.ac.nz/home/about/policy

The Policy on Staff Conduct can be found at:

http://www.victoria.ac.nz/home/about/policy

Academic grievances

If you have any academic problems with your course you should talk to the tutor or lecturer concerned; class representatives may be able to help you in this. If you are not satisfied with the result of that meeting, see the Head of School or the
relevant Associate Dean; The VUWSA Student Advocate is available to assist in this process. If, after trying the above channels, you are still unsatisfied, formal grievance procedures can be invoked. These are set out in the Academic Grievance Policy which is published on the Victoria website at:

http://www.victoria.ac.nz/home/about/policy

There is also a leaflet explaining the grievance process available from the AVC (Academic) website at:

http://www.victoria.ac.nz/home/about_victoria/avcacademic/Publications.aspx#grievances

**Students with Impairments**

Refer to the [Meeting the Needs of Students with Impairments Policy](http://www.victoria.ac.nz/home/about/policy), available on the University's policy website http://www.victoria.ac.nz/home/about/policy

The University has a policy of reasonable accommodation of the needs of students with impairments. The policy aims to give students with disabilities the same opportunity as other students to demonstrate their abilities. If you have a disability, impairment or chronic medical condition (temporary, permanent or recurring) that may impact on your ability to participate, learn and/or achieve in lectures and tutorials or in meeting the course requirements, please contact the course coordinator as early in the course as possible. Alternatively, you may wish to approach a Student Adviser from Disability Support Services (DSS) to discuss your individual needs and the available options and support on a confidential basis. DSS are located on Level 1, Robert Stout Building:

- telephone: 463-6070
- email: disability@vuw.ac.nz

The name of your School’s Disability Liaison Person is in the relevant prospectus or can be obtained from the School Office or DSS.

**Student Support**

Staff at Victoria want students to have positive learning experiences at the University. There are a number of support services available to help you directly if your academic progress is causing concern or if there are elements in your life that are affecting your ability to study. These include:

- Your course coordinator or programme director;
- Staff in your Faculty Student Administration Office Student Dedicated learning support through Student Learning Support Service; Kaiwawao Māori; Maanaki Pihiphipinga; Disability Support Services and Victoria International;
- Wider holistic support through the Health Service; Counselling Service; Financial Support and Advice; Accommodation Service and Career Development and Employment. Find out more at [www.victoria.ac.nz/st_services/](http://www.victoria.ac.nz/st_services/) or email student-services@vuw.ac.nz;
- VUWSA employs a Student Advocate who deals with academic problems and provides support, advice and advocacy services, as well as training and supporting class representatives and faculty delegates. The Education Office is located on the ground floor, Student Union Building. Email education@vuwsa.org.nz or tel. 463-6716 or 463-6984.

**Academic Integrity and Plagiarism**

Academic integrity means that university staff and students, in their teaching and learning are expected to treat others honestly, fairly and with respect at all times.
It is not acceptable to mistreat academic, intellectual or creative work that has been done by other people by representing it as your own original work.

Academic integrity is important because it is the core value on which the University’s learning, teaching and research activities are based. Victoria University’s reputation for academic integrity adds value to your qualification.

The University defines plagiarism as presenting someone else's work as if it were your own, whether you mean to or not. ‘Someone else's work’ means anything that is not your own idea. Even if it is presented in your own style, you must acknowledge your sources fully and appropriately. This includes:

- Material from books, journals or any other printed source
- The work of other students or staff
- Information from the internet
- Software programs and other electronic material
- Designs and ideas
- The organisation or structuring of any such material

Find out more about plagiarism, how to avoid it and penalties, on the University’s website: www.victoria.ac.nz/home/studying/plagiarism.html

**Use of Turnitin**

Student work provided for assessment in this course may be checked for academic integrity by the electronic search engine http://www.turnitin.com. Turnitin is an online plagiarism prevention tool which compares submitted work with a very large database of existing material. At the discretion of the Head of School, handwritten work may be copy-typed by the School and subject to checking by Turnitin. Turnitin will retain a copy of submitted material on behalf of the University for detection of future plagiarism, but access to the full text of submissions is not made available to any other party.

**Communication of additional information**

Find key dates, explanations of grades and other useful information at www.victoria.ac.nz/home/study. Find out about academic progress and restricted enrolment at www.victoria.ac.nz/home/study/academic-progress. The University’s statutes and policies are available at www.victoria.ac.nz/home/about/policy, except qualification statutes, which are available via the Calendar webpage at www.victoria.ac.nz/home/study/calendar (See Section C). Further information about the University’s academic processes can be found on the website of the Assistant Vice-Chancellor (Academic) at www.victoria.ac.nz/home/about_victoria/avcacademic/default.aspx