Accelerating the transition to a sustainable energy future - individual and collective action to increase the uptake of energy efficiency and renewable energy

A course and set of teaching resources developed by the Australian Research Institute for Environment and Sustainability (ARIES) for the Australian Government Department of Education, Employment and Workplace Relations (DEEWR)

15 December 2010
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Introduction

The Australian Research Institute for Environment and Sustainability (ARIES) has developed this course and teaching resources for the Australian Government Department of Education, Employment and Workplace Relations (DEEWR).

The purpose in developing these materials is to encourage more widespread teaching on the topics of energy efficiency and renewable energy within new and existing courses in both the vocational education and training (VET) and university sectors.

The materials have been structured to support teachers/lecturers in developing and delivering a complete course and/or incorporating content on energy efficiency and renewable energy into existing courses.

The materials have been developed with consideration of the Education for Sustainability principles outlined in *Living Sustainably - The Australian Government’s National Action Plan for Education for Sustainability* (2009). A key principle of Education for Sustainability is to ‘equip people with the skills, capacity and motivation to plan and manage change towards sustainability within an organisation, industry or community’. The emphasis on change is distinct from Education about Sustainability which tends to have a stronger focus on technical issues only.

The materials are presented in the form of a complete course that may be adapted for delivery as either VET or university courses. The intention has been to provide a balance between the development of practical skills and the broader knowledge and awareness that students need to influence others towards greater awareness and action on energy efficiency and renewable energy. The course and aspects of it may be appropriate for both technical and non-technical audiences due to the focus on action and change.

Some of the activities may appear to be unusual within formal educational settings. They have been included to demonstrate ways of increasing the level of engagement and action on the part of students to actively contribute towards the achievement of a sustainable energy future.

Assessment activities have not been explicitly suggested due to the varying contexts within which this course may be taught. However, a number of the activities suggested could be developed as assessment tasks.

There is a rapidly expanding amount of learning and teaching resources available on energy efficiency and renewable energy. The focus in this course is on online resources for ease of access; there is an assumption that most students will have access to a computer for some classes. The list of resources is comprehensive at the time of writing this report. The session activities are only a guide to what can be done with the resources available. We hope that this material will provide a

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‘way in’ to teaching these important topics, and encourage innovation and creativity in the design and development of individual courses and exercises.

Each of the 13 sessions has been structured as a three-hour face-to-face delivery session. As you review the course materials you may find that additional time is required. You may also find that you can spend more time on some topics than others - depending upon the particular needs of your course.

Background

Energy is one of the most important inputs to economic and social development. Climate change and growing energy demand in Australia and around the world present dual challenges that have significant economic, social and environmental implications. The Australian Government has established an unconditional target of a 5% reduction in greenhouse gas emissions from 2000 levels by 2020. This target represents a 25% reduction in greenhouse gas emissions compared to ‘business as usual’ growth in emissions. In response to these challenges the generation and use of energy is undergoing a major transformation. Energy efficiency and renewable energy are central to Australia’s ability to achieve this transformation.

Energy efficiency improvement (shortened to ‘energy efficiency’ in the rest of this course) involves modifying equipment and implementing practices or re-interpreting what needs to be done (e.g. replacing physical transport with virtual transport) with the outcome that less energy is required to deliver the same or an improved level of service. Energy efficiency is typically the most cost-effective action that can be taken in households and organisations to reduce greenhouse gas emissions as well as the costs associated with rising energy prices. Energy conservation, limiting the scale of energy services provided (e.g. turning down heating thermostats or wearing warmer clothes in cold weather), is also important to achieve overall energy reductions and minimise the impact of potential ‘rebound effects’ that may encourage an increase in energy use as costs are reduced through energy efficiency. These multiple issues and benefits - cost-effective greenhouse gas reductions, practical ways of addressing rising ‘cost of living’ issues and the benefits through reduced infrastructure spending and development - make energy efficiency a relevant and practical issue for many students across a number of disciplinary areas.

The development, installation and use of renewable energy sources displace energy that might otherwise be provided through the combustion of greenhouse-gas-intensive fossil fuels. Renewable energy options include the use of solar hot water, installation of solar photovoltaic cells and the purchasing of accredited GreenPower in households and businesses, as well as large-scale renewables such as wind, solar thermal and geothermal energy. Organisations are increasingly considering a range of renewable energy supply options - particularly where operations are undertaken in remote locations and/or where there is a positive reputational benefit.
Achieving such a fundamental transition from a fossil-fuel-based economy to a sustainable-energy economy is much more than a technical challenge, as described by Professor Ross Garnaut:

*Climate change presents a new kind of challenge. It is uncertain in its form and extent, rather than drawn in clear lines. It is insidious rather than (as yet) directly confrontational. It is long term rather than immediate, in both its impacts and its remedies. Any effective remedies lie beyond any act of national will, requiring international cooperation of unprecedented dimension and complexity. While an effective response to the challenge would play out over many decades, it must take shape and be put in place over the next few years.*

Observation of daily debate and media discussion in Australia and elsewhere suggests that this issue might be too hard for rational policy making. It is too complex. The special interests are too numerous, powerful and intense. The time frames within which effects become evident are too long, and the time frames within which action must be effected too short.

But there is a saving grace that may make all the difference. This is an issue in which a high proportion of Australians are deeply interested.2

Research conducted by the Australian Research Institute for Environment and Sustainability (ARIES) highlighted that teaching and learning on energy efficiency and renewable energy in Australian universities is ad hoc. Many academics were unaware of the importance of these topics and their relevance to their subjects and there were limited incentives to integrate the topics into new courses or the existing courses they teach. A major barrier for those interested in developing and teaching new courses or integrating these important topics was finding the time and resources to develop teaching materials. Further research highlighted a similar situation in the vocational education and training (VET) sector.3

**Guiding assumptions, principles and themes**

Development of the course and teaching pedagogy has been informed by the following guiding assumptions and principles:

- Energy and the technologies that use it are critical inputs for economic and social development.

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Increasing demand for energy and the environmental and social impact of energy is driving a transformation of energy systems⁴ in which energy efficiency and renewable energy are central components - globally, nationally, regionally and locally in government policy, in business, in industry and domestically.

Transformation of our energy system is a significant challenge and requires action at all levels of society by individuals in their homes, communities and workplaces. Accelerating the pace of the energy transformation requires informed and capable individuals to act in the community, government and business to develop and implement solutions to support the transition.

There is a basic level of knowledge and capabilities that can support action in communities and in the workplace that will contribute towards accelerating the transition towards a low/zero-carbon energy system. Currently this base of knowledge and skills is being developed in a limited manner within existing TAFE and university curricula although there are already some leading practices/practitioners.

Transforming the energy system must be conducted within a broader sustainability context that takes into account, for example, the concurrent challenges of climate change and the challenges presented by development that is driven by growth without sufficient consideration of ecological constraints.

The development of skills to transform the energy system include both skills to influence the technical systems as well as change management and people skills to effectively influence and create change. Without this combination of skills many technical solutions, although appropriate, may be unsuccessful in terms of implementation.

As mentioned earlier, the resources have been developed to consistently apply the key principles of Education for Sustainability (EfS) outlined in the Australian Government’s National Action Plan for Sustainability ⁵:

- envisioning a better future
- critical thinking and reflection
- participation
- partnerships for change
- systemic thinking.

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⁴It is assumed that the phrase ‘transformation of energy systems’ means a change, as much as is feasible, from a supply of energy based on non-renewable sources to renewable sources and from sources that result in high carbon emissions to sources with low or, ideally, zero carbon emissions, as well as improved efficiency of use, and smart management of demand and use of energy storage.

That is, the resource materials supporting learning activities will provide opportunities for students to apply these principles in addressing issues around energy efficiency, energy conservation and renewable energy.

The teaching and learning resources are focused on three sets of issues about energy efficiency, energy conservation and renewable energy and each set interacts with the others as represented in Figure 1. Throughout all of the issues there will be the common theme of energy demand and supply.

It is recognised that for different audiences the selection between and within these sets will be different. For a group of engineers on a half-day seminar, the emphasis may be more on facilitating change, whereas a course for environmental managers may incorporate a greater emphasis on policy, and a full one-semester teaching unit / subject in a multidisciplinary postgraduate program with students from a number of different specialisations would treat all sets in some detail.
Session 1: Our current energy system

Key topics covered in this session:

• Sources of energy.
• Where, how and why do we use energy? Transport, food production, consumer items, chemicals, plastics, machinery, packaging, homes, businesses, entertainment, services (water, electricity).
• Energy and service provision
• Energy use by sector and activity.
• History of energy use: the age of fossil fuels
• The effect of fossil fuel use on climate change.

Introduction
Energy is a fundamental input to our society. It plays a significant role in all aspects of our lives. Despite our dependence on and use of energy on a daily basis it is generally taken for granted and effectively invisible to us.

This session encourages students to think about the importance of energy use in society and describes the main features of our energy system. An historical perspective of the use of fossil fuels in particular and its contribution to anthropocentric climate change is also covered.

It is suggested that some time be spent initially explaining how the course or session has been organised.

Learning outcomes
By the end of this module participants should be able to:

• describe current sources of energy and the most intensive energy use sectors in Australia
• identify the ways in which we are dependent on fossil fuels as individuals and as a society
• identify the ways in which energy use influences our work and lifestyles through the services that energy provides and how the use of energy has changed historically
• understand the contribution of fossil fuels to human-induced climate change.

Competencies
• Analysing written material on complex issues and reflecting upon the values and knowledge portrayed to make decisions.
• Collecting, analysing and organising information.
• Participating in analytical verbal class discussions.

Session 1 timetable

<table>
<thead>
<tr>
<th>Activity</th>
<th>Title</th>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>30 minutes</td>
<td>Participant introductions, general discussion about our use of energy and the services it is an input to</td>
</tr>
<tr>
<td>2</td>
<td>How do we use energy as individuals and as a nation?</td>
<td>45 minutes</td>
<td>Individual reflection and group discussion; graph and table interpretation – sector use</td>
</tr>
<tr>
<td>3</td>
<td>The use of energy – an historical perspective</td>
<td>45 minutes</td>
<td>PPT presentation</td>
</tr>
<tr>
<td>4</td>
<td>The link between fossil fuel use and human-induced climate change</td>
<td>1 hour</td>
<td>Fact sheets and discussion questions; DVDs</td>
</tr>
</tbody>
</table>

ACTIVITY 1 (30 minutes) Introduction

Introduction to the course and to this session

It is important to introduce the course including the Education for Sustainability principles that underpin its development (envisioning a better future; critical thinking and reflection; participation; partnerships for change; systemic thinking), the intended learning outcomes, the assessment approach and any administrative matters. An outline of the entire course should also be presented, explaining how the course has been designed.

Introductions amongst the students

Because energy is something that we use every day, and as the course may be delivered to students from a variety of disciplines, it is important to acknowledge the unique skills, experience and perspectives that each student brings to the course.

Some ice-breaker questions (preferably asked in small groups) could include:

• What is your motivation for attending this course?
• What is your background?
• What do you want this course to help you achieve?

ACTIVITY 2 (45 minutes) How do we use energy as individuals and as a nation?

Small group followed by large group discussion
Ask participants to discuss the following questions in small groups for 3-5 minutes, or elicit responses directly from the whole group:

- What services have you used that involve energy input?
- How have you used energy in the past 24 hours? Answers could include transport, appliances, personal technology, food, personal hygiene (water, products), lighting, personal comfort.
- What different sources of energy have you used? Answers should include mostly fossil-fuel-based sources.
- What is energy?

Ask participants to share their responses. As they respond, list on the whiteboard:

- the services provided by energy
- uses of energy
- sources of energy
- ways those services could have been provided using less energy.

This discussion can be supported by a graphic showing energy sources and how they work together to form an energy system. The terms renewable and non-renewable sources of energy will need to be explained here. A useful example can be found at: http://new.dpi.vic.gov.au/energy-future/our-energy-story/how-our-energy-system-works/energy-sources

- A concise introduction to different energy sources is available from: http://library.thinkquest.org/C0110881/energy_en.html#voordele (including an easy to understand introduction to energy sources.)

Two different maps of Australia showing current renewable energy sources are available from:


- The make-up of energy resources in Australia both for our use and export income is available in the latest edition of Geoscience Australia p. 11. The contribution to the Australian economy is shown on p. 11.


- Another good resource on the above which also has statistics on our main uses of energy can be found at:

consumption. Very thorough, useful for getting statistics, valuable graphs and images and not too technical.


**ACTIVITY 3 (30 minutes) The use of energy - an historical perspective**

A useful exercise is to have students consider the way in which energy supports their lifestyles today as compared to when their parents and grandparents were the same age. Have each of the students draw the table shown below. In groups or individually they should write 3-5 dot points in each of the squares about the use of energy by themselves, their parents and their grandparents. This activity then supports a rich discussion of the changing use of energy and technology over time. It also highlights the way we use energy and the concept of energy as delivering beneficial services that support our lifestyles and ways of travelling and working.

This activity could also be used to explore what services households used energy for, and what levels of expectations they had for them. For example, home entertainment before TV vs today, access to services such as food supplies, work, health care, etc.

<table>
<thead>
<tr>
<th></th>
<th>You</th>
<th>Your parents</th>
<th>Your grandparents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy use in the home</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>E.g. List electrical appliances</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Energy use for transport</td>
<td></td>
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<tr>
<td>E.g. number of cars in the household</td>
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<tr>
<td>Transport mode for travel to work</td>
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<td></td>
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<tr>
<td>Energy use at work</td>
<td></td>
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<tr>
<td>List electrical equipment and the services it provides</td>
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</table>
The new EPA Victoria home greenhouse calculator should be available by early 2011, and that would allow students to explore their own home’s energy related greenhouse gases.

**ACTIVITY 4 (45 minutes) The link between fossil fuel use and human-induced climate change**

A useful way to cover both this and the next topic in this session is to show the DVD featuring Al Gore: *An Inconvenient Truth*. An alternative is to show a short video such as [http://www.youtube.com/watch?v=oJAbATJCugs](http://www.youtube.com/watch?v=oJAbATJCugs) which has been produced by National Geographic.

A simple diagram explaining the link between energy use and increased levels of carbon dioxide in the atmosphere leading to human-induced climate change (the greenhouse effect) can be found at: [http://library.thinkquest.org/C0110881/energy_en.html#voordele](http://library.thinkquest.org/C0110881/energy_en.html#voordele)

Greenhouse gas (GHG) emissions are gaseous pollutants released into the atmosphere through the burning of fossil fuels and through other avenues, which amplify the greenhouse effect. Such gases include CO2, CH4, N2O, HFCs, PFCs, SF6, and other CO2 equivalents. A clear explanation is provided at: [http://www.ace.mmu.ac.uk/kids/globalwarming.html](http://www.ace.mmu.ac.uk/kids/globalwarming.html)

Students will find a wealth of information about the effects of global warming on the earth’s climate at: [http://www.windows2universe.org/earth/climate/cli_effects.html](http://www.windows2universe.org/earth/climate/cli_effects.html). Divide the class into groups to explore the impacts of global warming on the following: coral reefs; sea level rise; heat waves and droughts; rainfall, cyclones and floods; glaciers and permafrost; ocean currents; and ecosystems. Ask each group to prepare a fact sheet for the whole class.

Although this session is not directly related to energy efficiency, its relevance can be explained thus: the use of fossil fuels has led to increased levels of carbon dioxide in the atmosphere which has, on the balance of probability, changed the climate and will make the earth less habitable in the future as ecosystems start to break down. This becomes a moral issue which will be discussed in more detail in session 11. Session 2 elucidates the fact that we all contribute to global warming through the use of fossil fuels. One key issue here may be to get students to look at the amount of CO2 stored in fossil fuels, how much of this humanity has released so far, and how much we would release if we used all the fossil fuels in existence - then what impact that would have on climate.

**Discussion questions**

- Conduct a web search to identify the global average temperature in the previous year and how this compares with the period in which records have been kept. Similarly, conduct a web search to identify how many of the warmest years on record have occurred in the last decade.

**Preparation for session 2**
Be aware over the next week of what you spend your money on; write it down. This information will be needed for the carbon accounting exercise. You will also need your electricity bills for this exercise. If possible bring those for the previous 12 months to highlight any differences between summer and winter. (Note: the teacher/lecturer may want to provide 12 months of their own electricity bills as an example.) Most electricity and gas retailers provide guidance on how to understand their power bills, e.g. http://www.originenergy.com.au/1482/Your-electricity-bill.

Also, most energy suppliers should be able to provide the past year’s consumption information if you ring them. And many retailers show your daily consumption for each billing period for the past year+1 on your energy bill. The activity described below tells you how you can work out your daily electricity use and then extrapolate that to your weekly, monthly and yearly use by reading your electricity meter: http://www.csiro.au/helix/sciencemail/activities/EnergyUse.html

Other teaching resources

- The Natural Edge Project (www.naturaledgeproject.net/) provides detailed, referenced lecture notes.
  

- The United States National Energy Education Development Project (http://www.need.org/) provides a range of resources including teaching guides on energy topics.
  
  For example, a 20-page guide to conducting a Transportation Fuels Debate Game in which students evaluate the advantages and disadvantages of conventional and alternative transportation fuels in an innovative debate format. This can be downloaded from: http://www.need.org/needpdf/Transportation%20Fuels%20Debate%20Game.pdf.

- Multimedia

  There are a number of useful multimedia sites that can provide updated information on energy issues. For example, try searching energy at www.ted.com.

Other useful resources

Understanding energy system fundamentals


- http://www.our-energy.com/introduction_into_energy_sources.html, not well written but provides introductory information and some useful images
• [http://library.thinkquest.org/C0110881/energy_en.html#voordele](http://library.thinkquest.org/C0110881/energy_en.html#voordele) provides an easy to understand introduction to energy sources.

• **World Energy Outlook**, International Energy Agency (IEA), 2010 Paris. [http://www.worldenergyoutlook.org/](http://www.worldenergyoutlook.org/) (note link only shows a summary). A textbook that details projections of energy demand, production, trade and investment, fuel by fuel and region by region to 2035. It includes the results from a new scenario that anticipates future actions by governments to meet the commitments they have made to tackle climate change and growing energy insecurity. Could be a valuable textbook but does not have an Australian focus, may be too detailed, and is difficult to assess its value from just the summary.

**Climate change and the use of fossil fuels**

• **The Science of Climate Change: Questions and Answers at** [http://www.science.org.au/policy/climatechange.html](http://www.science.org.au/policy/climatechange.html) Australian Academy of Science. 2010. A brief publication that clearly explains what climate change is, where there is consensus /uncertainty and addresses the confusion brought on by contradictory information (set around a series of key questions). It would be useful for students to grasp the fundamentals of climate change, and is well supported by images (there are online links to download individual images which could be used to aid comprehension or generate discussion).


  Provides estimates of greenhouse gas emissions. Updated quarterly, probably too technical and detailed to be of great use but may provide some useful images.


  Many statistics, (renewable/non-renewable) energy information and predictions. Although US-based it has many useful international statistics, including a particularly valuable global interactive map [http://www.eia.doe.gov/country/index.cfm](http://www.eia.doe.gov/country/index.cfm).
• ABARE has regular reports on Australian energy use. It has recently amalgamated with Bureau of Resource Science and information can be sourced from: http://www.daff.gov.au/brs.

• Significant reports on this issue include:
  - http://www.ipcc.ch/publications_and_data/publications_and_data.htm
    There have been four reports so far by the International Panel on Climate Change. This group comprises eminent international and Australian scientists who are experts in their field. The IPCC compiles scenarios of climate change futures based on scientific evidence.

### Australia and energy

• http://www.ga.gov.au/products/servlet/controller?event=GEOCATDETAILS&ca tno=70142 provides an extremely comprehensive report assessing the current and future state of Australia’s existing and potential energy resources - from fossil fuels and uranium to renewables. It also reviews the factors that will influence Australia’s energy resources to 2030 including new technologies to extract energy more efficiently and cleanly. The report is extremely thorough and lengthy but valuable, even if only for directing students to segments of the report (e.g. ‘Summary’ or ‘Australia’s Energy Resources and Market’) it is also packed full of graphs, charts and images that may be used to assist in-class comprehension.

• http://www.energyalliance.com.au/images/stories/YESON_Energy_Mix_Report_Aug_2010.pdf ‘A Myriad of Variables’ report by Young Energy Professionals based on conference proceedings tackling issues around forecasting potential energy usage in 2030. Provides a succinct summary of Australian Government policies. The section on ‘opinions’ could be used to stage various agree / disagree scenarios, e.g. ‘in the long term, the existing centralised model for electricity generation systems needs to be enhanced’ (agree / disagree / reasons) or ‘there are no clear technology ‘winners’ in tomorrow’s energy mix.’


### Renewable energy

• http://www.our-energy.com/videos/renewable_energy_from_the_deep_ocean.html video on ocean thermal energy conversion (OTEC) to generate electrical energy use as a
source for class discussion, pros / cons etc. Other videos on renewable energy, such as nuclear / wind are also available on the site (US based). OTEC is fairly fringe technology.

- **http://www.energyaustralia.com.au/Common/Education/About-energy/Renewable-energy.aspx** provides very clear and short summaries of types of renewable energy directed towards the layman in very simple terms, also highlights the advantages and disadvantages of each type. A useful introduction for students.

- **http://www.energyalliance.com.au/publications.html** contains an array of presentations that could be incorporated into lesson plans. For example, a publication addressing the prospect that ‘Energy Policy and Climate Policy Must Be Integrated’ (3 August 2009). Students could be asked to read it before staging a mock debate. Also useful suggestions for questions to ask students, e.g. ‘What actions need to be taken in connection with regulatory and infrastructure frameworks to develop and preserve the energy supply options necessary to provide an optimal energy mix for Australia in a carbon constrained world?’

**Low/zero emission energy plans**


A free textbook describing a range of renewable energy supply options in the Australian context. Based on English Physicist David MacKay's Sustainable Energy - without the hot air - Peter Seligman has undertaken to provide a clear account of Australia’s renewable energy potential. Peter has analysed a raft of available technologies, and offers a blueprint of a nation-wide renewable energy system based on the most efficient mix of technology, societal and habitual changes. A thoroughly researched and comprehensive resource stressing the importance of an interdisciplinary approach, awareness of social equity, market forces, environmental issues, etc. It also contains useful information on what the Australian government is doing and what an individual can personally do, although it becomes quite detailed and technical in parts.


Contemporary energy issues

- http://www.youtube.com/watch?v=QFowpz8rMdE or source directly through http://www.cleanskies.com/. A video introducing a range of current energy issues including the BP oil spill in the Gulf of Mexico, coal mining related deaths in China, a study of the environmental impact of wind turbines and the Beyond Zero Emissions report released in Australia in June 2010 that aims to transform Australian energy supply to emissions neutral by 2020.

Multimedia sites

- There are a number of useful multimedia sites that can provide updated information on energy issues. For example, try searching energy at www.ted.com or http://www.cleanskies.com/ and also http://beyondzeroemissions.org/media/radio which contains numerous podcasts relating to renewable energy and policy in the Australian context.
- www.slowtv.com.au has quite a few useful talks on energy and climate issues.

Some Examples …

- Al Gore http://blog.ted.com/2008/04/08/new_thinking_on/http://www.google.com/url?q=http%3A%2F%2Fblog.ted.com%2F2008%2F04%2F08%2Fnew_thinking_on%2F&t=sa=D&sntz=1&usg=AFQjCNFVvnO02ycw85wOqQeK3w6AALP8A presents a compelling speech stressing the need for a ‘generational mission’ similar to that of the civil rights movement if we are to combat climate change. A splendid speech which could provide a useful introduction to climate change. Students might be asked to review it.
- Shai Agassi’s bold plan for electric cars. Forget about the hybrid auto, Shai Agassi says it’s electric cars or bust if we want to impact emissions. His company, Better Place, has a radical plan to take entire countries oil-free by 2020. http://www.ted.com/talks/lang/eng/shai_agassi_onlectric_cars.html

Graphics

- Geoscience Australia, Interactive Renewable Energy Map http://www.agso.gov.au/renewable/. This site provides maps of operational renewable energy generators across Australia. A link is also provided to a map of proposed sites. The generators are classified by technology and can be viewed by state by click/zooming onto a spot on the map, and by requesting data about the facility by ticking a box on the right of the map. Raw data about all the generators can be viewed via a spreadsheet for sorting. There is much information here, and the interactive nature of the site is a plus, but there may be a bit too much detail for introductory lessons. For a simpler map see the one on p. 3 of https://www.ga.gov.au/image_cache/GA17049.pdf which is clearer and also contains information on non-renewable energy sources.
Session 2: Individual energy use

Key topics covered in this session:

- Our carbon footprint: calculating it and discussing the ways in which we personally generate greenhouse gas emissions.
- Further exploring the concept of energy services and the way in which we can reduce our carbon footprint through energy efficiency.
- Carbon offsets - what are they and how do I choose one?

Introduction

We can work out the amount of carbon we are each personally responsible for releasing into the atmosphere by examining our consumption patterns.

The activities in this session are designed to focus on the individual student’s energy consumption with the aim of providing a reflective space within which some personal action to reduce their energy consumption is contemplated. Energy efficiency and purchasing carbon offsets are explored.

*Individuals can and need to take big steps themselves to reduce their individual consumption levels - personal responsibility matters. We have done a lot of work on this and most people in this field agree that the way to reduce emissions quickly is to have a combination of policy, technology and personal responsibility.*

Dr Christopher Dey, Sydney University’s Integrated Sustainability Analysis Unit, *Good Weekend Magazine* 13 November 2010, p. 18.

Learning outcomes

By the end of this module participants should be able to:

- understand the concepts of ecological and carbon footprints
- understand their personal contribution to greenhouse gas (GHG) emissions due to their consumption patterns
- account for disparities in personal energy use between people living in the developed and developing world
- understand the concept of carbon offsets
- describe and understand the basic premise of our energy intensive economy, that is, to consume.
- Identify a personal plan to manage their carbon footprint

Competencies

- Thinking creatively and reflectively.
- Working with others and in teams.
• Communicating ideas and information.
• Participating in analytical verbal class discussions.
• Using mathematical ideas and techniques.
• Working with self and others to reduce carbon emissions.

Session 2 timetable

<table>
<thead>
<tr>
<th>Activity</th>
<th>Title</th>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Calculating my carbon footprint</td>
<td>1 hour</td>
<td>Introduce the concept: PPT presentation and/or website. Check students have done their homework; allow 15 mins for doing it now if not. Calculator tool. Self-reflective questions.</td>
</tr>
<tr>
<td>2</td>
<td>Reducing my carbon footprint 1: thinking about energy as a service and as embedded energy in the things we buy</td>
<td>1.5 hours</td>
<td>Video: The Story of Stuff Thinking about energy as a service Small group discussion.</td>
</tr>
<tr>
<td>3</td>
<td>Reducing my carbon footprint 2: carbon offsets</td>
<td>30 minutes</td>
<td>Website review and choosing an individual offset scheme.</td>
</tr>
</tbody>
</table>

ACTIVITY 1 (1 hour) Calculating my carbon footprint

Introduce the concepts of ecological and carbon footprints available from http://ezinearticles.com/?Carbon-Footprint-Versus-Ecological-Footprint&id=1501837. It is important to clarify the difference!

Ecological footprint assessment

This provides a measure of how much productive land and water an individual, a city, a country, or humanity requires to produce all the resources it consumes and to absorb all the waste it generates, using prevailing technology. The methodology can also be used to assess the footprint of product and service offerings.

The calculator table for estimating an individual's yearly carbon emissions (go to http://www.isa.org.usyd.edu.au and click on the foot) can either be done as a group effort or individually; a group effort is recommended as the task may prove difficult for those students not strong in number skills. In this case, average figures for the group as a whole will need to be used. Note that annual consumption patterns need to be determined from weekly budget amounts and that the calculator is for individual use so any household expenses need to be divided by the number of residents in the household to get an individual figure. After the class
average individual footprint has been determined, show the comparison slide from the presentation for an average Australian and someone from a third world country.

To put this exercise into perspective it can also be useful to consider the supply chain of key products and services. This can highlight that the reduction in use at the point of consumption can contribute significant savings up the ‘chain’ of players. Students can then explore how each of the players at key points in the supply chain can influence greenhouse gas reductions.

_Self-reflective questions_ (can be done individually or in small groups):

- How does the group’s carbon footprint compare to that of an average Australian and a third world person?
- Does this raise any ethical issues?
- Were you surprised at the size of the footprint?
- How could you reduce its size? Which option(s) most appeal to you?
- What are the most difficult challenges for you to reduce your carbon footprint?

**ACTIVITY 2 (1.5 hours) Reducing my carbon footprint 1: thinking about energy in the things we buy and as a service**

Show the video _The Story of Stuff_ (20 minutes) [http://www.storyofstuff.com/](http://www.storyofstuff.com/).

This is a very engaging cartoon explaining the huge amount of energy used in the production of everyday consumer items. The video should promote lots of discussion based around the questions below. As the students should have much to say about the content, small groups are recommended.

_Discussion questions_

- Did you like the video? Why or why not?
- Give one fact that you found interesting from the video.
- Have you ever thought about the life-cycle of a product before?
- Has the video encouraged you to think about your spending patterns?
- Is there any product you will consider not buying because of this video?
- Is there a product you would always buy no matter what?

Also introduce the concept of ‘energy services’ as a way of thinking about how we use energy.

_Why do we need these (energy) supplies? That is the key detail we so often ignore. We need fuels and electricity to run stuff. What matters is the stuff - lamps, motors, electronics, appliances, industrial plant, vehicles and especially buildings. This stuff, this technology, provides what we want - comfort, illumination, motive power, refrigeration, mobility, information and communication. The technology is what matters. Oil by itself is almost_
useless. Natural gas by itself is downright dangerous. Electricity as we use it does not even exist by itself. It's a process in technology. Fuels are only useful because of technology.

From: http://www.eceee.org/columnists/Walt_Patterson/Managing_Energy_Wrong/ paragraph 2.

Discuss:

• What are the services that energy provides to us? (For example, comfort, illumination, motive power, refrigeration, mobility, information and communication.)

• What are examples of the ways we can get those services with lower energy use and greenhouse gas emissions?

Introduce the principles: REFUSE, REDUCE, RE-USE, RECYCLE

REFUSE to buy things you don’t need.

REDUCE what you spend.

RE-USE goods in creative ways.

RECYCLE unwanted goods.

Ask the students to think of things they no longer want or need and to go through the above process.

• What have you bought recently that you could have done without?

• What goods do you now own that you could re-use in other ways or pass on?

Self-reflective question

Imagine a day in your life when cheap supplies of energy were no longer available. What sacrifices might you need to make? (Use more public transport; eat more locally grown, seasonal and less exotic foods; buy fewer consumer items; install renewable energy technologies, etc.).

ACTIVITY 3 (30 minutes) Reducing my carbon footprint 2: carbon offsets

A carbon offset is an investment in a project or activity that reduces greenhouse gas (GHG) emissions or sequesters carbon from the atmosphere to compensate for GHG emissions from your activities. Carbon offsets are not as effective in reducing personal GHG emissions as not purchasing products that use a lot of GHG emissions in their manufacture but they are better than not doing anything!
http://www.epa.vic.gov.au/climate-change/carbon-offsets has very comprehensive information about various carbon offset schemes and an FAQ for students. Students could peruse the site and choose their preferred scheme, listing the pros and cons of their choice in terms of effectiveness in actually reducing GHG emissions.

Ask students to compare the different options that are available to them. Discuss:

- What are your preferred offset schemes? Why?
- What gives you confidence that the offsets proposed will be delivered?
- How do you feel about purchasing offsets compared to reducing your impact directly through actions such as energy efficiency or more informed purchasing?
- How does your purchase of offsets contribute to meeting Australia’s national greenhouse gas emissions target? (For more information see: http://www.carbonoffsetwatch.org.au/component/content/article/1-latest-news/66-alliance-of-business-and-environment-groups-produces-communique-on-voluntary-offsets for more information)

**Other teaching options**

- In groups, students research YouTube clips for reducing consumption and then design their own YouTube advertising campaign encouraging people to buy less.
- Analyse the way the best YouTube clips are structured. What makes them effective for you? What are the most effective ways to stimulate change in people’s behaviour?

**Preparation for session 3**

To apply some of the content of this session ask students to do the following activity:

Research the purchase of a new television. Consider your options from an energy perspective. Use http://www.energyrating.gov.au/ as a resource and also go into a shop and talk to some salespeople.

Also review the Choice website for their consumer information on new televisions. What environmental and energy efficiency criteria do they assess?

http://www.choice.com.au/?gclid=cirq4ley6kucfphbgodaah94w&rid=kqbu5a3r8l9k9he78g99c0ahemahdjqb.aspx

Consider:

- What did you learn about the strengths and weaknesses of the energy efficiency star rating approach?
- How informed were the salespeople?
• What radical solutions can you think of that would provide the entertainment service provided by a TV? (For example, a USB tuner for your laptop, myvu glasses (www.myvu.com).

In preparation for the next session introduce Beyond Zero Emissions’ plan for moving Australia to 100% renewable energy within ten years (Matthew Wright, Patrick Hearps, et al. 2010. Australian Sustainable Energy Zero Carbon Australia Stationary Energy Plan.)

Students may also like to listen to multimedia reports available on:
http://beyonddzeroemissions.org/.

The Executive Summary and cost-abatement curves in the ClimateWorks Low Carbon Growth Plan also provide a useful introduction to transition options.

Session 3: Towards a more sustainable energy system

Key topics covered in this session:

- The change in mix of energy sources for a sustainable energy future.
- Behaviour change at an individual and social level.

Introduction

A change to a sustainable energy system based on renewable energy in Australia is possible by 2020, according to the not-for-profit climate solutions thinktank, Beyond Zero Emissions, based in Melbourne. This session will examine its report in detail and discuss the likelihood of it being implemented.

The transition to a sustainable energy system involves picking individual and collective behaviour change e.g. limiting demand for energy through our transportation habits and by doing simple things such as turning off lights when not needed, and not using stand-by on computers, as well as tackling more challenging issues such as investing in sustainable energy technologies like high-efficiency equipment and buildings, and solar panels. This session will examine the motivators for behaviour change.

Financial constraints can impact on the switch towards more sustainable energy systems at the corporate as well as the household and individual level. This issue is also discussed in this section.

Learning outcomes

By the end of this module participants should be able to:

- describe the main features of a sustainable energy system based on renewable energy
- identify factors likely to impact on achieving a totally sustainable energy system in 2020
- understand the processes and stages involved in individual and societal behavioural change.

Competencies

- Analysing written material on complex issues and reflecting upon the values and knowledge portrayed to make decisions.
- Working with others and in teams.
- Participating in analytical verbal class discussions.
- Thinking strategically.
- Planning and organising change activities.
### Session 3 timetable

<table>
<thead>
<tr>
<th>Activity</th>
<th>Title</th>
<th>Time</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Features of a more sustainable energy system</td>
<td>1 hour</td>
<td>Zero emissions report plus video; focus questions; class discussion</td>
</tr>
<tr>
<td>2</td>
<td>Individual behaviour change</td>
<td>30 minutes</td>
<td>Worksheet and sharing in pairs</td>
</tr>
<tr>
<td>3</td>
<td>Societal behaviour change</td>
<td>30 minutes</td>
<td>Podcast; discussion</td>
</tr>
<tr>
<td>4</td>
<td>Designing a social marketing program for energy efficiency</td>
<td>1 hour</td>
<td>Group design activity</td>
</tr>
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</table>

**ACTIVITY 1 (1 hour) Features of a sustainable energy system**

Check that students have read the sixteen-page synopsis from last week. Start the session with the video.

Using the Beyond Zero Emissions Stationary Energy Plan, describe what an energy system based totally on renewable energy might look like.

- What is the overall strategy? (Focus on some, or all, areas.)
- What are the key areas that present the most promise. Why?
- What constraints are there? (Finance; willingness to invest.)
- Describe the system for take-up proposed in the document - is it realistic?
- What is the level of change required on an individual, societal, economic and political level for the plan to be successful?

One suggestion in the report is for less use of oil and more use of electricity for transport purposes. How realistic is Shai Agassi’s bold plan for electric cars? Forget about the hybrid auto, Shai Agassi says it’s electric cars or bust if we want to impact emissions! His company, Better Place, has a radical plan to take entire countries oil-free by 2020.


**ACTIVITY 2 (30 minutes) Individual behaviour change**

Introduce this activity by linking it with last week’s session on individual energy use. Ask the students what role they think they might play in contributing to the transition to a sustainable energy economy? Reducing their personal energy consumption should come up. This exercise is a reflective way for the students to consider what motivates them to change their behaviour.

Ask the students to choose one behaviour change they have adopted in the last 12 months (preferably in order to save energy - it might be using more public transport, buying energy-efficient light bulbs, etc.). Any behaviour will do for this
exercise! They now fill in the behaviour-change questionnaire (see Additional resources) and, when completed, share their answers with another person.

Class sharing should follow with the conclusion that information alone does not motivate us to change - the students will be able to tell you what does!

**ACTIVITY 3 (30 minutes) Societal behaviour change**

Societal behaviour change is possible but is often a slow process until a critical mass is reached. It is at this stage that political pressure is likely to result in regulations supporting the change - examples are no smoking in hotels; wearing seat belts, etc. [www.enablingchange.com.au](http://www.enablingchange.com.au) has a good article on the adoption of innovations.

In the area of sustainability it is important to seek out leaders who can inspire people with their optimism so that they don't simply switch off and give up instead of trying to be more sustainable. We all need hope for the future!

For positive approaches to change and optimism that climate change can be slowed show the video of Al Gore in action at: [http://blog.ted.com/2008/04/08/new_thinking_on/](http://blog.ted.com/2008/04/08/new_thinking_on/)

**Questions**

- What approach to change is suggested by Al Gore?
- What aspects do you agree or disagree with?
- What works for you to change?

**ACTIVITY 4 (1 hour) Design a social marketing program for energy efficiency**

The report and activities described below could be used as an example of the role of government OR they could be framed as a way of exploring the behavioural-change issues associated with energy efficiency and renewable energy in the household.

The Lawrence Berkeley National Laboratory (LBNL) in California researched strategies that can be used to increase the adoption of comprehensive home energy upgrades ([http://drivingdemand.lbl.gov/](http://drivingdemand.lbl.gov/)). The research involved the development of 14 case studies of residential energy efficiency programs and draws out the lessons learnt and considerations for future programs.

Review the PPT presentation summarising the outcomes from the LBNL work and consider designing a social marketing program that you think is likely to work in your local community:

Fuller, Merrian 2010 *Driving Demand for Home Energy Improvements - Presentation*  
You may agree or disagree with the findings of the program. In designing the program, however, clearly state your assumptions about human behaviour and both the strengths and weaknesses of your program. Remember that people will only adopt a behaviour that has personal benefit for them, e.g. saves them money, makes them feel good, etc.

To help you with the design process, consider a new CSIRO program called Energymark at [www.energymark.com.au](http://www.energymark.com.au), which supports groups of friends and relatives getting together at home to discuss energy efficiency actions. The groups are supported with action sheets. The site also has an article on household attitudes to electricity use that may be useful for this exercise: [http://www.csiro.au/resources/Household-Electricity.html](http://www.csiro.au/resources/Household-Electricity.html).

Questions to consider before undertaking the design

- Do you think this program will be successful? Why or why not?
- Would you participate? Why or why not?
- Do you think working together on change is more effective than on your own? Why or why not?

Preparation for session 4

Ask the students to find a newspaper article for next week’s session that focuses on some aspect of the energy debate. It could be about the impact of a carbon price on business; an appraisal of the effectiveness of a particular energy rebate scheme or an editorial comment - there are always articles on this issue.

Some key questions for students to consider are:

- What was accurate about the information in the article?
- What was not accurate about the information in the article?
- How well do you think energy issues are well understood in the media?

Other teaching options

- Guest speaker: CSIRO Energymark communications officer or someone from a non-profit environmental organisation.

- Nuclear vs renewables debate: The discussion on a more sustainable energy system could be extended to include a debate about nuclear power versus renewable energy sources as discussed in the Beyond Zero Emissions report. Many people would agree that there are a number of unknowns concerning nuclear power’s future sustainability but others argue that it could be part of a future, more sustainable energy mix. See Bill Gates on energy: Innovating to zero! [http://www.ted.com/talks/lang/eng/bill_gates.html](http://www.ted.com/talks/lang/eng/bill_gates.html). At TED2010, Bill Gates unveils his vision for the world’s energy future, describing the need for
‘miracles’ to avoid planetary catastrophe and explaining why he's backing a dramatically different type of nuclear reactor. The necessary goal? Zero carbon emissions globally by 2050. The UK Sustainable Development Commission also has some good papers on the nuclear debate. See: http://www.sd-commission.org.uk/

- A 20-page guide to conducting a Transportation Fuels Debate Game in which students evaluate the advantages and disadvantages of conventional and alternative transportation fuels in an innovative debate format. This can be downloaded from http://www.need.org/needpdf/Transportation%20Fuels%20Debate%20Game.pdf. The target audience is grade 5-12, but it could assist in developing a similar debate for tertiary students.

- Ask students to consider how trendy ‘green’ appliances might make a difference and encourage behavioural change.

  Use some of the ideas at the Ecofriend website as a prompt and ask students to design their own creative solutions to household energy needs http://www.ecofriend.org/entry/empower-rocking-chair-concept-generates-renewable-energy/

Useful resources

http://energy.unimelb.edu.au/ozsebtn/ Chapter 3 (How are we travelling?) illustrates what the government is doing and failing to do at present to reach targets. Chapter 4 (A strategy for Australia) illustrates what we can or could do, and Chapter 5 (The Bill) explains how much it would cost. Section 4.2 provides a design exercise to engage students about the necessary requirements for replacing Australia’s existing energy supply with renewable energy. It is very detailed and technical but could perhaps be simplified into an in-class activity. Some of the images could also be used to generate class discussion, e.g. political cartoons.

Sell the Sizzle by Futerra also includes some interesting resources for people developing change programs. See http://www.futerra.co.uk/downloads/Sellthesizzle.pdf
Session 4: The role of government in promoting energy efficiency

Key topics covered in this session:

- Federal, state and local government policies.
- Rebates and schemes available for EE activities.
- Economic implications of EE regulations for businesses, individuals, etc.
- International regulations/agreements on climate change and Australia’s role.

Introduction

Governments at the federal and state level can implement policies and legislative requirements for energy efficiency as well as offering rebates and other incentives for businesses, social groups and individual householders to become more energy efficient. This session will explore current initiatives and also look at what is happening at the international level to limit greenhouse gas emissions and thus encourage the uptake of more sustainable energy options.

Learning outcomes

By the end of this module participants should be able to:

- understand the terminology associated with rebates and incentives for the uptake of renewable energy technology
- understand the role of the three levels of government in promoting renewable energy technology
- account for disparities in greenhouse gas emissions targets for different countries under the Kyoto Protocol
- be aware of the level and issues of debate on the topic of energy efficiency and renewable energy in Australia from a government perspective.

Competencies

- Analysing written material and reflecting upon the values and knowledge portrayed to make decisions.
- Working with others and in teams.
- Participating in analytical verbal class discussions.
- Thinking strategically.
- Using technology.
### Session 4 timetable

<table>
<thead>
<tr>
<th>Activity</th>
<th>Title</th>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>30 minutes</td>
<td>Article review</td>
</tr>
<tr>
<td>2</td>
<td>Federal and state government initiatives for energy efficiency</td>
<td>1 hour</td>
<td>PPT presentation; group work; discussion</td>
</tr>
<tr>
<td>3</td>
<td>Local government</td>
<td>45 minutes</td>
<td>Web search; group work; discussion</td>
</tr>
<tr>
<td>4</td>
<td>International agreements</td>
<td>45 minutes</td>
<td>Graph construction; discussion</td>
</tr>
</tbody>
</table>

**ACTIVITY 1 (30 minutes) Article review**

Collate on the whiteboard the topics of the articles the students were asked to collect over the previous week. There should be a variety. Tick those topics that will be covered in the session today and next week. If there are other topics of interest, ask if the students would like to do more work on those areas and allocate time for this over the remaining sessions and/or develop an assessment activity based around issues of interest for particular students.

**ACTIVITY 2 (1 hour) Federal and state government initiatives for energy efficiency**

There are a number of technical terms applicable to this topic: feed-in tariffs, renewable energy certificates (RECs); solar credits; renewable energy targets; encapsulated tubes; heat pumps, etc. What do they all mean?

To make this topic more interesting, divide the class into groups of about four and divide up the technical terms; see if the groups can find more as you show them the PPT presentation at [http://www.northsydney.nsw.gov.au/resources/documents/Green2Gold_energy.pdf](http://www.northsydney.nsw.gov.au/resources/documents/Green2Gold_energy.pdf)

Put the list on the whiteboard and write up the definitions as they are found. Keep adding terms whilst asking the students to do the activities below.

**Website reviews**

Ask students to review the following websites and compile a list of federal and state government policies, rebates and schemes to promote the uptake of renewable energy:


A summary of rebates and government assistance is available from:


Questions

• What is the role of the renewable energy target?
• Do you think it is realistic?
• What are its limitations?
• What issues are relevant to the federal government achieving its target?
• The following article could be helpful:

• The uptake by the community of solar technologies in particular has been very high, so much so that schemes in New South Wales have been terminated earlier than intended. Why do you think uptake has been so strong? (Increasing fuel costs; very generous schemes; desire to do the right thing?).

• Which of the listed schemes would you be interested in taking up? Why or why not? (Consider payback period and initial expenditure; warranty; convenience of uptake.)

• What are some of the economic advantages of moving towards more renewable energy resources for the nation as a whole? (Useful resource: ACF & ACTU. 2008. Green Gold Rush - How ambitious environmental policy can make Australia a leader in the global race for green jobs. Reported prepared by Cambiar Consulting for the Australian Conservation Foundation (ACF) and the Australian Council of Trade Unions (ACTU). (Not available online.)

• Contrast the overall approach and philosophy in Australia with the Green Growth approach being adopted in Korea. Energy systems in developing countries are developing at a time in which new technology is available and more cost effective. http://www.korea.net/detail.do?guid=46116

• Another useful activity would be to compare the feed-in tariffs for solar PV around Australia and to consider the implications of this policy for the national renewable energy target.
ACTIVITY 3 (45 minutes) My local government area

Conduct a web search for policies and projects that have an energy focus or component in your local government area (LGA). This activity may be done in groups if students live in the same LGA. Compile a list - don’t forget to consider what is happening at the council buildings as well for the ratepayers.

Compile a list of initiatives on the board.

- Which do you think would be the most effective?
- What factors might influence take-up of the initiatives? Examples could include free energy audits for householders, energy efficiency workshops, energy efficiency awards for businesses, etc.

ACTIVITY 3 (45 minutes) International agreements

International agreements involve commitments from nations to act in ways that are mutually beneficial. The United Nations Framework for Climate Change Convention (UNFCCC) was set up under the Kyoto Protocol (see http://en.wikipedia.org/wiki/Kyoto_Protocol).

A Protocol to the United Nations Framework Convention on Climate Change was adopted in Kyoto in 1997. This Kyoto Protocol establishes legally binding greenhouse gas (GHG) emission targets for developing countries. The Protocol came into effect on the 16th of February 2005 and includes flexibility mechanisms to help countries meet their emission-reduction targets. These flexibility mechanisms include the use of carbon sinks (e.g. trees planted on land cleared before 1990, the base year for Kyoto, that take up released carbon from another part of the carbon cycle) and emissions trading.

Australia has been allowed an increase of 8% in its greenhouse gas emissions (GHGs) for the period 2008-2012 relative to 1990 emissions, whilst the commitments and targets made by other countries under the Copenhagen Accord are listed here: http://www.nrdc.org/international/copenhagenaccords/

Exercise

Rank the countries in order - construct a graph and explain the differences, especially Australia’s (and Iceland’s) unique concessions. (Answer: the Australian economy is heavily dependent on coal and has much higher population growth than most other developed countries).

Do you agree that Australia should have this concession? (Consider the moral issues; disincentive to reduce GHGs, etc.)

Other useful resources

deliver a step change improvement in Australia’s energy efficiency by 2020, from the importance of EE, key principles to embedding behavioural change and governance issues. Certain chapters could be applicable to different sessions (e.g. EE in markets for session 10, behavioural change for session 3).

**Preparation for session 5**


This article explains the benefits and limitations of both emissions trading and a carbon tax. Ask students to read and formulate questions they would like to have clarified or answered in session 6.

A useful exercise is to ask students to give a selection of friends and family a post-it note for the next week and ask them to write down their explanation of what they think an emissions trading scheme (ETS) and a carbon tax are? Reassure them you are collecting anonymous data - not trying to make them feel smart or silly. Students are the bring the notes to next session where they will be discussed.
Session 5: What is the best way to put a price on carbon - emissions trading, a tax or both?

Key topics

- Benefits and limitations of emissions trading and a carbon tax.
- Stakeholder interests and the challenges they present in implementing a system to price carbon

Introduction

Many students may find the concept of emissions trading difficult to understand so the approach used in this session is one of explaining the concepts of both an emissions trading scheme (ETS) and a carbon tax in simple ways - using animated cartoons. Once the concepts are understood, various stakeholder positions will be considered through recent newspaper articles forming the basis of a class debate.

Learning outcomes

By the end of this module participants should be able to:

- understand the concepts and components of a carbon pollution reduction scheme.
- identify different stakeholder positions and the reasons for them.

Competencies

- Analysing written material on complex issues and reflecting upon the values and knowledge portrayed to make decisions.
- Working effectively as a multi-disciplinary team.
- Participating in analytical verbal class discussions.
- Thinking strategically.
- Communicating ideas and information.

Session 5 timetable

<table>
<thead>
<tr>
<th>Activity</th>
<th>Title</th>
<th>Time</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Emissions trading</td>
<td>1 hour</td>
<td>Videos and discussion</td>
</tr>
<tr>
<td>2</td>
<td>Choosing the best way to put a price on carbon</td>
<td>2 hours</td>
<td>Role play</td>
</tr>
</tbody>
</table>
ACTIVITY 1 (1 hour) Emissions trading

Before getting into the main activity, collate the post-it notes that students had their friends and family write on. Compare the responses and discuss the following questions with the class:

- Do you think ETS’s and carbon taxes are well understood?
- Why or why not are these concepts well understood?
- What makes these topics hard for the public to understand?
- What do you think are the best ways of explaining these concepts using both written and visual materials?

After this discussion, check to see if the students have reviewed the explanation of an emissions trading and carbon tax at http://www.cpaaustralia.com.au/cps/rde/xchg/cpa-site/hs.xsl/intheblack-2009-november-cap.html

They should have a number of questions to clarify. Write these on the whiteboard. One important question is: Why is emissions trading considered to be fundamental to Australia achieving greenhouse gas reduction targets?

Now watch the following two animated cartoons that explain emissions trading (also called cap and trade by Annie Leonard) to further explain the concepts before answering the questions:


http://www.storyofstuff.com/capandtrade/

Questions

- Explain in your own words how an emissions trading scheme and a carbon tax works.
- What is the main difference between the two schemes?
- Discuss the pros and cons of both systems - write them on the whiteboard. Take a class vote on the preferred system.
- Is it inevitable that Australia will put a price on carbon in the future? Why or why not?

ACTIVITY 2 (2 hours) Choosing the best way to put a price on carbon

This activity looks at the various positions and vested interests of stakeholders in the debate about putting a price on carbon.
Print off the newspaper articles in *Additional resources* which include a number of recent articles on various stakeholder positions. Give appropriate articles to the various groups to help them formulate their arguments.

*Other useful resources*

- CarbonTrust. 2008. *Climate change - a business revolution? How tackling climate change could create or destroy company value*. This report sets out a range of global carbon mitigation scenarios and related assumptions for the transition to a low carbon economy. It demonstrates how these assumptions and scenarios could affect projected company cash flows and therefore company value. (Not available online.)

The process for this role play is described below:

- Divide the class up into major interest or stakeholder groups involved in the energy debate. Groups could include government bureaucrats, politicians (Greens, Labor, Liberal Coalition, Independents), business owners, communities, non-governmental organisations, corporations (including big emitters such as coal producers) and financiers. Also have a group called ‘future generations’.
- Distribute the handout of newspaper articles to help students determine various interests and the publicly held positions of their group on the CPRS debate. Now rank them on the whiteboard according to the scale below:

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<th>7</th>
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<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefit is to maintain the status quo</td>
<td>Transformational change</td>
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Each stakeholder group now considers amongst themselves the benefits and disadvantages of change.

- How has the balance of benefits to disadvantages changed over the past 10 years? For example, why have some businesses that seem to have much to lose modified their public position? (See the last article about the CEO of BHP Billiton)
- How can we tell what their true position is?
- Who has the most to lose?
- Who has the most to gain?
- What are the limitations of these different groups?

Each group now selects a spokesperson to represent their interests in a Q&A discussion session on how best to transition to a more sustainable energy economy. The remainder of the groups become the studio audience and ask questions of the
stakeholder representatives seated in a panel setup at the front of the room. The teacher/lecturer becomes the facilitator.

Encourage the students to explore common areas of interest and potential pathways towards solutions. Start the Q&A session by getting each of the representatives on the panel to give a short speech stating their position on putting a price on carbon and which approach they prefer: emissions trading or a carbon tax.

At the end of the Q&A session ask the audience to vote (by a show of hands) for their preferred option, i.e. emissions trading or carbon tax.

**Preparation for session 6**

Think about how university and TAFE campuses could become more energy efficient. How does your campus rate? What carbon targets and environmental reporting systems has your university or TAFE already established? Be observant over the next week and bring your thoughts to the next session.

Students may also review the website Australasian Campuses Towards Sustainability (ACTS) [http://acts.asn.au/](http://acts.asn.au/)
Session 6: EE in educational institutions: barriers and opportunities for change

Introduction

This session provides a good opportunity to put some of the theory surrounding energy efficiency (EE) into practice. A site audit of the campus is preceded by some case studies showing what other campuses have done to improve their EE. The students should be able to build on both the case studies and the site audit to develop a campus plan of management for EE.

Learning outcomes

By the end of this module participants should be able to:

- undertake the initial observations of a site audit for energy efficiency
- analyse and apply current energy efficiency measures used on university or VET sector campuses to design a site management plan for energy efficiency on their own campus.

Competencies

- Planning and organising activities.
- Working effectively as a multi-disciplinary team.
- Using mathematical ideas and techniques.
- Thinking strategically.
- Solving problems.
- Planning for change.

Session 6 timetable

<table>
<thead>
<tr>
<th>Activity</th>
<th>Title</th>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The role of higher education institutions</td>
<td>1 hour</td>
<td>Case studies in EE; Green Skills</td>
</tr>
<tr>
<td>2</td>
<td>Site audit</td>
<td>1 hour</td>
<td>Energy audit sheet for campus</td>
</tr>
<tr>
<td>3</td>
<td>EE campus plan of management</td>
<td>1 hour</td>
<td>Developing a campus plan of management focusing on EE and incorporating findings from the above activities</td>
</tr>
</tbody>
</table>
ACTIVITY 1 (1 hour) The role of higher education institutions

The mission of Australasian Campuses Towards Sustainability is to promote the integration of the principles of sustainability within the curriculum development and operational management of these sectors. These two functional aspects of higher education will be the focus of this session but it should be explained to the students that holistic sustainability encompasses other functions of the higher education institution e.g. research, outreach programs, corporate governance, etc.

Curricula

Start this activity by discussing how tertiary education can incorporate the teaching of sustainability issues such as energy efficiency into all of its courses; reiterate the importance of this for the nation’s future (see http://www.deewr.gov.au/Ministers/Gillard/Media/Speeches/Pages/Article_091023_125628.aspx http://www.deewr.gov.au/Skills/Programs/WorkDevelop/ClimateChangeSustainability/Pages/GreenSkillsAgreement.aspx).

Questions
- What is the Green Skills program?
- How many students will be involved?
- What will be the benefits for Australia?

‘Green jobs’ is the focus of the following document: ACF & ACTU. 2008. ‘Green Gold Rush - How ambitious environmental policy can make Australia a leader in the global race for green jobs.’ Report prepared by Cambiar Consulting for the Australian Conservation Foundation (ACF) and the Australian Council of Trade Unions (ACTU). (Not available online.)


Report to the Dusseldorp Skills Forum, June 2008. CSIRO Sustainable Ecosystems, Canberra is also useful.

Discussion points with students include:
- Do the students believe that the green jobs sector will grow substantially in the future? Take a vote.
- How might they take advantage of this sector growth?

Operations
As well as sustainability issues embedded in courses, university and TAFE campuses are ideally placed to showcase sustainability initiatives. US campuses in particular have embraced this mission (see http://www.presidentsclimatecommitment.org/).

The key role of higher education institutions in addressing energy efficiency issues is covered in the following document available from: http://www.ecosmagazine.com/?act=view_file&file_id=EC151p16.pdf (The Natural Edge Project magazine articles.)

The Association of University Leaders for a Sustainable Future (ULSF) http://www.ulsf.org/ has links to case studies of sustainable campuses worldwide.

Students could be allocated different countries or regions to review several in preparation for their next activity: a site audit of their campus. Ask them to focus on operational issues.

**ACTIVITY 2 (1 hour) Site audit**

There is a sustainability assessment questionnaire available at: http://www.ulsf.org. Ask the students to go to the section on operations and find energy efficiency. Using the points listed, and in small groups, they design a more comprehensive questionnaire that can be used around their own campus. They then trial the questionnaire in their groups by visiting a few areas of the campus, e.g. kitchen areas, the library, classrooms, etc. and report back for the next activity.

An alternative to using the above questionnaire: http://www.eia.doe.gov/kids/resources/teachers/pdfs/SchoolSurveySecondary.pdf ‘School Building Survey’ which is specifically geared towards EE assessment (although the target audience is secondary students).

**ACTIVITY 3 (1 hour) EE campus plan of management**

Once the site audit is completed, check to see where initiatives could be implemented to promote better energy efficiency. Write a report on each item and suggest ways in which EE could be improved. Some examples could include the installation of solar panels for hot water heating; removing a perpetual urn; turning lights off when not required, etc. This activity could be done as a class for the actual campus and then submitted; or else as an individual assessment exercise. The website www.standards.com.au may be useful.

If time permits discuss issues surrounding the challenges and processes of the implementation of their plan.

**Useful resources:**

- Re-engineering higher education for energy efficiency solutions (2009) http://www.ecosmagazine.com/?act=view_file&file_id=EC151p16.pdf. An article discussing the need for reformation of Australia’s higher education institutes (HEIs) to promote energy efficiency. Provides a good introduction for students - analysis of why change is needed, how HEIs can set about implementing change, the numerous challenges being faced and the influence that policies and external controls have on activating change.
• Australasian Campuses Towards Sustainability (ACTS) [http://acts.asn.au/](http://acts.asn.au/). ACTS is a not for profit association that serves as the umbrella body for sustainability initiatives in HEIs for both Australia and New Zealand. Its mission is to give practitioners the resources and tools to green their campus and embed sustainability concepts in higher education. The site contains contemporary news articles, upcoming conferences etc. The resource section has lots of potentially useful resources, e.g. energy and water conservation, and green office programs, but you need to be a member to access these.

What are campuses doing?

• [http://www.bth.se/fou/cuppsats.nsf/all/cbc37cf9fee56bdec125707900678163/$file/MandyTewThesis.pdf](http://www.bth.se/fou/cuppsats.nsf/all/cbc37cf9fee56bdec125707900678163/$file/MandyTewThesis.pdf). A thesis evaluating the University of Canterbury’s (NZ) strategic transition toward sustainability (using the natural step framework). Pros: emphasises the importance of strategic planning and an interdisciplinary approach (government, industry and university), incorporates the natural step philosophy - could be presented to students as a useful case-study in understanding the complexities around activating change. Cons: dated (2005), lengthy, not directly concerned with EE.


Teaching tools


• [http://www.need.org/](http://www.need.org/). The United States National Energy Education Development Project contains a range of resources including teaching guides on energy topics. The focus is on primary and secondary levels. Useful to provide examples of how other countries are attempting to embed energy topics in curriculum. The ‘blueprint for success’ is worth looking at (a guide to help educators develop effective energy education programs), there is also a range of games available on the site which illustrate innovative ‘fun’ ways to approach energy topics.

Green skills

• [http://www.deewr.gov.au/Skills/Programs/WorkDevelop/ClimateChangeSustainability/Pages/GreenSkillsAgreement.aspx](http://www.deewr.gov.au/Skills/Programs/WorkDevelop/ClimateChangeSustainability/Pages/GreenSkillsAgreement.aspx) The ‘Green Skills Agreement’ was between state / territory and federal governments (2009) to build the capacity of the vocational education and training sector - to develop the skills required in the workplace to enable individuals, business and the community to adjust and prosper in a low carbon economy. The agreement outlines principles,
objectives, outcomes, implementation strategies and governance issues - really just a statement of intent, although it does demonstrate government has a commitment to promoting green skills.

- Julia Gillard gave a speech to the Green Skills Forum [http://www.deewr.gov.au/Ministers/Gillard/Media/Speeches/Pages/Article_091023_125628.aspx](http://www.deewr.gov.au/Ministers/Gillard/Media/Speeches/Pages/Article_091023_125628.aspx) that summarises the importance of developing green skills and what the government has done, is doing and is planning to do to get the green skills agenda in place.


- *Environmental sustainability: an industry response paper* prepared by the eleven Industry Skills Councils (ISCs) is a collective response, as well as individual responses from each ISC, produced as an e-zine, enabling you to read the report on-line.


- The UNEP- ILO- IEO - ITUC Green Jobs Initiative
• UNEP Green Jobs: Towards decent work in a sustainable, low-carbon world  

• Labour and the Environment: A Natural Synergy  

• UNESCO Integrating Sustainable Development TVET Curriculum  

**Preparation for session 7**

Over the next week, note opportunities for EE measures in your workplace.

• What are they?
• Who would be responsible for implementing these initiatives?
• How might this happen?
• What if they don’t work?

Set as *pre-reading* a case study of a corporation that has undertaken Energy Efficiency Opportunities (EEO) program assessments. Case studies can be found at:

Session 7: Energy efficiency in organisations

Key topics covered in this session:

- Models of change - sustainability phases.
- Implementing change: the processes and challenges of working in teams to provide a more energy efficient workplace - varying roles, perceptions, etc.

Learning outcomes

By the end of this module participants should be able to:

- describe the phases of development towards organisational sustainability and how energy efficiency fits into the phase development model
- describe the potential opportunities for, and barriers to, energy efficiency within an organisation
- appreciate diverse viewpoints on energy efficiency and how these might be utilised to develop an effective energy efficiency strategy within an organisation.

Competencies

- Planning and organising activities.
- Communicating ideas and information.
- Working effectively as a multi-disciplinary team.
- Thinking strategically.
- Thinking creatively and laterally.
- Analysing written material on complex issues and reflecting upon the values and knowledge portrayed to make decisions.
- Participating in analytical verbal class discussions.

Session 7 timetable

<table>
<thead>
<tr>
<th>Activity</th>
<th>Title</th>
<th>Time</th>
<th>Description</th>
<th>Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The Dunphy et al (2007) phases of development towards organisational sustainability</td>
<td>20 mins</td>
<td>Present phase model</td>
<td>Phase model slide, teaching notes explaining each phase and types of eco-efficiencies</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Group discussion</td>
<td>Discussion points: Examples of companies in each phase; Examples of companies who have</td>
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</tbody>
</table>
| **2** | **What are the potential opportunities for energy efficiency in the organisation?** | 20 mins | Case studies, presentation of statistics  
Group discussion | Short case study, fact sheets  
Discussion points:  
What were the key drivers for energy efficiency in the company?  
What steps were taken to achieve the company's goals in terms of energy efficiency? |
| **3** | **What are the potential barriers to energy efficiency in the organisation?** | 20 mins | Group discussion | Discussion points:  
How was change implemented at the case organisation?  
What barriers to change needed to be overcome?  
Why haven't the opportunities for EE where you work been taken up yet? |
| **4** | **How can we facilitate EE within an organisation?** | 110 mins | Group discussion about pre-reading (10 minutes)  
Present six thinking hats concept (10 mins)  
Role play (90 mins) activity in groups of five or six:  
1. Facilitator puts participants into groups of ‘company executives’, allocates each group an industry/company identity, and each member adopts a different colour hat (10 minutes)  
2. Group discussion | Discussion points:  
What are your key conclusions from the pre-reading?  
Do you think these ideas for facilitating EE apply to your workplace?  
Six thinking hats handout  
Sheets of butcher paper and markers |
ACTIVITY 1 (20 minutes) The phases of development towards organisational sustainability

Facilitator presentation:


See Figure 1.1 on p. 17 for a summary of the model. Descriptions of each phase can be found at http://www.uts.edu.au/new/speaks/2007/March/resources/1503-slides.pdf

Whole-group discussion:

After presenting the phase model, ask the group to consider:

- examples of companies in each phase
- examples of companies who have moved from one phase to another.

ACTIVITY 2 (20 minutes) The potential opportunities for energy efficiency in the organisation

There are many case studies and much information available supporting the case for energy efficiency in business.

Video:

A short, fun video by greenthing.com about teleconferencing rather than flying (2.03 minutes):

http://www.youtube.com/watch?v=JxftZaK7nLw&feature=player_embedded

Facilitator presentation:
See graphs from the report *First Opportunities: A look at results from 2006-2008 for the energy efficiency opportunities program*, Australian Government Department of Resources, Energy and Tourism, particularly those that clearly show the financial and environmental benefits of energy efficiency for business, such as the graph depicted in Table 1. The report is available at:


**Whole-group discussion:**

A group discussion of the chosen case study about questions such as:

- What were the key drivers for energy efficiency in the company?
- Were the key drivers more about people, business competitive advantage or technologies?
- What steps were taken to achieve the company’s goals in terms of energy efficiency?
- What are the potential opportunity costs associated with NOT implementing energy efficiency? You might refer back to the cost abatement curves available in the ClimateWorks Low Carbon Growth Plan http://www.climateworksaustralia.com/Low%20Carbon%20Growth%20Plan.pdf

Students can also be directed to the following links to information about how to go about improving energy efficiency at work, either as pre-reading or for further information:

A guide to buying and using environmentally friendly office equipment:

Tips for improving energy efficiency at work and short case studies of cost savings from increasing energy efficiency in business:

A series of fact sheets describing how to improve energy efficiency at work in a range of areas such as air conditioning and hot water supply:

**ACTIVITY 3 (20 minutes) What are the potential barriers to energy efficiency in the organisation?**

**Whole-group discussion:**

After discussing the chosen case in Activity 1, ask students to identify:
How was change implemented at the case organisation?

Was there an effective change strategy embedded in the organisational approach?

What barriers to change needed to be overcome?

Why haven’t the opportunities for EE where you work been taken up yet?

Based on what you have learnt, how would you design the EE program next time for your case organisation?

**ACTIVITY 4 (110 minutes) How can we facilitate EE within an organisation?**

*Facilitator presentation:*

The ‘six thinking hats’ tool, developed by Edward de Bono, is an aid to group discussion with input from diverse perspectives.


*Videos:*

Edward de Bono describes the big picture on six thinking hats, and how it encourages ‘parallel thinking’, rather than argument (2.55mins): [http://www.youtube.com/watch?v=o3ew6h5nHcc&feature=related](http://www.youtube.com/watch?v=o3ew6h5nHcc&feature=related)

Another video presents a short description of each hat (3.04mins): [http://www.youtube.com/watch?v=cjVxSk1Mo4](http://www.youtube.com/watch?v=cjVxSk1Mo4)

The function of each hat is summarised in the following diagram that can be used as a *Handout:*


*Role play:*

The facilitator puts participants into groups of ‘company executives’, allocates each group an industry/company identity, and each member adopts a different colour hat (10 minutes).

*Small group role play/discussion* with aim of developing a plan for facilitating EE within the industry/company (30 minutes). Each member of the group should participate in the discussion using the thinking mode of their hat colour. The plan should contain the following components:

- Energy efficiency goals.
- Barriers to energy efficiency.
Opportunities for energy efficiency.
Which opportunities will be pursued and why?
Resources needed to pursue these opportunities.
Change management, communication and education strategies.

Each group’s plan is presented to the whole class (50 minutes)

Resources for role play:
Six thinking hats handout for each student.
Sheets of butcher’s paper and markers.
Optional - coloured sticky notes that correspond with and can be used to represent the six hats during role play.

ACTIVITY 5 (10 minutes) Wrap-up
Whole group discussion:
What did you learn today?
What would you like to know more about?
What energy efficiency action will you take when you return to your workplace?

Preparation for session 8
Pre-reading:
The report Driving Energy Efficiency in the Mining Sector describes actions required to gain management support and how to access necessary resources to implement EE projects in the mining sector. The report demonstrates that EE has numerous advantages for the mining sector, e.g. cost reductions, improved productivity and reduced greenhouse gas emissions. (Many of the principles can be translated to other industries.) This is a valuable resource for students providing succinct, clear, concise and practical mechanisms to promote EE in the mining sector. The report can be accessed at:


Consider
What are your key conclusions from reading Driving Energy Efficiency in the Mining Sector?
Do you think these ideas for facilitating EE apply to your current (or a previous) workplace?
• Which EE strategies will actually generate short term and long term energy savings in your organisation?

**Additional teaching methods/ options:**

• Guest speaker such as a Sustainability Manager from a local organisation.

• Short walk around the teaching institution to identify energy efficiency measures taken and further opportunities for energy efficiency.

**Other teaching resources:**

The Natural Edge Project (www.naturaledgeproject.net/) provides detailed, referenced lecture notes. For example:


• Opportunities for energy efficiency for the Australian Manufacturing sector (paper, glass, brick, textiles, etc.). Document available from: http://www.naturaledgeproject.net/documents/ESSP/EnergyTransformed/TNEP_Energy_Transformed_Lecture_5.2.pdf

• Case study for reducing energy consumption in a data centre. Document available from: http://www.naturaledgeproject.net/Documents/SustainableIT/Sustainable%20IT%20-%20Lecture%204.pdf (also useful for session 9).

**Other useful resources**


• http://www.ted.com/talks/lang/eng/ray_anderson_on_the_business_logic_of_sustainability.html is another talk with an entrepreneurial / optimistic focus by CEO Ray Anderson of Interface (although the focus is not only energy but creating a sustainable business).


  http://www.wbcsd.org/templates/TemplateWBCSD5/layout.asp?type=p&MenuId=MTA5NA&doOpen=1&ClickMenu=LeftMenu aims at producing a road-map for
reaching energy self-sufficiency in buildings by 2050, while being economical and socially acceptable.


- [http://www.gbn.com/consulting/article_details.php?id=13](http://www.gbn.com/consulting/article_details.php?id=13) could be modified into an interesting role play / discussion on scenario planning - was a report produced by the Global Business Network examining potential energy impacts that businesses may face over the coming decade based on four plausible scenarios.

- [http://www.retail.gov.au/energy/Documents/energyefficiencyopps/PDF/EEO_FirstOpportunitiesReport_2010_FINAL.pdf](http://www.retail.gov.au/energy/Documents/energyefficiencyopps/PDF/EEO_FirstOpportunitiesReport_2010_FINAL.pdf) First Opportunities: A look at results from 2006-2008 for the energy efficiency opportunities program, Australian Government Department of Resources, Energy and Tourism. This report profiles the energy use and energy savings of corporations participating in the EE opportunities program. The report is very comprehensive (80+ pages) but many of the graphs are extremely catchy, e.g. Table 1 clearly shows the correlation between energy opportunity, energy saving and financial benefits, and there are many statistics showing that EE results in environmental and financial pluses for corporations.

- [http://www.retail.gov.au/energy/efficiency/eeo/resmaterial/casestudies/Pages/default.aspx](http://www.retail.gov.au/energy/efficiency/eeo/resmaterial/casestudies/Pages/default.aspx) provides useful case studies of corporations that have undertaken Energy Efficiency Opportunities (EEO) program assessments. (Students may engage better with one or two tangible case studies rather than looking at the entire EEO report.)

- The Natural Edge Project ([www.naturaledgeproject.net/](http://www.naturaledgeproject.net/)) provides detailed, referenced lecture notes. For example:
  - Opportunities for energy efficiency for the Australian Manufacturing sector (paper, glass, brick, textiles, etc.). Document available from [http://www.naturaledgeproject.net/documents/ESSP/EnergyTransformed/TNEP_Energy_Transformed_Lecture_5.2.pdf](http://www.naturaledgeproject.net/documents/ESSP/EnergyTransformed/TNEP_Energy_Transformed_Lecture_5.2.pdf)
Session 8: Energy Efficiency in energy intensive industry

Introduction
Almost all industries heavily depend on large inputs of fossil fuels for operational purposes such as manufacturing and transport. Examples include pesticide and fertiliser products for the agricultural sector, fossil-fuel-based chemicals for the plastics and cosmetics industries, machinery operation for the manufacturing sector, transporting consumer goods to distribution outlets, etc. Saving energy use and costs will be a valuable goal to which new graduates can contribute on entering the workforce in coming years.

Improved energy efficiency will account for two-thirds of avoided greenhouse gas (GHG) emissions in 2030 (IEA, 2006). Since the industrial sector represents more than one third of both global primary energy use and energy-related carbon dioxide emissions, improving energy efficiency in the industrial sector is critically important for meeting this goal. (http://www.iea.org accessed 15/11/2010).

Two main aspects to improving EE will be covered in this session: operational and managerial.

Learning outcomes
By the end of this module participants should be able to:

- understand the terminology associated with the energy used in the production of goods
- describe managerial processes that facilitate the incorporation of EE measures into industrial enterprises
- describe the advantages of EE measures for industries
- understand the likely challenges for industries in adopting EE measures.

Competencies
- Analysing written material on EE and reflecting upon the values and knowledge portrayed.
- Working with others and in teams.
- Participating in analytical verbal class discussions.
- Thinking creatively and laterally.
- Translating written information into flowcharts.
- Planning and implementing action.

Session 8 timetable
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<th>Time</th>
<th>Description</th>
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<tr>
<td>1</td>
<td>Introduction</td>
<td>30 minutes</td>
<td>Graph interpretation</td>
</tr>
<tr>
<td>2</td>
<td>Opportunities for EE in industry</td>
<td>90 minutes</td>
<td>Life-cycle product analysis; carbon offsets</td>
</tr>
<tr>
<td>3</td>
<td>EE in the mining sector</td>
<td>1 hour</td>
<td>Case study</td>
</tr>
</tbody>
</table>

**ACTIVITY 1 (30 mins) Introduction**

Review the material from last week’s session. Explain how this week’s session will build on EE in business and focus on industrial activities.

Show the graph at:

**Questions**

- Which sector uses the most energy?
- Which sector uses the least energy?
- After the previous section, maybe students might point out that most of the energy use of the construction sector is hidden in resource/material/product production and downstream, in the energy use of buildings.
- What factors contribute to energy sector use? (Consider the type of industrial process used to make the product; supply chain; number of components; location of markets, etc.).

Note: It is important to highlight that in this graph all electricity energy use is allocated to the electricity generation sector. About half the electricity is used by the commercial and residential sectors combined, and most of the rest by industry, of which aluminium smelting is dominant.

**ACTIVITY 2 (90 minutes) Opportunities for EE in industry**

Manufacturing any product requires designing (or growing) the product; sourcing components; transporting them to the factory; a manufacturing process; getting products to consumers; dealing with unwanted parts of the raw materials, etc. All of these processes refer to the life-cycle of the product. When we purchase a product we rarely think of all the processes involved in bringing it to us nor what happens to the bits we don’t want, e.g. the packaging (refer back to ‘The Story of Stuff’ in Session 2, Activity 2).

**Product life-cycle analysis**

For this activity, students choose a product they use and draw a flow chart indicating where energy is used in its life cycle.
Useful websites include:

- [http://www.ted.com/talks/lang/eng/catherine_mohr_builds_green.html](http://www.ted.com/talks/lang/eng/catherine_mohr_builds_green.html) explains the concept of ‘embodied energy’, that is, the energy that goes into making a product.

Once this is done, the students think of areas where EE measures could be employed, e.g. raw material substitution to use recycled products (road base is a good example) or less processed goods.

**Additional information on key terms**

(Note that some of these concepts have been introduced in the previous session.)

**Life Cycle Assessment**

LCA studies the environmental aspects and potential impacts throughout a product’s life (i.e. cradle-to-grave) from raw material acquisition through production, use and disposal. The general categories of environmental impacts needing consideration include resource use, human health, and ecological consequences.


**Life Cycle Management**

LCM is a flexible integrated framework of concepts, techniques and procedures to address environmental, economic, technological and social aspects of products and organizations to achieve continuous environmental improvement from a Life Cycle perspective. LCM, as any other management pattern, is applied on a voluntary basis and can be adapted to the specific needs and characteristics of individual organisations.


Life cycle costing - breakdown of the financial aspects of a product over its life.

**Product Stewardship**

A concept of shared responsibility by all sectors involved in the manufacture, distribution, use and disposal of products.

Purchasing Strategies
Purchasing strategies refers to the environmental benefits that can be obtained through sustainable procurement. [http://www.unepie.org/pc/sustain/design/green-background.htm](http://www.unepie.org/pc/sustain/design/green-background.htm)


‘Sustainable procurement is the process in which organisations buy supplies or services by taking into account:

- the best value for money considerations such as, price, quality, availability, functionality, etc.
- environmental aspects (‘green procurement’: the effects on the environment that the product and/or service has over its whole lifecycle, from cradle to grave)
- the entire Life Cycle of products
- social aspects: effects on issues such as poverty eradication, international equity in the distribution of resources, labour conditions, human rights.’

Carbon offsets
Industrial enterprises can offset their GHG emissions through buying carbon offsets.


Under the Kyoto Protocol a planted forest which is established after 1 January 1990 on previously cleared land will count as a carbon sink. The carbon dioxide sequestered in such a forest can be used to create carbon credits. Emissions trading will allow countries and individual companies to buy and sell carbon credits created by activities that reduce the level of GHG emissions.


Imagine you are the CEO of a company that produces the item for which you did the life-cycle analysis. Decide on a carbon-offset scheme to compensate for the amount of energy used in producing a year’s output from your industrial enterprise.

ACTIVITY 3 (1 hour) Selling the benefits of EE in business

The document *Driving Energy Efficiency in the Mining Sector* available from [http://www.ret.gov.au/energy/Documents/eex/Driving%20Energy%20Efficiency%20in%20the%20Mining%20Sector.pdf](http://www.ret.gov.au/energy/Documents/eex/Driving%20Energy%20Efficiency%20in%20the%20Mining%20Sector.pdf) describes actions that can be taken to gain management support and access the resources needed to implement energy efficiency projects. Energy efficiency makes sense for mining operations and other businesses because it can reduce costs. It can also generate a range of other benefits, for example by improving productivity or reducing greenhouse gas emissions.
Split the class into groups of 4-5 students. Ask each of the groups to do the following:

- Nominate an organisation that everyone in the group is familiar with (e.g. bank, retailer, mining company, manufacturer).
- List the key decision-makers in those businesses (e.g. general manager, finance manager, environmental manager, etc.).
- List the key business issues that each individual decision-maker is likely to be most interested in.
- List three benefits of energy efficiency that is likely to be of most interest to each decision-maker.
- List three factors likely to discourage each decision-maker’s interest in energy efficiency.
- Describe the actions you can take to get the support from these decision-makers for energy efficiency.

After 20-30 minutes ask each of the groups to select 1-3 decision-makers and report back on the key messages and actions they will take to increase their motivation to support energy efficiency in the business.

Following the discussion, discuss the ‘political’ nature of organisations and the strategies that can be used to get different decision-makers to support energy efficiency.

**Preparation for session 9**

During the coming week make a rough plan of your home:

- its aspect (which direction the sun rises and sets; look up your street directory if you’re not sure of directions, maps generally show north to the top)
- which direction warm/cold winds come from
- outside areas - grass, garden beds, main features
- any sustainability/EE/renewable features either in the design or retrofitting
- which way the land slopes
- the locations of trees and other obstructions to winter or summer sun
- the location (or absence) of eaves and verandahs.

You may be surprised how few people are actually aware of the environmental features of their own homes that impact upon their energy use!
Session 9: EE in the home

Key topics covered in this session:

- Practical solutions covering heating, cooling, electricity generation, hot water.
- Devices to measure energy consumption.
- Understanding energy bills.
- Government incentives to save energy use.
- Passive solar design.
- Energy rating system.
- Retrofitting

Introduction
This session will concentrate on practical solutions to conserving energy at home.

Learning outcomes
By the end of this module participants should be able to:

- understand the principles of passive solar building design and its applicability to their own home
- describe appropriate actions concerning the home that can save energy such as EE measures and installing solar technology.

Competencies
- Collecting, analysing and organising information.
- Communicating ideas and information.
- Thinking creatively.
- Applying knowledge to solve problems.
- Planning and managing change

Session 9 timetable

<table>
<thead>
<tr>
<th>Activity</th>
<th>Title</th>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EE outside the home</td>
<td>90 minutes</td>
<td>Website review; house plan drawing; DVD - retrofitting</td>
</tr>
<tr>
<td>2</td>
<td>EE inside the home</td>
<td>90 minutes</td>
<td>Website review; worksheets</td>
</tr>
</tbody>
</table>
ACTIVITY 1 (90 minutes) EE outside the home

Students review websites on passive solar building design from sites such as these:

- [http://interestingenergyfacts.blogspot.com/2010/05/energy-efficiency-facts.html](http://interestingenergyfacts.blogspot.com/2010/05/energy-efficiency-facts.html) has a useful graphic showing energy loss from two houses using a thermographic image.

Ask students to draw a plan of the outside of their home, be it an individual house, unit or townhouse, including the below:

- prominent features such as fences, garden beds, paths, trees, sheds, clothesline, ponds, etc.
- where the sun rises and sets
- where the warm and cold winds come from
- sloping land
- shade areas
- location of eaves.

All of the above features may impact to some extent on energy transfer from the outside to the inside of the home. Ask the students to add passive solar design features to the plan to reduce energy transfer to the inside of the home in summer and insulate and allow sun into the home in winter.

Examples could include:

- planting deciduous vines or trees on the western side of the home
- adding a pergola
- installing shutters
- painting the roof a lighter colour
- double-glazing windows.

Use the websites listed above for more suggestions.

Share solutions by displaying plans around the room.

Show the DVD *A good home forever* by Rosemary Morrow, available from Lysis Films, Blue Mountains for $25. Retrofitting is a cost effective option for those with limited funds wanting a more sustainable lifestyle.
Questions
List the changes made by Rosemary to her modest brick veneer home, both inside and out, to make it more energy efficient.

Which of these changes require spending money and which require changing people’s behaviour?

What are the short term and long term benefits?

Which of the changes that were made could you implement at your home?

Additional useful resources for these activities are the Sanctuary and ReNew magazines which are both published by Alternative Technology Assn (www.ata.org.au). They include case studies, as does http://www.yourhome.gov.au/

ACTIVITY 2 (90 mins) EE inside the home

There are many websites available on ways to save energy inside the home, for example:

- http://www.energyrating.gov.au
- http://www.naturaledgeproject.net/documents/ESSP/EnergyTransformed/TNEP_Energy_Transformed_Lecture_9.1.pdf ‘Residential Building Energy Efficiency and Renewable Energy Opportunities: Towards a Climate-Neutral Home’ is a very clear lecture with links to additional resources and supporting images, graphs and tables - an extremely useful introduction to key concepts surrounding domestic energy supply - contemporary, with an Australian focus, it includes a case study and details of available government subsidies. Definitely worth a look.

Questions
What can you do to save energy at home? (Turn off lights when not needed; don’t use standby; use energy efficient light bulbs; wash at off-peak times; don’t use microwaves, dryers; buy energy efficient appliances, etc.)

Which of the above actions do you do already?

As well as these actions, choosing renewable energy options such as GreenPower and installing solar technology is also important (see below).

GreenPower

http://www.greenpower.gov.au/what-is-greenpower.aspx a hub of information relating to GreenPower, e.g. what it is, how it works, reasons to switch and current news. The fact sheets could be useful support material for students.

http://www.greenpower.gov.au/admin%5Cfile%5Ccontent2%5Cc7%5Cgp%20switching%20Fact%20Sheet%20March%20202010127900037348.pdf has tips on making sure the renewable energy you buy is accredited, choosing an electricity provider, how your purchase should benefit the environment, and what you need to know about your electricity contract (two pages).

http://www.greenpower.gov.au/admin%5Cfile%5Ccontent2%5Cc7%5Ccsv_fac
tsheet_a4_07_final.pdf is a one page fact sheet explaining GreenPower.

Questions
- Ask whether anyone in the class has signed up to GreenPower.
- How does GreenPower work?
- What do you think about it - will it drive change?
- What are the alternatives to using GreenPower if you want to rely more on the sun’s energy for power?
- What green power products are there on the market and which are the most effective?
- What types of households does GreenPower most suit (tenants, people moving around a lot, poor solar access, etc.)

Choosing solar

Questions
- Explain how solar technology works.
- How would you encourage someone to install solar technology?
- Is it an economically attractive proposition for people now? Will it be more so in the future?
- What government rebates/incentives are available at the present time to encourage uptake?
• Research which is the most efficient and cost-effective in reducing GHG emissions: installing solar photovoltaic systems or solar hot water.

Other useful resources:
• [www.energymark.com.au](http://www.energymark.com.au) a new CSIRO program that encourages people to form community discussion groups in the home to discuss ways that people can reduce their energy use - much useful material.

Case studies
• Gerding/Edlen Development Company, LLC, Portland, Oregon, USA [http://www.naturalstep.org/it/usa/gerdingedlen-development-company-llc-portland-oregon-usa](http://www.naturalstep.org/it/usa/gerdingedlen-development-company-llc-portland-oregon-usa) provides an example of how, through incorporating the natural step philosophy, a building’s energy usage was cut by half. Honest and frank information - also describes difficulties and failures, succinct - could be useful to generate discussion / questions.

Tips and guides

Green supply options
• [http://www.climatechange.gov.au/government/initiatives/~/media/publications/renewable-energy/solar-pv-factsheet.ashx](http://www.climatechange.gov.au/government/initiatives/~/media/publications/renewable-energy/solar-pv-factsheet.ashx) a fact sheet on solar panels - researching the various types, obtaining quotes, choosing a system, and installation procedures, also contains links to support material / further information, e.g. where to get advice on solar credits, and connection procedures for each state.

- [www.greenelectricitywatch.org.au](http://www.greenelectricitywatch.org.au)

**Activities**

- [http://www.csiro.au/helix/sciencemail/activities/EnergyUse.html](http://www.csiro.au/helix/sciencemail/activities/EnergyUse.html) is an activity directed toward school students that works out how much energy the student currently uses and what would be necessary to match that with a generator (using diesel fuel) or solar panels.

- CSIRO has also published a home energy saving manual that is quite good. John Wright and Peter Osman are the authors.

**Preparation for session 10**

Consider your use of technology (e.g. laptops, mobile phones, DVD players, etc.) and how much power each product uses.

- How many items do you have today compared to five years ago?
- What items could you do without?
- What does this tell you about our energy demands in the future?
- What potential is there for energy efficiency to offset or amplify these trends in demand?
Session 10: Energy Efficiency in Information Technology equipment

Key topics covered in this session:

- Measuring power consumption in IT equipment
- Identifying options to purchase and use IT equipment to reduce energy use.

Introduction

This session provides practical activities that can help individuals understand more about electricity, how to measure it and how to reduce energy consumption in common IT equipment used in the home and workplace.

Learning outcomes

By the end of this module participants should be able to:

- measure the power consumption of common IT equipment
- implement initiatives to reduce their use of IT equipment in the home and workplace.

Competencies

- Collecting, analysing and organising information.
- Thinking creatively.
- Applying knowledge to solve problems.
- Connecting personal IT usage with energy usage.

Session 10 timetable

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<th>Activity</th>
<th>Title</th>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>How can we measure power consumption in IT equipment?</td>
<td>90 minutes</td>
<td>You Tube videos, PowerPoint slides and an exercise to measure consumption.</td>
</tr>
<tr>
<td>2</td>
<td>Where are the opportunities to improve the energy efficiency in our use of IT equipment?</td>
<td>60 minutes</td>
<td>PowerPoint slides and an exercise to estimate energy and cost saving potential</td>
</tr>
<tr>
<td>3</td>
<td>The wider impact of e-waste</td>
<td>30 minutes</td>
<td>YouTube videos</td>
</tr>
</tbody>
</table>
ACTIVITY 1 (90 minutes) How can we measure power consumption in IT equipment.

Show a video that describes the energy issues associated with IT equipment.

For example:

When tech meets green - OECD

http://www.youtube.com/watch?v=w-BjMkFWijY

Explaining green computing

http://www.youtube.com/watch?v=350Rb2sOc3U

Step through the Session 10 slides 1-9 explaining how to define green IT, and explain the fundamentals of power consumption in IT equipment.

Then conduct a group exercise following the instructions in exercises 10.1 and 10.2. You will need a power meter to conduct the exercise. Google ‘plug-in appliance power meter’ to find some purchasing options - ranging from about $25 for a single plug system. The web page http://wattsclever.com/products/energy-watch-monitors provides some options that you might consider. You need to be very careful with cheap meters: many don’t read poor power-factor consumption very accurately. In particular, this may overstate standby power, which usually has a very poor power-factor.

ACTIVITY 2 (60 minutes) How can we reduce power consumption in IT equipment.

Step through slides 10-15 exploring options to reduce energy use.

Complete worksheet 10.3.

ACTIVITY 3 (30 minutes) The wider impact of e-waste

View the two videos about e-waste in Ghana

These are available at:

http://www.youtube.com/watch?v=OgpBcFDjK7Y
http://www.youtube.com/watch?v=ACXwo6MntpA

Discuss the implications of e-waste and how this might influence students purchasing and disposal decisions.
Other useful resources

- [http://www.computersoff.org/default.asp](http://www.computersoff.org/default.asp) a guide to help government, business and individuals reduce computer power use. Includes videos that could be incorporated into lesson plans.

- [http://www.naturaledgeproject.net/SustainableIT.aspx](http://www.naturaledgeproject.net/SustainableIT.aspx) contains a lecture series on sustainable IT. Although it has an holistic emphasis there are modules that deal with decreasing carbon footprints. In particular see lecture 3 which presents a four-step process to reduce energy consumption, and lecture 4 detailing a seven-step process for improving energy efficiency in data centres and a case study.

- [http://www.naturaledgeproject.net/documents/ESSP/EnergyTransformed/TNEP_Energy_Transformed_Lecture_5.3.pdf](http://www.naturaledgeproject.net/documents/ESSP/EnergyTransformed/TNEP_Energy_Transformed_Lecture_5.3.pdf) an extremely valuable lecture on ‘Opportunities for Energy Efficiency in the IT Industry and Services Sector’. It provides a synthesis of key concepts, numerous best practice examples (global and national), additional resources and many supporting images.
Session 11: The ethics of energy supply and use

Key topics covered in this session:

- Energy supply: inequities between regions, countries, locally.
- Energy use: personal, societal, in the workplace.
- Policy responses to manage social impacts as energy prices increase.

Introduction

There are many issues surrounding the ethics of energy supply and use including the control and distribution of supplies between developed and developing nations; the rights of individuals to a certain amount of energy to live comfortable lives; the unforeseen environmental, and the social and economic impacts of energy use and production on people.

This session provides an opportunity for students to consider these issues and to reflect on potential solutions.

Learning outcomes

By the end of this module participants should be able to:

- understand the range of ethical issues relating to the environmental, political, social and economic impacts of energy supply and use
- describe the links between poverty, economic development and energy
- describe measures that can reduce the disparity in quality of life between energy rich and energy poor nations
- recognise that their personal actions in regard to energy use have an ethical dimension.

Competencies

- Analysing and organising information.
- Communicating ideas and information.
- Thinking creatively and laterally.
- Applying knowledge to solve problems.
- Working with others and in teams.
- Summarising complex issues.
Session 11 timetable

<table>
<thead>
<tr>
<th>Activity</th>
<th>Title</th>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>An introduction to ethical issues</td>
<td>30 minutes</td>
<td>Two short DVDs with brief class discussion</td>
</tr>
<tr>
<td>2</td>
<td>Environmental, political, social and economic impacts of energy supply and use</td>
<td>90 minutes</td>
<td>Brainstorming and mind mapping; group work</td>
</tr>
<tr>
<td>3</td>
<td>What can be done?</td>
<td>1 hour</td>
<td>Class discussion; interactive group activity; reflective writing</td>
</tr>
</tbody>
</table>

ACTIVITY 1 (30 minutes) An introduction to ethical issues

Start this session with two DVDs that illustrate some of the ethical issues surrounding the use of energy:

- **Clean Skies News June 21 2010 (4.22 mins).**
  [http://www.youtube.com/watch?v=QFowpz8rMdE](http://www.youtube.com/watch?v=QFowpz8rMdE)

  This video introduces a range of current energy issues including the BP oil spill in the Gulf of Mexico, coal-mining-related deaths in China, a study of the environmental impact of wind turbines and the Beyond Zero report released in Australia that aims to transform Australian energy supply to emissions neutral by 2020.

  After viewing, briefly list on the whiteboard the political, environmental, social and economic impacts of the BP oil spill in the Gulf of Mexico.

- **http://www.ted.com/talks/lang/eng/william_kamkwamba_how_i_harnessed_the_wind.html** is a very powerful speech demonstrating the power of an individual to combat adversity - poverty, lack of education. (The speaker constructed a wind generator to generate electricity and pump water with meagre resources creating fundamental changes to quality of life). 6 minutes; a good introduction to the power of the individual in activating change.

  This video will raise lots of questions that can also be put on the whiteboard such as is it right that we have so much and William has so little? What can we personally do about it?

Ask the students for other ethical issues not covered in the DVDs that can also be noted on the whiteboard. These could include:

- Australia supplies coal for industrial activities in China.
- As electricity prices increase domestically, who will be unable to pay their power bills?
• What are the environmental impacts of underground coal mining and coal seam methane extraction on water supplies?

• Should we continue building coal-based power stations when the Beyond Zero Emissions Stationary Energy Plan has shown that an economy based totally on renewable energy is possible by 2020?

• How do we compare environmental and social impacts of our current energy regime? How should decisions be made around trade-offs between jobs and environmental impact?

**ACTIVITY 2 (90 minutes) Environmental, political, social and economic impacts of energy supply and use**

This activity follows on from the videos and reflective questions in Activity 1. The points listed on the whiteboard can now be removed and replaced in the format of a mind map as students brainstorm the many ethical implications of mining fossil fuels for electricity and export at a political, environmental, social and economic level. Information on these techniques is available at http://www.mind-mapping.co.uk/make-mind-map.htm; and http://www.mindtools.com/brainstm.html

The teacher/lecturer can construct the mind map on the whiteboard or ask students to add their own issues and links.

Once the mind map is completed, ask the students to classify the issues into political, environmental, social and economic. Circle the issues with a different coloured whiteboard marker for each category.

Which areas have the most ethical issues? Students could then be divided into four groups to come up with potential solutions for each of the four areas. Provide some guideline questions for the groups - examples are given below. It will become obvious that areas overlap. For example, the first question relates to both social and economic development; the second question relates to both economic and environmental issues. Websites are listed below under each of the areas for discussion. Have each group elect a spokesperson to summarise their ideas for the whole class to finish this activity.

**Questions for the economic group**

• What role does access to energy play in development?

• Should Australia contribute to the development of coal-fired power stations in developing countries? Why/why not?

• [http://www.eia.doe.gov/country/index.cfm](http://www.eia.doe.gov/country/index.cfm) is a link to an interactive map that could assist students comprehend the relationship between energy use and economic development.

• Discuss the complexities around the economics of climate change and EE and the cost of early action versus late action to reduce greenhouse gas emissions.
• How can governments act to make the costs of energy increases more equitable?

Questions for the environmental group
• What are the short term environmental consequences of more effective EE?
• What are the long term environmental consequences of more effective EE?

Questions for the social group
• What is the link between energy and poverty in Australia?


A characteristic of advanced economies is continual growth in household income and plunging costs of electric appliances. In Australia, increases in household floor-space combined with power prices that are among the lowest in the world have resulted in rapid growth in peak demand. The power grid in turn requires substantial incremental generating and network capacity, which is utilized momentarily at best. As the cost of augmentation is gradually revealed, fuel poverty seems predictable. We call this the Boomerang Paradox; the nation’s rising wealth has created the pre-conditions for fuel poverty. But appropriate and timely policy settings can defuse its effects. Intriguing paper highlighting the dilemma that increased wealth = increased energy use = increased energy poverty, supported by graphs and additional references, quite dense and technical though.


ACTIVITY 3 (1 hour) What can be done?

1. Australia contributes to the energy development of developing nations through AusAid. See:

• http://www.ausaid.gov.au/country/country.cfm

• http://www.worldenergyoutlook.org/development.asp

Questions
• What role does access to energy play in development?
• Why is Australia contributing to energy development through organisations such as AusAid?
• Given the link between fossil fuels and climate change, is Australian aid for energy development helping people in developing countries in the long run?

2. What is the role of business in the ethical debate?

Split the class into groups of 3-4 students.

Review the list of companies represented on the Federal Government’s Business Roundtable on Climate Change. This is available at:


Allocate one of the companies to each group. Have each of the groups respond to the question: ‘What are the ethical obligations of your nominated company in relation to climate change?’

Allocate a suitable period of time for the group work and then ask each of the groups to report back in a whole group plenary session.

After the presentations, discuss the following:

• What are some of the similarities and differences in the way in which each of the groups presented the companies’ views of their ethical obligations in relation to an issue like climate change?

• How might a company balance longer term national and global priorities with short term shareholder interests?

• What examples are there of companies taking a strong ethical stance on a particular issue? Did this help or hinder corporate performance?

Although not directly related to climate change, the video of a talk titled ‘How big brands can help save biodiversity’ by Jason Clay of the WWF can be a useful resource.

http://www.ted.com/talks/jason_clay_how_big_brands_can_save_biodiversity.html

3. What is my role? Is it OK to waste energy?

Mention that this is the topic of the last session so this question could provide an opportunity for some self-reflexive scribing.

Other teaching option

Students read an article from The Australian on Australia’s role in providing cheap energy to overseas nations through coal exports (see Export coal: our power gift to Asia in Additional resources). They are then asked to classify the reader comments (71) following the article into categories such as supportive, not supportive, hostile, etc. Ask the students to decide on the categories - they could be issues-based, rather than feelings-based, e.g. business, personal.
**Questions**

- Which category of reader response do they most identify with? (There should be a variety of responses here.)
- Discuss the history of why we are exporting coal rather than solar, wind or geothermal technologies to these countries?
- How many of the comments related to moral issues?
- What other issues were raised?
- What do you notice about the strength of emotions around this issue from the comments?

Finish the session by asking for a show of hands on the question: should Australia be exporting coal to Asia? Then ask the question in a different way: Should Australia be exporting GHG emissions into the atmosphere via other countries in addition to our own carbon footprint?

**Other useful resources**

- Bill Gates on energy: Innovating to zero! [http://www.ted.com/talks/lang/eng/bill_gates.html](http://www.ted.com/talks/lang/eng/bill_gates.html) Bill Gates unveils his vision for the world's energy future, describing the need for ‘miracles’ to avoid planetary catastrophe and explaining why he's backing a dramatically different type of nuclear reactor. The necessary goal? Zero carbon emissions globally by 2050. Also deals with issues of equity / developed vs. developing countries.
- Electricity bills 'to soar regardless of carbon tax' [http://www.abc.net.au/news/stories/2010/10/15/3039995.htm?section=justin](http://www.abc.net.au/news/stories/2010/10/15/3039995.htm?section=justin) Discusses future predictions of electricity costs, the ramifications of a carbon tax and the concept of ‘fuel poverty’ (the implications shifts in energy prices will have on sectors of society), valuable in that it stresses the ethical dilemmas around energy and the complexities and the challenges in resolving them.
- Australia’s contribution to energy development through Ausaid [http://www. Ausaid.gov.au/country/country.cfm](http://www. Ausaid.gov.au/country/country.cfm). You need to sift through the contributions for the ones that relate to energy but there are quite a few, e.g. India Energy Security and Climate Change Partnership Program.
  - Activities supporting effective government to government technical exchange in climate change, energy efficiency and renewable energy, water and resource management, and agriculture/dryland farming.
  - **Contribution:** $5 million ($1.2 million for 2010-11)
Duration: 2010-2013  
Implementing organisations: Australian and Indian Public Institutions

- WEO 2010 - Energy Poverty: How to make modern energy access universal  
  Alarmingely there is no Millenium Development Goal specifically related to energy. To help support action and policy making in this area the International Energy Agency, the United Nations Development Programme and the UN Industrial Development Organisation have pooled their resources to produce this report. This is a very valuable summary of what has been done, what should be done and how to implement and monitor change in order to facilitate an equitable supply of energy.

- [http://www.korea.net/detail.do?guid=46116](http://www.korea.net/detail.do?guid=46116) a link to Korea’s Green Growth Strategy. Have students review the summary.

- There’s also the Maldives plan to go carbon neutral by 2030:  
  Suggested question: Developing countries can provide us with insights since their energy systems are developing at a time in which new technology is available and more cost effective.

  Exercise: Contrast the overall approach and philosophy in Australia with the Green Growth approach being adopted in Korea and the Maldives. You Could also look at Germany's Green Economy Strategy (aim: 100% renewable by 2050)  
  provides a succinct summary of their approach.


  More than $36 billion a year is needed to ensure that the world’s population benefits from access to electricity and clean-burning cooking facilities by 2030, the International Energy Agency said Tuesday. The agency said the goal of eradicating extreme poverty by 2015 would be possible only if an additional 395 million people obtained access to electricity and one billion gained access to more modern cooking facilities that minimize harmful smoke in the next few years. “Without electricity, social and economic development is much more difficult,” Fatih Birol, the energy agency’s chief economist, said by telephone. “Addressing sanitation, clean water, hunger - these goals can't be met without providing access to energy.” China is one of the bright spots, with universal electricity availability expected in 2015, followed by Latin America in 2030.  


- ‘In the developing world - Power to the people’, *The Economist*, 2 September 2010 - A growing number of initiatives are promoting bottom-up ways to deliver energy to the world's poor. The technology in question, from solar panels to
low-energy light-emitting diodes (LEDs), is rapidly falling in price.


• Solar power and the poor: SciDev.net, March 2010. As technological obstacles to the efficient use of solar energy diminish, economic and political challenges remain to its widespread adoption by the poor. The capital costs of solar devices remain considerable, particularly to the poor. And government subsidies for energy produced from non-renewable sources - intended ostensibly to keep prices affordable - have too often also distorted the market in the interests of conventional energy suppliers.


• New WRI report: ‘Power to the People: Investing in Clean Energy for the Base of the Pyramid in India’. This report by the World Resources Institute informs investors about the market potential of the clean energy industry serving India's rural Base of the Pyramid (BoP) market, by looking at its opportunities, challenges, and potential paths to growth. WRI estimates that the aggregated potential market for the four sectors studied in this report to be INR 97.28 billion (US$2.11 billion) per year, including INR 94.06 billion (US$2.04 billion) for decentralized renewable energy services and INR 3.22 billion (US$70.1 million) for energy products per year. http://www.wri.org/publication/power-to-the-people

• Bringing light to India's rural areas: New York Times, 2 September 2010. Selco designs simple, low-cost systems that combine solar panels and storage batteries, an aggressive financing package and comprehensive installation and service support. Selco's efforts are one example of India's broader push for solar energy. Alternative energy, like wind, biomass and solar, accounts for less than 8 percent of India's power generation. Yet the need for more clean energy in India is urgent.


• Solar energy brings power to rural Africa: CNN, 23 August 2010. In rural communities of Africa, where more than 95 percent of homes have no access to electricity, solar energy has the power to transform lives. Among those bringing solar power to the world's poor is Rural Energy Foundation, a Dutch non-profit organization. It has now helped 450,000 people in sub-Saharan Africa gain access to low-cost solar power. Rural Energy Foundation runs the SolarNow program, training independent retailers and technicians in nine countries to sell low-cost solar gadgets or home systems to people without electricity.


Preparation for session 12
Ask students to review:


   Transitioning towards sustainable rural electrification in developing countries: a case study of Luangwa district in Zambia is a useful example of the challenges involved in developing and implementing sustainable technologies for energy harvesting in rural, developing nations.
Session 12: Alternative approaches to a sustainable energy future

Key topics covered in this session:

- Grassroots community initiatives for a sustainable future: transition towns and localised climate action groups
- Government initiatives: urban consolidation, improved public transport, smaller residences. Partnerships.

Introduction

Alternative approaches to a more sustainable future are those that will reduce energy usage by individuals and society by adopting options such as more sustainable land use practices, more locally based economies and efficient public transport systems. The use of renewable energy and the uptake of energy efficiency measures will still be important. All of these initiatives will be needed to contribute to a less fossil-fuel-based society and economy in the future!

Who is responsible for the adoption of these alternative approaches? There is a role here for both governments and communities, both of which will be explored in this session. The potential for individuals to bring about change is covered in the final session of the course. The role of the higher education sector, businesses and industries as agents of change has been covered in previous sessions.

Learning outcomes

By the end of this module participants should be able to:

- understand the focus on, and reasons for, urban consolidation as a government policy to improve the EE of cities
- describe alternative ways that communities are dealing with energy uncertainty in the face of peak oil and climate change
- visualise a more sustainable energy future for cities and towns
- describe how communities, governments and businesses are and can form partnerships to bring about a more sustainable energy future.

Competencies

- Analysing and organising information.
- Communicating ideas and information.
- Thinking creatively and laterally.
- Visualising.
- Applying knowledge to solve problems.
- Working with others and in teams.
Thinking reflectively.
Educating for change.

Session 12 timetable

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<th>Title</th>
<th>Time</th>
<th>Description</th>
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<tr>
<td>1</td>
<td>Role of governments</td>
<td>45 minutes</td>
<td>Discussion questions based on last week’s reading</td>
</tr>
<tr>
<td>2</td>
<td>Role of communities</td>
<td>45 minutes</td>
<td>DVDs – introduction to the Transition Town movement</td>
</tr>
<tr>
<td>3</td>
<td>Imagining communities of the future</td>
<td>45 minutes</td>
<td>Visioning exercise</td>
</tr>
<tr>
<td>4</td>
<td>Energy descent action planning</td>
<td>45 minutes</td>
<td>Group activity</td>
</tr>
</tbody>
</table>

ACTIVITY 1 (45 minutes) Role of governments

First check that students have done their homework. If not, a quick review of the below will be required:

- [http://www.bth.se/fou/cuppsats.nsf/all/5e9c65680f4e1975c12572040039ab9d/$file/15_Benny_Gerald_Pavan_-_Transitioning_to_Rural_Electrification_in_Developing_Countries.pdf](http://www.bth.se/fou/cuppsats.nsf/all/5e9c65680f4e1975c12572040039ab9d/$file/15_Benny_Gerald_Pavan_-_Transitioning_to_Rural_Electrification_in_Developing_Countries.pdf)

Transitioning towards sustainable rural electrification in developing countries: a case study of Luangwa district in Zambia is a useful example of the challenges involved in developing and implementing sustainable technologies for energy harvesting in rural, developing nations.

State and local governments are responsible for land use planning decisions which can have a major impact on the use of energy. For example, urban consolidation policies in Sydney have resulted in 70% of new residences being built in ‘brownfield’ sites (disused, old industrial areas) compared to 30% in ‘greenfield’ areas (farming areas on the fringe). This saves energy resources being used to construct new infrastructure such as roads and water pipelines. It also means that householders can live closer to work. See these websites on urban consolidation:

Questions

- Can we rely on governments to bring about a more sustainable energy future? Why/why not?
- What roles can local governments play in contributing to a more sustainable energy future for their communities?
- How can local authorities improve the integration and sustainability of the urban land use, transport and energy nexus in a strategic and comprehensive manner?
- What barriers prevent cities and regions from adopting existing best practices towards an integrated and sustainable nexus?
- How can local authorities use the Strategic Sustainable Development Framework to improve the integration and sustainability of the nexus?
- How can national and state governments support local authorities in this endeavour?
- What land use and/or transport policies could your state government introduce for a more sustainable energy future?
- How does the future energy situation in rural Africa vary from a rural area in Australia?
- Governments also have a role in working with communities and NGOs to bring about a more sustainable energy future. In what ways might they provide this support?
- Do we have the policies we need to support and reward personal action for EE eg net and gross feed-in tariffs?

ACTIVITY 2 (45 minutes) Role of communities

This activity is designed to raise the students’ awareness of the options available for communities to create their own resilient and sustainable communities in the face of peak oil and climate change.

The website http://www.transitionnetwork.org/support/publications/transition-movie shows sections from the Transition Movie which covers peak oil, the impact of fossil fuel use on climate change and associated issues - a very good introduction. The entire movie can be purchased from the website.

Other recommended resources:

- http://video.google.com/videoplay?docid=4090822098327203388#docid=-1721584909067928384 Excerpts from The power of community which explains how Cuba overcame their food crisis due to the oil embargo by developing food gardens on all unused urban land. Bicycles also replaced cars. The whole movie is worth showing if time permits.
• Transition to a world without oil. Rob Hopkins is the founder of the Transition movement, a radically hopeful and community-driven approach to creating societies independent of fossil fuel. In this lecture he reminds us that the oil our world depends on is steadily running out. He proposes a unique solution to this problem, the Transition response, where we prepare ourselves for life without oil and sacrifice our luxuries to build systems and communities that are completely independent of fossil fuels.

ACTIVITY 3 (45 minutes) Imagining communities of the future

Once the students have an understanding of the many ‘transition’ initiatives that communities can undertake and have developed their energy descent action plan, ask them to do a visioning exercise. Using a technique called backcasting, students imagine a community going about its everyday activities in more sustainable ways.

• http://www.naturalstep.org/backcasting provides a summary of the concept of ‘backcasting’ from sustainable principles - an alternative, trans-disciplinary and holistic process for planning for the future and creating positive change.
• The report ‘Enhancing planning for local energy systems by the strategic sustainable development framework’
http://www.bth.se/fou/cuppsats.nsf/all/073a06375cb779e8c125730a0046e2c9/$file/20070627_Energy_Thesis.pdf provides a case-study of the effectiveness of employing this methodology in the energy context.

It may also be useful to introduce scenario planning and to consider ways in which the two approaches might complement each other.


Ask the students to do the visioning process in silence and to write down their vision or scenario of a more sustainable community. Stress that the focus is on community activities (the process for individual actions will be covered in the final session).

You will probably need to walk students through the exercise. Get them to close their eyes and imagine, focusing on energy issues if you like. Here are some suggested questions:

• What do the new houses look like?
• Do they have solar panels?
• Are there many trees for shade?
• How are people getting to work?
• What size are the new dwellings?
• Are people happy?
• Where are they doing their shopping?
• Where do they spend their weekends, and what are they doing?
• Are there bicycle paths and walkways?
• Are there safe areas for children and community play?

Spend 15 minutes on the process and the remainder of the session in sharing visions.

**ACTIVITY 4 (45 minutes) Energy descent action planning**

This activity is best done *after* the visioning exercise.

The website [http://www.transitionnetwork.org/patterns/implementing-infrastructure/energy-descent-action-plans](http://www.transitionnetwork.org/patterns/implementing-infrastructure/energy-descent-action-plans) explains a process that was first trialled by the Transition Town Movement founder, Rob Hopkins, with a group of permaculture students in Kinsale in Ireland. It is still very much a developing process. Perhaps the most successful energy descent action plan (EDAP) is that developed by Transition Sunshine Coast as it was formulated by the group and has now been integrated into council strategies. See [http://www.transitionsunshinecoast.org/energy-decent-action-plan-sunshine-coast-queensland-australia.php](http://www.transitionsunshinecoast.org/energy-decent-action-plan-sunshine-coast-queensland-australia.php)


‘Transition in Action’ is an energy plan designed for and by a local community (Totnes and District, UK). This also provides a useful case study of how to engage the community to stimulate behavioural change towards EE, and the important role the community can have in shaping the future / changing government policy.

The activity suggested for the students is to develop an EDAP for the energy sector of the community surrounding their campus. Divide the class into groups of about four and give each a specific area of energy usage. Ask them to design a plan for ‘energy descent’ for that area, e.g. the transport group could discuss plans to encourage walking, car pooling, construct cycling paths, etc.

**Other teaching options**

• Guest speakers
• Field visit to an eco-village or a local Transition group meeting.
• Research your local climate action groups and visit their website and their meetings and events.

**Other useful resources**
• [www.livelocal.org.au](http://www.livelocal.org.au) has a large number of initiatives centred around supporting the local economy such as reducing ‘food miles’ by growing some of your own food and buying locally produced, seasonal food.

• [www.transitionsydney.org](http://www.transitionsydney.org) showcases transition initiatives in the Sydney region. They vary from working on community and verge gardens to setting up bulk-buying schemes for solar technology to running practical skills workshops.

**Preparation for session 13**

In the last session students will be asked to commit to at least ONE significant action that will save energy in their work or home. Ask students to think about this for the next session as they will be asked to do a number of activities based around their choice.
Session 13: My role in a sustainable energy future

Key topics covered in this session:

- This session is devoted to interactive group work and scribing and aims to get a commitment from the students in regard to increasing their personal EE.

Introduction

The activities in this session combine two important Education for Sustainability principles: envisioning the future and self-reflection. Although they may seem unusual and quite different to previous activities in the course, they should be engaging for the students as they revolve around their own personal agendas and should tap into their need to empower themselves in the face of irreversible detrimental changes in the state of the world in the future, unless we all take some degree of personal responsibility in changing our behaviour for the sake of our own and future generations.

Learning outcomes

By the end of this module participants should be able to:

- demonstrate their understanding of the complexities of the issues surrounding EE across all sectors
- demonstrate or commit to personal behaviour change towards EE
- understand the obstacles faced by individuals and communities in bringing about a more EE future and the potential importance of their role
- engender hope in others that a more sustainable energy future is possible.

Competencies

- Communicating ideas and information.
- Thinking creatively and laterally.
- Working with self and others for change.
- Thinking reflectively.
- Visualising.
- Acting for change.

Session 13 timetable

<table>
<thead>
<tr>
<th>Activity</th>
<th>Title</th>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course review</td>
<td>30 minutes</td>
<td>Class discussion</td>
</tr>
<tr>
<td></td>
<td>Activity</td>
<td>Duration</td>
<td>Task</td>
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<td>---</td>
<td>--------------------------------------------</td>
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</tr>
<tr>
<td>2</td>
<td>Imagining and planning for the future</td>
<td>45 minutes</td>
<td>Written exercise</td>
</tr>
<tr>
<td>3</td>
<td>Overcoming obstacles</td>
<td>45 minutes</td>
<td>Work in pairs</td>
</tr>
<tr>
<td>4</td>
<td>Going forth</td>
<td>45 minutes</td>
<td>Work in groups of 3</td>
</tr>
<tr>
<td>5</td>
<td>Course evaluation</td>
<td>15 minutes</td>
<td>Worksheet</td>
</tr>
</tbody>
</table>

**ACTIVITY 1 (30 minutes) Course review**

Hold a class discussion about what the students have learnt from the course and list important things they have learnt on the whiteboard. Explain that the focus of the session today is about their personal action towards EE in the workplace, at home and in their communities. It could be that students have already taken action as a result of knowledge gained throughout the course. If not, the activities should empower them on a personal level to use less energy and thus contribute to a more sustainable future. Suggestions of personal actions should be listed on the whiteboard; examples could include using their car less often, turning off standby appliances at night, taking advantage of government rebates, etc.

You may find it useful to get people to frame their ideas in terms of:

- What can I do now (0-1 year)?
- What can I do in the medium term (1-5 years)?
- What can I do in the long term (over 5 years)?
- What can I Influence?

Particularly with students, who may have limited funds and live in rented accommodation, this helps to look forward to when they may be making major decisions in their lives.

**ACTIVITY 2 (45 minutes) Imagining and planning for the future**

This activity builds on Activity 1 and also on the backcasting exercise done in the previous session for communities. The focus here is on *individual actions for energy sustainability*.

See: [http://www.naturalstep.org/backcasting](http://www.naturalstep.org/backcasting)

Ask the students to do the visioning process in silence and to write down their vision.
An alternative approach would be to walk the students through their various daily activities in a more sustainable society powered by 100% renewable energy. What differences are there compared to today? How do they feel? What forms of transport are being used? What type of houses do they live in?

Spend 15 minutes on the process and the remainder of the session in sharing visions.

**ACTIVITY 3 (45 minutes) Overcoming obstacles**

Having determined that there are indeed many ways to contribute to EE on a personal level, students choose ONE behaviour change that they commit to implementing after today. If they have already taken personal action on EE then ask them to choose an additional action. Once they have chosen their action, ask them to form pairs with someone in the class they don’t know very well or someone they haven’t worked with before. Each person now tells their partner what they plan to do and discusses any obstacles they may encounter for 5 minutes. The partner writes down both the action and the obstacles - this is a record for the speaker and is a powerful way to obtain commitment. An ‘action’ could be riding a bicycle more often, and ‘obstacles’ could include the extra time taken to get places, finding somewhere to park it, the effort required in using it, maintaining it (money and time), safety concerns. Include a set of key criteria for successful behaviour change programs as a starting point for your plans.

Now the roles are reversed for a second five minutes.

The class then comes together. As the exercise is about empowerment, for the next 10 minutes each student reads out their obstacles only, in turn, and then tears them up. It is interesting to note that one person’s obstacles could be another person’s incentive to change, e.g. to use the bicycle example again, the effort required in riding the bike. i.e. the exercise, could either be an incentive or an obstacle depending on the person’s attitude. You could make this part of the exercise optional.

**ACTIVITY 4 (45 minutes) Progressing your action plan**

This activity consolidates the previous three activities and should empower the students to play their role in a more sustainable society, and indeed to initiate change.

The activity is done in groups of three students. It focuses on deepening the students’ commitment to their actions described above and provides them with an intergenerational perspective on the importance of their role for the future of the planet. It also draws on the ‘wisdom of the elders’ or the voice of experience. Here is the process:

1. The students sit together in groups of three, not with their partner from the previous activity.
2. Each person silently reflects on the EE action decided on in the last activity.
3. Decide on Person A. The first round begins as Person A shares their action with the others, what it will involve, obstacles, etc. (2 minutes Note: the
teacher will need to keep time and tell the groups when each person’s time is up). The other participants listen attentively without comment.

4. The others in the group now have opportunities to respond, one by one, to A’s offering, while everyone else listens without comment. First, the person on A’s left speaks as the voice of Ancestor, sharing a perspective that arises from hearing what Person A will be offering. (2 minutes)

5. Now, the person on A’s right responds as a Future Being, sharing a future perspective upon hearing how person A will be contributing to a better future. (2 minutes)

6. Finally, person A has an opportunity to reflect aloud on what they’ve heard, inviting verbal response from others in the group if they wish. (2 minutes)

7. The role of Person A moves around the circle, with the same sequence of responses.

8. Upon completion of the 4th round, allow a few minutes for circle members to share with each other.

**ACTIVITY 5 (15 minutes) Course evaluation**

It is likely that you will have an evaluation form that you need to use for your courses to evaluate the experience of individual students. It can be useful to supplement this with a small group exercise in which students respond to the following questions in groups:

1. What did you learn in this course that really surprised you?
2. What did you learn about how to change yourself and the rest of the planet?
3. What was the most inspiring aspect of the course for you?
4. If you could include three additional topics what would they be?
5. What suggestions do you have that would improve this course for future students?
### Additional resources

**1) Session 3, Activity 2**

**Behaviour-change questionnaire**

Recall a discrete, voluntary change you have made in your life over the past 12 months. It could be due to a social marketing campaign or a significant interaction with a friend or through a family event. Spend a few minutes thinking quietly about your feelings and thoughts associated with the old and new behaviours as well as your memories about that time of change. Now write down your recollections in the spaces below.

- What was the change?
- What feelings were associated with the old behaviour?
- What stories and inner narratives were used to justify the old behaviour?
- What triggered the change?
- What knowledge, skills, ideas, services helped make the change possible?
- How do you feel about the change now?
- Has your change involved sustained feelings of satisfaction?

**2) Session 5, Activity 2**

**Newspaper articles**

**How the emissions trading system works**

October 18, 2009

THE trading system aims to reduce greenhouse gases released into the atmosphere by putting a limit on emissions.

Within this cap, 1000 of the nation’s biggest polluters will have to buy permits for each tonne of emissions they produce.

The costs will be passed on to consumers and companies can trade unwanted permits.

These are designed to act as incentives to reduce emissions.
The carbon price - the cost of each permit - will depend on the level of emissions allowed.

**Under the Federal Government's model:**

- Heaviest polluters get compensation at scheme's start, but it will be wound back later

Limited assistance for coal-fired power stations

- Agriculture excluded until 2015

- Transport costs offset by reducing petrol excise

**Under the Opposition's model: Agriculture permanently excluded**

- Compensation for food producers such as milk- and meat-processing plants

- More compensation for heavy polluting industries such as aluminium

- More compensation for coal companies if they agree to reduce emissions

**Ad campaign aims to crush emissions trading plan**

*Marian Wilkinson, Ben Cubby and Flint Duxfield*

November 7, 2009

SENIOR executives from the world's biggest coal companies unanimously agreed to back the multimillion-dollar advertising campaign running in rural NSW and Queensland attacking the Rudd Government's emissions trading scheme.

"It was ticked off by our board of directors, more than ticked off. It was enthusiastically endorsed," said Ralph Hillman, of the industry's main lobby group, the Australian Coal Association. The campaign entitled, “Let’s cut emissions, not jobs”, will run until the Senate votes on the emissions trading scheme later this month.

The group has have employed experts from the leading political consulting firm, Crosby Textor, which worked for the Liberal Party, and Neil Lawrence who worked on Labor's successful Kevin '07 campaign. The campaign is just one of the hundreds of lobbying efforts around the world by companies to soften the impact of domestic laws. These efforts are slowing progress on an international agreement at the Copenhagen climate talks next month.

*A Sydney Morning Herald* analysis of the lobbying registers around Australia has established that 120 companies with significant greenhouse emissions employ about 80 lobbying firms. This is in addition to the companies' own in-house lobbyists. Tracking the lobbying effort, however, is difficult because the federal lobby register relies on a trust system, with lobbyists able to remove themselves from the lists by request.
Many of the biggest emitting companies, either through their executives, lobbyists or industry lobbies, have got assistance and exemptions from the emissions trading scheme. The Government assistance to 20 major companies is already estimated at more than $11.7 billion, according to a study by the corporate consultant RiskMetrics, commissioned by the Australian Conservation Foundation.

Most lobbyists contacted by the Herald were reluctant to talk but some agreed that the Government was lending a willing ear to their arguments. The lobbyists have helped to secure unpublicised meetings with Government and Opposition MPs, generally with the aim of extracting concessions.

“It's fair to say that most of the big companies would be very happy with the contact they've had with ministers,” said one lobbyist working for one of the largest greenhouse gas emitters.

“Most big firms work on the strategy side of things themselves - what they need from us is access. They have batteries of lawyers and economists working for them to sort out the strategy and details. Our advice is who they need to talk to ... It hasn't been that hard to get access.”

The Herald collaborated in a global report on the climate lobby with the International Consortium of Investigative Journalists across eight countries in the lead up to the Copenhagen talks.

The report covers Australia, the US, China, Brazil and the European Union, and found that big emitters are exerting heavy pressure on domestic governments in developed and developing countries, to weaken laws at home, impeding the chances of a successful international climate agreement in Copenhagen.

Carbon price 'inefficient' without extra measures, say Greens

Lenore Taylor
November 4, 2010

The Greens have rejected a call by an expert adviser to the cross-party climate committee that expensive greenhouse programs such as solar feed-in tariffs be phased out after a carbon price comes into effect.

The chairman of the NSW Independent Pricing and Regulatory Tribunal, Rod Sims, told the Herald this week a carbon price should allow federal and state governments to phase out more expensive greenhouse gas abatement programs such as solar feed-in tariffs and even the renewable energy target, taking some pressure off household power prices.

But the Greens senator Christine Milne, who sits with Mr Sims on the climate committee, says the other programs are also needed to overcome "non price barriers". "[Mr Sims] is unfortunately still promoting an economic line that does not recognise market failures or how the real world actually works ... a carbon price on its own does not work as effectively and efficiently ... as a price coupled with other policies for industry development," Senator Milne said.
The Climate Change Minister, Greg Combet, said his main aim was to get a carbon price through the Parliament.

"A carbon price is the most efficient way of reducing emissions, if we get it through then we can have a look at the whole suite of measures and look at which are the most efficient," he said.

Mr Sims argued that without a carbon price electricity prices would rise anyway, because the uncertainty would force generators to invest in less-efficient open-cycle gas plants to deliver power during times of peak demand rather than cheaper and more efficient baseload gas-fired plants.

The opposition climate change spokesman, Greg Hunt, said the argument was absurd.

“The purpose of the Gillard electricity tax is precisely to increase electricity prices - it is designed to force pensioners and others to have doubts about whether to use a heater in winter or a cooler in summer … Now [the Prime Minister] is running the absurd argument that increasing electricity prices will decrease electricity prices - a little like in order to save the village we had to destroy it,” he said.

He pointed to Santos plans to invest in the Shaw River gas-fired power station in western Victoria.

The cross-party climate committee - formed to try to bridge the divide between Labor and the Greens that sank the Rudd government’s emissions trading scheme - will hold its second meeting next Wednesday. It is considering all options to put a price on carbon, including a carbon tax or an emissions trading scheme with an initially fixed price while international talks on climate continue.

The committee will also recommend whether a price should apply across the economy or just to the electricity sector. It will report to a special cabinet subcommittee by the end of next year.

**Climate change net catches 38 big fish**

*Phillip Coorey*

*October 18, 2010*

The government has co-opted almost 40 union leaders, business, mining and industry executives, as well as environment groups and charitable organisations, to advise it on climate change policy.

The full list, published yesterday, underscores the government’s strategy of spreading as far as possible ownership of the policy to put a price on carbon, which is now likely to be decided late next year.

While the policy will be devised by the parliamentary Multi-Party Climate Change Committee, comprising Labor, the Greens and independents, the government will take advice from two roundtables.
As reported in the *Herald* recently, the business roundtable will include executives from mining giants such as BHP Billiton, Rio Tinto and Woodside Petroleum, as well as the National Australia Bank.

The full list of 18 includes the chief executive of Qantas, Alan Joyce, the head of Woolworths, Michael Luscombe, and the chairman of Shell Australia, Anne Pickard.

The second roundtable of non-government organisations has 20 members, ranging from Don Henry, head of the Australian Conservation Foundation, to the ACTU president, Ged Kearney, one of five union leaders, Tim Costello of World Vision and Tim Flannery, representing the Coast and Climate Change Council.

Like the Climate Change Committee, the roundtables will meet once a month until the end of next year with the aim of developing support among their constituencies. The NGO roundtable will advise on compensation needed for households and on jobs that could be created.

The business roundtable will advise on business and economic impacts.

Since the Senate twice defeated the emissions trading scheme and deferred it during the last term, the Gillard government has been determined to build a wide consensus before legislating. It has left open the options of an emissions trading scheme, a carbon tax and a hybrid.

Under a yet-to-be-declared strategy, the government aims to have a policy operational by mid 2012, well before the next election, due in mid to late 2013. The plan is that people will become accustomed to the scheme, as they did the GST, and there will be little desire to revoke it come the election.

By enlisting the services of so many third parties, the government also plans to isolate the Opposition Leader, Tony Abbott, who again yesterday was railing against a carbon price as an impost on the cost of living.

*Everything's on the table ... except an agreement*

October 8, 2010
Julia Gillard and Bob Brown announce the new multi-party climate change committee. *Photo: Andrew Meares*

When Labor and the Greens say the new climate committee will consider “all options” they really mean all options except one. The one option off the table is an emissions trading scheme, at least one implemented straight away.

The tacit understanding between Labor and the Greens is that they can’t agree on emission reduction targets - the Greens think Labor’s minimum target of 5 per cent by 2020 is negligently inadequate and Labor thinks the Greens’ proposed minimum target of 25 per cent would be political suicide.

This gulf proved unbridgeable in negotiations between the two parties on Kevin Rudd’s emissions trading scheme, because an ETS “locks in” the target it is designed to meet. The whole idea of an ETS is to vary the carbon price to make sure it hits the specified goal.

It was to bridge this gulf that the Greens moved in January to support Ross Garnaut’s proposal for an interim carbon tax - because a tax can start the mammoth job of reducing emissions without enshrining the final target in its design.

And that means the vexed question about targets can be argued out later, when a global agreement is closer, or when voters realise a carbon price won’t make the sky fall in.

The same agreement-to-disagree will be the basis of the climate committee’s debate, given that Climate Minister Greg Combet has said Australia’s emission reduction targets are “not on the table” and the Greens’ Christine Milne has been clear Labor’s targets will never be acceptable to her.

That still leaves plenty of options - a carbon tax, or a temporary carbon tax before an emissions trading scheme applying to the whole economy, or maybe just to the electricity sector.

Meantime, the government could implement some energy-efficiency measures in a report it will finally release today, which cabinet baulked at before the election because it feared they would play into the Coalition’s scare campaign about power prices.

Labor is now spinning the report as “bolstering the case for a carbon price” because in among its substantive points it also states the bleeding obvious - we can't create a low carbon economy just by being more efficient and using less electricity, we also need a carbon price to force changes to the way we generate it.

The energy efficiency measures were always supposed to be add-ons to a carbon price - but they are smart and cheap add-ons. In fact modelling in the report shows households could have been better off because any electricity price rises would be more than offset by reduced energy use.

Even so, Labor was too scared to announce them, instead opting for the “cash for clunkers” scheme, which reduces emissions at a cost of hundreds of dollars per
tonne of carbon saved, as opposed to $20 or $30 under a possible carbon price, or even less for most energy efficiency measures.

At least the daft citizen’s assembly idea has now been formally ditched.

Whatever compromise carbon pricing model the new climate committee goes for, it couldn’t get less logical than the main parties’ policies so far.

**Australia lags trading nations on carbon price**

*Lenore Taylor NATIONAL AFFAIRS CORRESPONDENT*  
October 19, 2010

CHINESE power generators face what is in effect a carbon price eight times higher than Australian producers, and British companies pay 17 times more, according to a world-first study that challenges the argument a carbon price would penalise Australian industry while international competitors continue to pollute without penalty.

The analysis, which calculated the total cost of taxes, regulations and subsidies to reduce CO2 emissions in six countries, found Australia was lagging rather than “leading the world” on a carbon price. On an international comparison, Australian electricity producers face extremely low charges.

Australia’s renewable energy target and various state government policies add up to what, in effect, is a carbon tax on electricity producers of $1.68 per tonne of emissions. That compares with a cost of $29.31 in Britain, $14.22 in China, $9.52 through the emissions trading scheme in the north-eastern states of the US, $5.05 in other US states, and $3.11 in Japan, the study found. Only South Korean power producers enjoy a lower carbon price than Australia, at 72¢ per tonne.

The work, by Vivid Economics in Britain, is similar to analysis that will be conducted for the multi-party climate committee set up to find a carbon pricing scheme that can pass the federal parliament this term.

The conclusions could be critical to the horse-trading over assistance to trade-exposed Australian industries under a new carbon price.

The climate committee member Professor Ross Garnaut argues Australian companies should be compensated only for costs in excess of those borne by international competitors.

Some members of a business committee appointed to advise the Gillard government on a climate policy immediately said they would be making the case against a carbon price that would disadvantage Australian industry.

Peter Anderson, a committee member and chief of the Australian Chamber of Commerce and Industry, said he wanted to “present the case against a pre-emptive move to carbon pricing, which will damage our competitiveness, and also put the views of the hundreds of thousands of mainstream businesses … who were ignored during the development of the earlier carbon pollution reduction scheme.”
But other business leaders, including the chief executive of BHP Billiton, Marius Kloppers, and electricity industry chief executives, have called for a speedy end to the political impasse on a carbon price so they can have investment certainty.

The emissions trading scheme defeated in Parliament last year envisaged a fixed carbon price for the first year of $10 per tonne, and the hybrid model suggested by the Greens in January proposed an interim carbon tax starting at $23 per tonne.

The Vivid analysis, commissioned by The Climate Institute, took into account policies implemented by 2009, leaving out proposals for emissions trading in Japan and South Korea and stricter rules being imposed in China.

China is cutting emissions in part through government edicts to shut down the highest emitting power stations. Most of Britain's costs come from its participation in the European Union emissions trading scheme as well as a mandatory target for renewable energy. Japan has a voluntary emissions scheme and a tax on coal use.

The argument that Australia is considering “going it alone” on a carbon price flared during an estimates hearing yesterday.

The Nationals' Senator Ron Boswell said: "The one thing that is indisputable is that for Australia to go ahead alone is going to achieve absolutely nothing."

The secretary of the Climate Change Department, Dr Martin Parkinson, replied "the presumption that no one else is acting is a peculiarly Australian perspective ... it is absolutely nonsense to say no one else is acting."

**Big business backs push to cut carbon**

*Lenore Taylor, NATIONAL AFFAIRS CORRESPONDENT  September 17, 2010*

INDUSTRY groups are backing BHP's push for rapid action to put a price on carbon emissions as the Prime Minister, Julia Gillard, has indicated Labor is no longer insisting on an emissions trading scheme and is now prepared to consider a direct carbon tax.

Big business has been quick to “deal itself in” to the complex climate policy negotiations in the unwieldy minority government, with the electricity generation industry joining the Business Council of Australia and BHP's chief executive, Marius Kloppers, to demand a resolution to Australia's political impasse on carbon pricing.

The Minerals Council of Australia has also called for a "clear, predictable and long-term price signal on carbon" and will take part in the cross-party climate change policy process.
3) Session 10

ENERGY EFFICIENCY IN IT - Worksheets
(A copy of the presentation slides is shown at the end of this document.)

Worksheet 10.1: Measuring Power Consumption of a Desktop Computer

Equipment

- A mains extension lead
- Power-meter
- 4way power board
- Desktop computer running Windows 7 with an administrator account.
- Flat screen

When you are taking power measurements, the meter will most likely not give a steady reading, the power is often varying quite a bit. Watch the reading for a few seconds then try to estimate an average or most common reading.

Setup

- Plug the extension lead into a power point
- Plug the watt-meter into the extension lead
- Plug the power board into the watt-meter
- Plug the computer and the monitor into the power board

Measuring Standby Power

Temporarily disconnect the monitor and computer from the watt-meter.

Turn on the power to the watt-meter.

Use the controls on the watt-meter so that it reading power (watts)

Note the power being used (no load power). It should be very close to zero.

Plug in the computer (powered off). Measure the power (computer off)

Unplug the computer and plug in the monitor (powered off). Measure the power (monitor off)

Turn the monitor on (standby). Measure the power (monitor standby)
Plug the computer in again. Measure the power (both standby)

<table>
<thead>
<tr>
<th>Device</th>
<th>Power (Watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer only, powered off</td>
<td></td>
</tr>
<tr>
<td>Monitor only, powered off</td>
<td></td>
</tr>
<tr>
<td>Monitor only, standby</td>
<td></td>
</tr>
<tr>
<td>Computer (off) + Monitor (standby) (A)</td>
<td></td>
</tr>
</tbody>
</table>

Create a new Power Profile

Turn on your computer running Windows 7.

Time how long it takes the computer to boot to the login screen.

Also watch the power meter as it starts up. Write down the peak power while the computer starts. (Not a particularly useful measurement as it only happens for a few seconds)

<table>
<thead>
<tr>
<th>Boot up time - cold boot (seconds)</th>
</tr>
</thead>
</table>

Computer + Monitor                  Power (Watts)

Computer starting, display on (Peak)

Login as an administrator to Windows7. Open Control Panel and click View | Small Icons.

Browse the list and locate Power Options.

Click Power Options and open Create Power Plan.

Now we will create a new, but unrealistic, power plan. The times are too short for real situations nut allow us to make our measurements without too much delay.

Click on Balanced mode as a starting point.

Type in a name of greenIT then click Next
Use the settings shown in the next picture: (Display: 2 minutes, Sleep: 5 minutes)
Click **Create** when finished.

When back in main Power Plan window, check that your new plan is selected.

Close the power management window.

Next, we will do some more power measurements.

**More Power Measurements**

With your new power plan activated do the following power measurements:

<table>
<thead>
<tr>
<th>Computer + Monitor</th>
<th>Power (Watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer running (idle), display on (B)</td>
<td></td>
</tr>
<tr>
<td>Program starting*</td>
<td></td>
</tr>
</tbody>
</table>

* Start a big program (for example a word processor or a browser) and note the peak power (which will be due mainly to hard disk activity).

Now do not touch the keyboard or mouse for about 2 minutes until the screen off mode initiates, wait for all hard disk activity to stop.

<table>
<thead>
<tr>
<th>Computer + Monitor</th>
<th>Power (Watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer running (idle), display off (C)</td>
<td></td>
</tr>
</tbody>
</table>

Wait another three minutes for the computer to go to sleep. Again, wait until all hard disk activity ceases,

<table>
<thead>
<tr>
<th>Computer + Monitor</th>
<th>Power (Watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep (D)</td>
<td></td>
</tr>
</tbody>
</table>

Wake up your computer. Time how long it takes to reach the login screen.

| Wake up time (seconds)                      |               |
| Clod boot time (seconds) from Page 2        |               |
Conclusions

Bring all the results together by copying some of the earlier results here:

<table>
<thead>
<tr>
<th>Computer + Monitor</th>
<th>Power (Watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer (off), Monitor, standby (A)</td>
<td></td>
</tr>
<tr>
<td>Computer running (idle), display on (B)</td>
<td></td>
</tr>
<tr>
<td>Computer running (idle), display off (C)</td>
<td></td>
</tr>
<tr>
<td>Sleep (D)</td>
<td></td>
</tr>
</tbody>
</table>

Before we start the calculations we need to find out how much energy costs.

Go to the web site of your local supply authority and find out how much they charge for one kilowatt-hour (kWh).

<table>
<thead>
<tr>
<th>Supply Authority Name</th>
<th>Cost per kWh ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hint: If you don't want to do this calculation manually as shown below, we have provided a spread sheet to do it for you. See powercalc.xls on Moodle

Now we will calculate the energy used by a computer left on for 24 hours per day, 7 days per week and compare that with a computer that is actually used for 6 hours per day and is in sleep mode for the rest of the week.

Here is a sample calculation. Ask your teacher for help if you are stuck.

Assume the power is 90W. In 7 days the total energy is:

\[
\frac{(90 \times 24 \times 7)}{1000} = 15.2\text{kWh in one week. At }$0.20\text{ per kWh, it would cost }$3\text{ per week.}
\]

Next, we will calculate how much energy this device uses running 5 hours for 5 days:

\[
\frac{(90 \times 5 \times 5)}{1000} = 2.25\text{kWh in one week}
\]

Add to this the sleep energy. For this calculation let us assume 10W. That means for 5 days per week the device is asleep for 19 hours and for 2 days (weekend) it is asleep for 24 hours.

\[
\frac{(10 \times 19 \times 5)}{1000} + \frac{(10 \times 24 \times 2)}{1000} = 1.43\text{kWh in one week}
\]

Adding the last two figures together we get about 3.7kWh per week for a device that has sleep mode activated. At $0.20 per kWh it would cost less than $0.80 per week.
Now for your calculations:

<table>
<thead>
<tr>
<th>Computer running, 24 hours</th>
<th>Total energy per week (kWh) (M)</th>
<th>Cost per week ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(B x 24 x 7) / 1000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Computer running 5 hours</th>
<th>Plus computer in sleep mode</th>
<th>Total energy per week (kWh) (N)</th>
<th>Cost per week ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(B x 5 x 5) / 1000</td>
<td>[(D x 19 x 5) + (D x 24 x 2)] / 1000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Now compare yearly totals for a fleet of 1000 computers.

Multiply your weekly totals above by 52 x1000

For my sample calculation:

<table>
<thead>
<tr>
<th>kWh/yr</th>
<th>Annual cost ($)</th>
<th>Carbon dioxide emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always on (15.2 x 52 x 1000)</td>
<td>790400</td>
<td>158080</td>
</tr>
<tr>
<td>Sleep mode (3.7 x 52 x 1000)</td>
<td>192400</td>
<td>38480</td>
</tr>
</tbody>
</table>

Now your turn:

<table>
<thead>
<tr>
<th>kWh/yr</th>
<th>Annual cost ($)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Always on (M x 52 x 1000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleep mode (N x 52 x 1000)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To calculate the carbon emissions use 1kg of carbon dioxide per kWh for a coal fired power station.

Other Devices

Use the watt meter to measure the power for other devices eg printers, switches, modems, routers

<table>
<thead>
<tr>
<th>Device</th>
<th>Power (Watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Worksheet 10.2

Measuring Power Consumption of a Laptop Computer

1. **Equipment**
   - A mains extension lead
   - Power-meter
   - 4way power board
   - Laptop running Windows 7 with an administrator account.
   - Note: make sure the laptop battery is fully charged before commencing this exercise

When you are taking power measurements, the meter will most likely not give a steady reading, the power is often varying quite a bit. Watch the reading for a few seconds then try to estimate an average or most common reading.

4. **Setup**
   - Plug the extension lead into a power point
   - Plug the watt-meter into the extension lead
   - Plug the computer into the power meter

5. **Measuring Standby Power**
   - Turn on the power to the watt-meter.
   - Use the controls on the watt-meter so that it reading power (watts)
   - Plug in the laptop (powered off). Measure the power (power off)

<table>
<thead>
<tr>
<th>Device</th>
<th>Power (Watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laptop, powered off (A)</td>
<td></td>
</tr>
</tbody>
</table>

6. **Create a new Power Profile**

Turn on your computer running Windows 7.

Time how long it takes the computer to boot to the login screen.

Also watch the power meter as it starts up. Write down the peak power while the computer starts. (Not a particularly useful measurement as it only happens for a few seconds)

| Boot up time - cold boot (seconds) |               |
Login as an administrator to Windows7. Open Control Panel and click View | Small Icons.

Browse the list and locate Power Options.

Write down the name of the current power saving plan:

We will need to know this to restore the laptop back to its original state.

Click Power Options and open Create Power Plan.

Now we will create a new, but unrealistic, power plan. The times are too short for real situations but allow us to make our measurements without too much delay.

Type in a name of greenIT then click Next

Use the settings shown in the next picture: (Display:2 minutes, Sleep: 5 minutes)

Click Create when finished.

When back in main Power Plan window, check that your new plan is selected. Close the power management window.

Next, we will do some more power measurements.

7. More Power Measurements

With your new power plan activated do the following power measurements:

<table>
<thead>
<tr>
<th>Laptop</th>
<th>Power (Watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer running (idle), display on (B)</td>
<td></td>
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<tr>
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* Start a big program (for example a word processor or a browser) and note the peak power (which will be due mainly to hard disk activity).

Now do not touch the keyboard or mouse for about 2 minutes until the screen off mode initiates, wait for all hard disk activity to stop
Wait another three minutes for the computer to go to sleep. Again, wait until all hard disk activity ceases.

**Laptop** | **Power (Watts)**
---|---
Sleep (D) |  

Wake up your computer. Time how long it takes to reach the login screen.

| **Wake up time (seconds)** |  |
| **Cold boot time (seconds) from Page 2** |  |

8. **Conclusions**

Bring all the results together by copying some of the earlier results here:

**Computer + Monitor** | **Power (Watts)**
---|---
Laptop off (A) |  
Laptop running (idle), display on (B) |  
Laptop running (idle), display off (C) |  
Sleep (D) |  

Before we start the calculations we need to find out how much energy costs.

Go to the web site of your local supply authority and find out how much they charge for one kilowatt-hour (kWh).

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Now we will calculate the energy used by a computer left on for 24 hours per day, 7 days per week and compare that with a computer that is actually used for 6 hours per day and is in sleep mode for the rest of the week.
Here is a sample calculation. Ask your teacher for help if you are stuck.

Assume the power is 90W. In 7 days the total energy is:

\[(90 \times 24 \times 7)/1000 = 15.2\text{kWh in one week. At $0.20 per kWh, it would cost $3 per week.}\]

Next, we will calculate how much energy this device uses running 5 hours for 5 days:

\[(90 \times 5 \times 5)/1000 = 2.25\text{kWh in one week}\]

Add to this the sleep energy. For this calculation let us assume 10W. That means for 5 days per week the device is asleep for 19 hours and for 2 days (weekend) it is asleep for 24 hours.

\[(10 \times 19 \times 5)/1000 + (10 \times 24 \times 2)/1000 = 1.43\text{kWh in one week}\]

Adding the last two figures together we get about 3.7kWh per week for a device that has sleep mode activated. At $0.20 per kWh it would cost less than $0.80 per week.

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<td>[[(D \times 19 \times 5) + (D \times 24 \times 2)]/1000</td>
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<td></td>
</tr>
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Now compare yearly totals for a fleet of 1000 computers.

Multiply your weekly totals above by 52 x1000

For my sample calculation:

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<th>kWh/yr</th>
<th>Annual cost ($)</th>
<th>Carbon dioxide emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Always on</strong> ((15.2 \times 52 \times 1000))</td>
<td>790400</td>
<td>158080</td>
<td>790400kg = 790 tonnes</td>
</tr>
<tr>
<td><strong>Sleep mode</strong> ((3.7 \times 52 \times 1000))</td>
<td>192400</td>
<td>38480</td>
<td>192400kg = 192 tonnes</td>
</tr>
</tbody>
</table>

Now your turn:

<table>
<thead>
<tr>
<th></th>
<th>kWh/yr</th>
<th>Annual cost ($)</th>
<th>Carbon dioxide emissions</th>
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<tbody>
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To calculate the carbon emissions use 1kg of carbon dioxide per kWh for a coal fired power station.

9. Other Devices

Use the watt meter to measure the power for other devices eg printers, switches, modems, routers

<table>
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<tr>
<th>Device</th>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Worksheet 10.3

Use Energy Star Website to calculate Energy Usage

Review questions:
What is the effect of turning off Power Management on energy consumption (no air con)?

What is the effect of air conditioning for 12 months on energy consumption (energy save)?

Based on energy consumption, what type of computer would you recommend?

Review questions
Based on the total cost over 4 years, make a recommendation re purchase of a laptop vs workstation.

Calculate the baseline costs for 1000 units of your recommendation above.

What other factors need to be included to calculate a realistic TCO for your recommendation?
4) Session 11, other teaching option

Article from *The Australian* plus comments

Export coal: our power gift to Asia

*The Australian 5 November 2010*

SOUTH Korea and Taiwan are managing to produce cheaper power than Australia, even though they have to ship the Australian coal that fires their furnaces.

In self-sufficient Australia, households are paying one-third more for electricity than those in Taiwan and South Korea - two of the biggest buyers of Australian coal.

Residential power prices in Australia have surged 12.4 per cent in the past year, four times the rate of inflation.

Australia is now paying more for power than some of the countries to which it ships its coal, who also happen to be trade competitors.

Local households paid 14.3c for every kilowatt hour of residential power, while Asian households paid 10.6c, based on the most recent 2008 data provided by the Australian Bureau of Agricultural and Resource Economics.

Industrialists yesterday declared that Australia’s surging power prices could rob the manufacturing and mining sectors of their competitive edge.

Have your say

Comments on this story

- **John of Perth** Posted at 12:20 AM Today

  That would be right, would not expect anything else. You name it fuel, food, flights, power, banks everything is a rip-off in this place.

  Comment 1 of 71

- **peter connell of mortdale** Posted at 12:59 AM Today

  Its even worse. Many or most stations are built on the coalfields. There is almost zero shipping involved. Only OZ would shoot itself in the foot like this. Our competitors must think its a hoot.

  Comment 2 of 71

- **streetwise of NSW** Posted at 1:05 AM Today
Labor and the Greens are sending us down the shaft. A future carbon tax for what? OK to ship it out for others to prosper while we self destruct. Complete madness driven by socialist ideology. How long does Australia have to suffer these fools who proclaim that Co2 emission is the substantial cause of global warming?

Comment 3 of 71

- **Gary of Erskineville Posted at 1:25 AM Today**

  It seems that none of our managers of essential services know how to run a simple budget. Whatever the scale, equipment needs maintenance and regular replacement. Is it too hard for them to figure the price to charge to cover that? It really has the appearance that they've been pocketting the profits and now they're blackmailing us to fill their black hole.

Comment 4 of 71

- **The Ref of Singapore Posted at 2:50 AM Today**

  While I think Aus pays too much for electricity - particularly after deregulation was supposed to cut costs - the article is misleading. "Mr Freund said Australia had not built any new coal-fired power stations for two decades" was not corrected in that Kogan Creek power station, near Dalby, was opened in 2007.

Comment 5 of 71

- **Colin Bradley Posted at 3:36 AM Today**

  It would seem that the problem is, that as a consequence of having privatised electricity, profits go to shareholders at the expense of investment.

Comment 6 of 71

- **Realist of Earth Posted at 3:58 AM Today**

  Here in S.A. the government ALLOWS the electricity companies to not give any rebate or deduction off of your electricity bill even though your putting back power into the grid with your solar panels. Despite it being law, they hunted and found a loop hole and rann has done nothing to change it. So they simply steal what you put back into the grid and charge someone else for it ( top rate no doubt )

Comment 7 of 71

- **Van M Pray of Las Vegas NV Posted at 6:13 AM Today**

  Export coal: our power gift to Asia I believe you sell it at market value, not gift.

Comment 8 of 71
• **Gavin Stevens Posted at 6:15 AM Today**

Could I respectfully suggest Wayne & Julia put the big 4 banks on hold and tackle the massive electricity increases. Yes, the bank situation affects quite a few people, but the cost of electrical power affects ALL the people. I don't know where the writer of this article got their 12.4% increase from. My last bill went from $474 to $800! That's 69%! With reference to competitiveness, aren't we on the borderline now? Add the increase in the value of the Australian dollar and I think you will find we are not competitive in any field. This means we are headed for increases in unemployment.

Comment 9 of 71

• **Ronald Kitching of Frenchville. 4701. Posted at 6:20 AM Today**

On 16th June 1924 General Sir John Monash, Chairman of SEC and designer of Victoria's first brown coal powered power house delivered Australia's cheapest and cleanest power to Melbourne. Often referred to as "dirty brown coal", by the green and some of the press, the brown coal contains about 62% water, an ash content of about 2% and a sulphur content that is measured as a trace element only. The emissions contain no pollutants, they are steam and carbon dioxide. The anti-industrial Greens leader, Bob Brown says that the Yallourn Valley power houses are an environmental abomination and all coal driven power houses should be closed by 2020 or sooner. Deputy Green Leader, Christine Milne on ABC TV, assured the Nation that "....We want to see a carbon price as quickly as possible, because we want transformation of the whole economy and society." The Labor/Green coalition is by their own admissions anti-industrial and anti-productive occupiers of the Canberra Kremlin. The great industrial benefactors from the past would be aghast at this job destroying turn of political events.

Comment 10 of 71

• **Mr Loyd Posted at 6:52 AM Today**

The thing is that these countries do not have the greed that Australia has with its executives. The politicians are terminated. permanently. And more importantly is that the CEO’S do not get 5-10 million dollars a year in compensation and feel that it is justly deserved for doing a job. Taiwan and Korea are manufacturers of industry. Australia is a net importer of food as it appears to be too expensive to grow and manufacturer it because of greed due to the extreme high cost of actually doing anything.

Comment 11 of 71

• **TheDawg Posted at 6:52 AM Today**

Nothing new here, except one thing - I pay 22c pkw peak, 16c off peak. Having lived in Tokyo for more than ten years its a shock returning back to Australia. It isn't just the electricity prices that are higher. A range of Australian produced goods, from rump extending down to Colgate
toothpaste (all produced in Australia according to the labels) are cheaper in downtown Tokyo supermarkets than Australian stores. Its a bloody disgrace cobbers! Oh, and in Japan they are trialling fuel cells in homes because they make homes self sufficient - not reliant on sun, wind or some other variable source - as is logical.

Comment 12 of 71

• **Jack Black Posted at 6:54 AM Today**

So, are the Greens and their Labor puppets going to levy a carbon tax on China's exports to Australia in the form of a tariff on their non-compliant goods? Or, are we expected to just pay more for our own domestically produced goods and watch our industries and our wealth generation disappear along with the jobs of our kids? Bob Brown and his green Bolshies will kill our kids' futures.

Comment 13 of 71

• **BD Posted at 7:13 AM Today**

To some degree Australia will always higher power costs because of the large distances involved. For the same reason taxes generally will be higher per unit population than say a place like Switzerland for roads etc.

Comment 14 of 71

• **Brian Handley of Gippsland Posted at 7:28 AM Today**

This story reveals both the hypocrisy of Australian politicians on Global Warming and the timidity of them in allowing themselves to be so intimidated by this fraudulent Green agenda.

Comment 15 of 71

• **BobbyDan of Country WA Posted at 7:33 AM Today**

There is also massive amounts of Brown Coal waiting to be exported too but there is no Government assistance to build the railways and ports to do it, but they want thier cut of the cake.

Comment 16 of 71

• **Wil's Wife of Sydney Posted at 7:34 AM Today**

It is astounding that with atmospheric pollution, carbon pricing, etc, at the top of the worry list we still have so called educated people bemoaning the fact that Australia didn't build more coal fired power stations. Why is there such an aversion in Australia to nuclear power generators and a wider use of renewable sources such as solar and wind generators? Growth of renewables at 10% per annum is far too low and I would have thought that 30% per annum would be more realistic.
Comment 17 of 71

- Bob of Townsville Posted at 7:34 AM Today

Australia's higher retail electricity prices are a direct result of this stupid "renewable energy target" and the pricing advantage afforded to wind power. Every megawatt of wind power generated has to be matched by backup capacity of one megawatt that sits idle while the wind blows, but as soon as it dies down (the timing of which no one can predict) the backup power plant must fire up immediately, not tomorrow or in six hours time - now. This creates an enormous and totally un-necessary cost burden that someone has to pay for. Who? The consumer, stupid.

Comment 18 of 71

- mbh Posted at 7:43 AM Today

I'm not sure of AER's logic in saying unless we pay more for power, we'll have more blackouts. If the infrastructure isn't there, paying more for it isn't going to increase the amount of it from the existing plant. As consumers we've been bled dry for years by State governments who have skimmed the revenues for years instead of maintaining existing and planning for future infrastructure. So they rob the utilities to pay for useless bureaucracy, then turn around and say we'll have to pay more because there isn't money left to build increased base load capacity to meet future demand. Oh, and by the way, it's our fault anyway that current power generation can't handle it as we have a growing population that uses shock horror, airconditioning during Australian summers. How dare we. The same debacle is done with the water utilities. We're suckers.

Comment 19 of 71

- Captain Jack Posted at 7:53 AM Today

The 'global warming' conspirators are achieving some of their aims. The transfer of resources, wealth and productivity from the West to the Thrid world being one of them.

Comment 20 of 71

- Easy Street Posted at 7:53 AM Today

Why am I not surprised? Australians have a long history of allowing and almost encouraging our own companies to screw us blind. We pay some of the highest rents, highest food costs, highest bank charges, highest fines and highest utility bills of any other comparable country. Travel overseas and see for yourself how much our large companies and even our own governments are screwing us. When is enough enough? When will aussies demand the best for ourselves instead of foreign owned companies. We produce some of the best food in the world and most of it we can't buy because it is exported while we pay the highest prices for the leftovers.
• **Tony Mc of Lower Mitcham SA Posted at 7:56 AM Today**

About thirty five years ago in South Australia the government of the day wanted money to buy votes so they put their snouts into the money the state owned power authority had put aside to replace aging infrastructure and successive governments did the same. We will now have to pay for thirty five years of neglect.

Comment 22 of 71

• **martin m Posted at 8:02 AM Today**

is this another coal industry funded story?

Comment 23 of 71

• **Botswana O’Hooligan of Brissie Posted at 8:08 AM Today**

The govt and the greens can put as much lipstick on this pig of a (carbon tax) as they want, but its still a carbon tax and they will squander the money on anything that takes their fancy as usual, but little on actually generating clean power. There will be an explosion of bureaucrats, advisers,and consultants, along with snake oil salesmen who will reap more rewards, make more promises, and the end result will be that the ordinary people will still use about the same amount of electricity and pay double the price whilst watching industry fleeing offshore to Korea, Taiwan, and China where electricity is cheaper thanks to coal imported from Australia.

Comment 24 of 71

• **timex of Mooloolaba Posted at 8:11 AM Today**

And who is to blame STATE and FEDERAL governments!

Comment 25 of 71

• **who voted greens of wa Posted at 8:21 AM Today**

So clever are we 20 million people paying through the nose to save the planet yet in Asia 2 billion people pollute away to their hearts content on cheap electricity. WE ARE THE CLEVER COUNTRY ALRIGHT.

Comment 26 of 71

• **The Antidote of Earth Posted at 8:25 AM Today**

The story illustrates that we need take a long hard look at the way we are governed in Australia, and whether we can really afford the current numskulls running the state format level of government. While the Australian Energy Regulator may regulate the wholesale supply, it is State governments that have made a very costly mess of the electricity market and the sky rocketing prices. Ditto water, roads, etc. Until we get rid of this ancient form of government things will only get worse.
Comment 27 of 71

• **R Gray** Posted at 8:27 AM Today

And yet the Greens (and Gillard) have the temerity to say a Carbon Tax will be good for growth and jobs in Australia. You have no chance of convincing Australians that their electricity bills will not go up if a tax of any sort is put on power sources.

Comment 28 of 71

• **James moylan of Lismore** Posted at 8:41 AM Today

So how does such a headline fit with the idea that The Australian is a newspaper? The whole article - headlining the paper - might have been ghost written by the coal lobby (in fact I am pretty sure it was). Now don't get me wrong, I'm not a radical greenie or anything, I just like to have a newspaper deliver stories and not propaganda. Just the simplest passing consideration will provide an answer as to why these various asian countries have cheaper electricity than we do in Aus - most of these countries would fit in an average Aussie backyard and we lose almost fifty percent of our generated power in transmission losses. Obviously it is the fault of the labor guvmint.

Comment 29 of 71

• **Spin Baby, Spin of Brisbane** Posted at 8:47 AM Today

The Government is telling us our power prices have increased as a result of higher coal prices and infrastructure costs. Only a very small component of the price rise is attributable to renewable energy costs. This article is totally at odds with the Government's argument that clean energy only represents a very small component of price increases. And Ms Gillard has been telling us there will be less of an increase if we introduce a price on carbon. Where's the modelling that shows us how much extra we are paying to build government approved power plants -v- what we should perhaps be building instead, ie what our asian competitors are building: the cheapo coal fired power plant? What's the effect on jobs in Australia if we are having to build a more expensive power plant?

Comment 30 of 71

• **Spin Baby, Spin of Brisbane** Posted at 8:53 AM Today

A few years ago I was forced to upgrade my electricity as I could no longer buy the cheap box air-conditioner that goes in my window. I was forced due to Government regulation to buy split systems that then required a power upgrade. I was told then the newer style machines were considered “greener” and the Government didn't want the old box air-conditioners to be available anymore. Maybe some investigation needs to be done as to why we are forced to buy air-conditioning appliances that require power upgrades and one assumes by the upgrade draw more power than they did.
in the 80's? I feel like the Government has contributed to this problem by legislating certain appliances can no longer be sold.

Comment 31 of 71

- **tom bonacci Posted at 8:54 AM Today**

South Korea and Taiwan also have the benefit that their electoral system does not allow preferential bribery such as ours by the Greens to gutless politicians more concerned with short term power than long term welfare of the country!!!

Comment 32 of 71

- **Fred Bloggs of Castlemaine Posted at 8:59 AM Today**

How's this for a fairy story! "Local households paid 14.3c for every kilowatt hour of residential power" In your dreams! I'm paying nearly 20c/kwh, and after 999 kwh, the cost increases. Gotta keep the shareholders happy, and bugger the consumer. How about a 50% cut in CEO and director's fees so that it'll take another two years before they become billionairs?

Comment 33 of 71

- **Tony of Landsborough Posted at 9:02 AM Today**

Well it is quite obvious that there must be real competition in the Asian countries overseas. We have no competition, and Utility companies that are set up by floundering and inefficient state governments who are only interested in lining their buddies pockets. Until we get real competition all the power Utility companies in this country will be charging whatever they want.

Comment 34 of 71

- **Frank Christie of Melbourne Posted at 9:06 AM Today**

Where do their figures comre from? I pay over 23 cents during peak times!

Comment 35 of 71

- **rodney allsworth of morayfield Posted at 9:08 AM Today**

interesting comment by the Australian Energy Regulator, mr Andrew Reeves says, quote-he likened Australia's electricity transmission network to a run-down car.and then says, quote-"The big drivers (of higher bills) are replacing infrastructure built in the 1960s and 70s and the need to expand the network,- well well, now that has to be recognition of the fact that state govs were not using the profits to maintain the basic infrastructure of our state power transmission systems for decades, that the same regulators also says, quote- consumers faced blackouts unless they paid more for power. so thats how the game is played, renege on state responsabiltys,
and then turn the issue around to blame the public power consumption and costs on the public victims, such is politics, sigh. rod qld

Comment 36 of 71

- **CN Posted at 9:13 AM Today**

This was all the lunatics who want a carbon price need to understand. It will shift manufacturing off-shore, reduce Australian jobs, increase prices, and reduce our standard of living. BUT what's more is it does nothing for the environment. The carbon just gets produced in another country.

Comment 37 of 71

- **Danny Posted at 9:19 AM Today**

I have to admit to longing for the olden days, when Australian government loyalty, first and foremost, was to the Australian people. Now, clearly it is to internationalist bodies. To borrow from Sheehan, I get existential mutiny.

Comment 38 of 71

- **Bob Close of Sydney Posted at 9:25 AM Today**

I guess the big question is why governments have allowed this vital infrastructure to deteriorate so badly, given that keeping power costs relatively low is vital to all industries and the public good. Even if this is not another difficult federal vs states issue we badly need some leadership here and the application of a carbon tax to drive renewable energy is simply not going to cut it. One has to ask what is the smart thing to do to foster investment in cheaper energy given we have abundant thermal coal and natural gas resources? Perhaps an over arching plan to coordinate the replacement of aging power infrastructure with new more efficient and cleaner generation plants that recycle waste products would be a good start.

Comment 39 of 71

- **Marcus of Adelaide Posted at 9:30 AM Today**

At the end of the day-no matter how much this newspaper seeks to bag renewable energy-the "real" reason Australian's pay so much for their electricity is a combination of "gross" underinvestment-by the now largely privately owned generators & distributors-& outright profiteering.

Comment 40 of 71

- **Dr Strangemath of Sydney Posted at 9:37 AM Today**

What the article fails to point out is that Korea at least keeps its retail electricity prices artificially low by subsidising the cost of power generation. Australia is entitled to do the same thing - indeed we used to do
just that. But then all the government's decided they wanted to pay for pork barrelling by selling off state owned electricity assets - which now being in hands of private operators - will charge market prices. That's not a bad thing necessarily - as it keeps our system and economy much more flexible and adaptive - but the journalists here have added 2 and 2 together and got 22.

Comment 41 of 71

- **Steve** *Posted at 9:40 AM Today*

Taiwan and South Korea are a lot smaller than Australia so their networks are much more compact and less costly to maintain. They also probably haven't neglected investment in transmission infrastructure over the last decade the way Australia has, and probably haven't experienced the same rapid rise in demand (the two things driving our prices up). And, judging by the fact that industrial users pay what we do, they probably also spend taxpayer money to subsidise residential power.

Comment 42 of 71

- **daev** *Posted at 9:42 AM Today*

Whose paying 14c/kwh? Country energy has the audacity to charge me 21c/kwh. I don't think that I can do anything more to save power, apart from switching off the mains for a few hours a day. Everyday I got more efficient in my use, the stupid power company ramps up the rate to ensure they keep making money. Power efficiency in this country is a joke. There is no effort at all on the part of energy producers to improve their own processes, they just con the govt into increasing the cost the customer.

Comment 43 of 71

- **Energy observer of Qld** *Posted at 9:48 AM Today*

Mr Freund (CEO Energy Users Australia) is quite wrong about no coal fired power plants being built in Australia for two decades. Queensland has added significant new coal fired plant at Millmerran, Kogan Creek, Callide and Tarong in the past 15 years. All highly efficient, low polluting, low running cost plant. Surplus output is even sent to NSW, when they want. WA has also added new coal fired plant in the past 15 years (Collie and Bluewaters projects). And about power prices, Qld Govt generators are supplying power mostly at below cost due to a general oversupply. The electric energy retailers like Origin and AGL are the ones reaping the benefits right now. They use their so-called "green" gas fired power plants to kill off high prices in peak demand times, thus helping profits in their retail arms.

Comment 44 of 71

- **Johnno of Adelaide** *Posted at 9:49 AM Today*

That is because our Governments do not place expectations on our energy suppliers to do so. They like the banks are allowed to rip us off and the
governments make no attempt to protect us from this criminal behaviour. I say criminal because it is no more than thievery under the guise of profiteering.

Comment 45 of 71

- **rob of brisbane** Posted at 9:55 AM Today

  this is a poorly thought out comparison that does not compare the cost of power at the source. Australia has a much larger area to run the infrastructure out over, and this price takes into account that infrastructure. Looking at the size of Queensland and what it costs to run out lines, is not comparable to what it costs to run out lines in a much smaller area like South Korea. If you want to make a comparison, then compare apples with apples, not one apple against a case of apples.

  Comment 46 of 71

- **Reality Check of OZ** Posted at 9:55 AM Today

  It has been a long known fact in Australia that wages are the source of all problems from Bank CEO's on $16 Million a year to plumbers at $65 hour, so is it any wonder everything in Australia is expensive when the basic wage in Asia is around $10 a day. But the one thing I have noticed that has changed the most in the past 20 years was that the Poms are no longer the biggest whingers in the world, the Aussies are now. The biggest problem in Australia now is greed.

  Comment 47 of 71

- **lincoln of victoria** Posted at 9:59 AM Today

  Well, we lead the world yet once more in inefficiency!

  Comment 48 of 71

- **Hannes of Perth** Posted at 10:07 AM Today

  The Mines in WA are more concerned about the availability of energy than the price of it - especially gas. My rough calcs on the tells me that the Mines can afford to pay at least 5-10 times the current price of gas before their operations will be effected. If you judge that energy companies are making an extraordinary profit then nothing stops you from investing in energy.

  Comment 49 of 71

- **fuljoh** Posted at 10:08 AM Today

  It is becoming clearer by the day that the NSW Labour Government is using the electricity providers and the dividends thereby provided as a back door tax worth as much as a billion dollars a year. Roll on March 2011!

  Comment 50 of 71
• **Bob of ADL Posted at 10:10 AM Today**

Australians are dumb with their money and accept prices no other people would accept. eg In my cafe it costs 90c to make a cup of real bean latte - how much do you pay? Power cost is not a government issue, its a business issue. Ozzies love to over pay, whinge and then over pay some more. If they dont pay top dollar they are worried someone will look down on them. WEAK

Comment 51 of 71

• **Logical of Canberra Posted at 10:10 AM Today**

Lousy state Labor governments who don't see their role as providing essential services are the cause of this shambles. The federal Labor love affair with non-existent climate change is another cause of uncertainty. You get what you vote for.

Comment 52 of 71

• **Henrietta of Tasmania Posted at 10:11 AM Today**

Australians were warned that the anti-carbon dioxide fad would bring hardship via increased energy and other prices. The reality is starting to bite as the highly inefficient 'alternative' energy sources cause higher and higher electricity prices. We need courageous politicians who will actually put debate on nuclear power on the table as this surely has to be the sensible energy source of the future.

Comment 53 of 71

• **John Davidson of Brisbane Posted at 10:16 AM Today**

My power supplier claims that 47% of my power bill is a distribution cost. The big difference between Australia and places like Taiwan is that the power is generated much closer to the consumer which means much lower distribution costs. It is worth noting too that the cost of coal contributes relatively little to the cost of power. The export price of thermal coal is running at about $100/tonne. Which works out at about 3 cents/kWh for black coal generated power.

Comment 54 of 71

• **Climate Con Posted at 10:16 AM Today**

Whack a carbon Tax on it and you haven't seen anything yet. Climate Change has become an embarrassment but the Limousine Left are 10 steps behind.

Comment 55 of 71

• **Jaykorea of Brisbane Posted at 10:18 AM Today**


Having lived in South Korea for the past 7 years, I can tell you that the price of power is at least 50% lower than it is here in Brisbane. That does include using very similar household white goods. Also, the cost of gas is cheaper too! The cost of everything has gone through the roof in Aus. I am thinking about moving back to Korea or Singapore, where a pay 30% less tax, and the cost of living is cheaper than here, expect for real estate. And the government wonders why educated Australian moved overseas.

Comment 56 of 71

- **Turbine of Perth Posted at 10:25 AM Today**

  "The federal government's Australian Energy Regulator, which regulates the nation's wholesale electricity market, warned this week that consumers faced blackouts unless they paid more for power." Would someone mind explaining to a confused electrical engineer, how the price of energy can stop a blackout. I mean if this is true, then the world's power problems don't really exist.

Comment 57 of 71

- **The Original Oz of Melbourne Posted at 10:29 AM Today**

  To sum it all up - You have been paying power bills all your life with the expectation that at least part of what you were paying was being used to maintain and improve the equipment infrastructure used to create and distribute this power. The Power companies have, however, been funneling this to improve the salaries and lifestyles of their executives and, since privatisation, diverting it all to the profit column of the ledger in order to pay higher dividends to shareholders. Now that it is time to maintain and improve the network it is us the bill payers who are to foot the bill for what we have already paid. It is time to Nationalise the electricity grid into a single unified entity, build more generation capability (just what is wrong with nuclear generation anyhow?). Electricity (and gas, water, education, health, telecommunications, police and defence) are essential services in the 21st century and, as such, should be under direct government control not be subject to the whims of a fickle share market and should not be run with the attitude that "it is all for the shareholders". Hey guys, the shareholders are consumers of your products too.

Comment 58 of 71

- **Paul of Toowoomba Posted at 10:31 AM Today**

  I should hope they could too. If they weren't there would be something very wrong. Two very small countries with very concentrated populations which makes the transmission of electricity far easier than Australia with its vast distances and decentralised population (by that I mean our love of single stand alone dwellings makes for very expensive access costs. If you have visited the major cities of these two countries you would know that most people live in multistory apartment dwellings again far easier and cheaper to hook up to the grid.) A very poor article essentially comparing apples with oranges. Can I suggest greater focus on analysing all aspects of the
power supply and charging issue, before making such sensationalist headlines.

Comment 59 of 71

- **Kev from taree of taree Posted at 10:35 AM Today**

That's it, dig up our coal and become the world's biggest coal exporter. Do the same with uranium whilst Australian's have to live with clowns like the Greens and ALP wanting to close down our power stations and overcharging for energy.

Comment 60 of 71

- **Laz of Sydney Posted at 10:53 AM Today**

What we have is a deadlock with no reesultion to be found for many years. No new coal power stations, No Nuclear power stations, No dams that produce electricity. All we have left are small token Solar, Wind and gas stations. The result is our competivness will nose dive and pay higher electricity prices. Welcome to the the biggest incompentent state and federal Labor governments we have had in history and boy we are indeed going to pay for it.

Comment 61 of 71

- **overcharged_aussie of adelaide Posted at 10:53 AM Today**

up the price of the exports to supplement the price to our internal users. STOP RAPING OUR COUNTRY to the benefit of others. we need to start looking after our own country for once!

Comment 62 of 71

- **Focus Posted at 10:55 AM Today**

Have you ever noticed how the state governments are interested in investing in everything else apart from the fundamental things they monopolise.

Comment 63 of 71

- **Collie of Mt Barker Posted at 10:56 AM Today**

The Australian statistics in this story have no relevance. Current domestic consumers who haven't yet received their most recent 2010 electricity bill will be in for a rude shock.

Comment 64 of 71

- **Peter Sandery of Townsville Posted at 10:58 AM Today**
The fact of the matter is that these are the countries with which our commercial operations are competing and if we cannot do that competitively, we are on the outer. Everything needs to be adequately maintained and replenished effectively. We are reaping the benefits of those leaders who did not or would not understand these simple facts. We have been and still are living beyond our means and if both ourselves and leaders do not quickly turn this around we will rapidly become the economic basket case of the Asian/South West Pacific Area - the latest mining boom notwithstanding.

**Comment 65 of 71**

- **Wise old owl of newcastle** Posted at 11:01 AM Today

My brother in Law works for transgrid and I thought he was only Employed on a casual basis. The amount of time he has off is mind blowing. just disgraceful really. Maybe that is why the maintenance is not getting done.

**Comment 66 of 71**

- **Jeremy C** Posted at 11:04 AM Today

What the article doesn't say what part of our electricity bills are going up. They are made up of generation, network and distribution charges so its hilarious reading the ignorant ranters blaming greenies, carbon tax, renewables etc. Interesting that this story has apperaed just after it was reported that Sth Korea, japan and otehr countries were starting to buy less of our coal as they restructure their economies to deal with global warming issues. Hmmm, me wondering if a scare campign is in the offing.........?
No, I'm being too cynical.

**Comment 67 of 71**

- **Greed of Melbourne** Posted at 11:12 AM Today

Reality Check of OZ Can you please send me the contact details of 65 dollar an hour plumber. Here in Melboune they charge 90, plus a call out fees

**Comment 68 of 71**

- **Rick from NSW of NSW** Posted at 11:15 AM Today

What the hell is the point of publishing irrelevent 2008 data that shows 'Australian housholds' are being charged 14.3c per kWh for their power? Considering what has happened to power bills over the last two years, this data might as well be from the last century. I don't know about city people, but here in Country NSW, we pay at least 22.5c per kWh (for the time being anyway)! No doubt this will almost double once TOU metering is adopted. It is pretty obvious that a large chunk of these huge profits are not being used to 'upgrade the ageing infrastructure' and are in fact being paid to the State in the way of big fat dividends. Even blind freddy can see that the NSW Government (hiding behind the supposedly independent IPART) are jacking up prices to make future sales/floats of the government owned power
utility and retailer cash cows more attractive to all those ‘mum & dad’ and institutional investors out there.

Comment 69 of 71

- **Bev of Mid-north coast of NSW Posted at 11:17 AM Today**

  In NSW the State Government still owns the Electricity distribution completely, so they are the only SHAREHOLDERS that are reaping the benefits of higher energy prices and NOT spending it on repairs and maintenance. So until it is all sold or part thereof sold the State government gets it all.

Comment 70 of 71

- **Paul Obvious of Brisbane Posted at 11:19 AM Today**

  Don't complain, people. You voted for it.

Comment 71 of 71

4) Other useful publications


Calwell, Chris. 2010. ‘Is efficient sufficient?’ Prepared for the European Council for an Energy Efficient Economy (ECEEE) with funding from the European Climate Foundation and the U.S. Environmental Protection Agency’s ENERGY STAR program.

Carbon Trust. 2009. ‘Making a business case for a carbon reduction project’.

Carbon Trust. 2009. ‘Building the future today - Transforming the economic and carbon performance of the buildings we work in’.


CSIRO. 2010. ‘Intelligent Grid - A value proposition for distributed energy in Australia’. Commonwealth Scientific and Industrial Research Organisation (CSIRO) Report ET/IT 1152. (Wide-scale deployment of distributed energy will require a revolution in engineering design, practice and regulation. To facilitate this change, CSIRO has investigated economic, social, environmental and technical barriers and enablers for wide scale adoption of DE. Results of these investigations are contained within this Intelligent Grid report which provides evidence of the critical role distributed energy can play in Australia’s Energy future.)


Johnson Controls. 2010. ‘Empire State Building Case Study’.


Seligman, Peter. 2010. Australian Sustainable Energy - by the numbers. (This is an open source book that describes the pros and cons of a range of renewable energy sources that could be incorporated into the design of a low-carbon energy system in Australia.)


Session 10: Energy Efficiency in Information Technology Equipment
Agenda

- What is Green IT?
- Defining End User Devices
- Power Consumption
- Power Management
- Mobile Computing
- Printing
- Where to next?
In IT’s case power bills are rising while at the same time the power consumption of the IT process is also rising. New power-saving technologies like virtualisation and flat screens are now available but the number of devices continues to increase. Companies will continue to look for other ways to reduce power consumption and therefore cost.

What is Green IT?

“Green IT is the conscious implementation of technologies, techniques and policies designed to reduce the carbon footprint of the IT function within the organisation … … and the use of IT to reduce the carbon footprint of the whole organisation”
End User Efficiencies

- Desktop computing
- Mobile computing
- Printing

- End User IT Efficiencies have to do with those that the end user has most control over.
- There are a range of different technologies and techniques that can reduce the organisation’s power consumption and carbon footprint.
- The relative importance of end user IT efficiencies varies, largely in relation to the size of the organisation. For a small organisation this may constitute their entire IT power spend. Organisations with datacentres will be looking at other ways to reduce power consumption.
- Also very important because of its visibility. It is the area that most affects non-IT people.
- Green IT policies and practices will be most apparent to most people in the organisation.
Power Consumption

• PCs, Displays, Printers and other components
• How is power measured?
• How much does it cost?
• What is the annual cost?

• Explain that each of the desktop components must be included in calculating the overall consumption – motherboard, CPU, HDD, Monitor, printers
• Discuss power saving modes
  • Sleep v hibernation v power off
    • Hibernate takes the memory that is stored in the ram and puts it on the hard drive, and shuts down everything. This means nothing will work and it will not use any power at all, then when you hit the power button it turns the computer back on and it doesn’t have to boot up. It will load the memory back to the ram and put windows right back where it was, so if you get tired of waiting for windows to boot just use hibernate all the time to shut it down, then you save more power because you are not waiting on it to boot up and increases productivity. Uses no power.
    • Sleep (also called suspend or standby) keeps RAM active, but shuts down power to display and disk drive. Uses about one tenth of the operating power. Restarts immediately.
    • Power off can be set to happen automatically after hours. Uses a very small amount of power but takes time to reboot which reduces productivity.
  • Screensaver v display off
    • Screensaver is not a power saving mode. Was originally designed to stop the CRT from being “burned” with long term still images.
    • Display off puts the screen into standby but still uses a small amount of power about 2W for a flat screen.
    • Power off uses no power.
• Power is measured in Watts (W) and kilowatts (kW).
• We can use a power meter to find out how much power each component uses instantaneously.
• Energy is billed by kilowatt hour (kWh). This is kiloWatts x time. 1 kWh = 1000W x 1 hour. The power meter can also give this measurement.
• You would need to contact local energy supplier to find cost. It varies by state, time of day, provide and usage.
• Example: if power is charged at 20c/kWh and 1 PC uses 100W
• Annual cost needs to include downtime so is not a straight forward calculation once the hourly cost is known.
Power Consumption Example

• Assumptions:
  – Energy is charged at 20c per kWh
  – 1 PC uses 100W
• What is the cost for 100 PCs for one 8 hour day?
• What is the cost per year?

• Example: if power is charged at 20c/kWh and 1 PC uses 100W
• Annual cost needs to include downtime so is not a straight forward calculation once the hourly cost is known.
Power Consumption Example Solution

- Energy per PC per hour:
  \[100\text{W} \times 1\text{hr} = 100\text{Wh} = 0.1\text{kWh}\]
- Cost per PC per hour: \[0.1\text{kWh} \times 20\text{c} = 2\text{c}\]
- Cost per PC per 8 hour day: \[2\text{c} \times 8\text{hr} = 16\text{c}\]
- Cost for 100 PC per day: \[100 \times 16\text{c} = 1600\text{c} = 16.00\text{d}\]
- Cost for 100 PC per year: \[16 \times 365 = 5840\text{d}\]

This may not sound like a lot of money but any business will be trying to reduce all costs of production.
These figures are now a little out of date but are still indicative. A class exercise could be to search manufacturers websites to get more up to date figures. For example, LED backlit LCD monitors have recently become available and typically use half as much power as LCD units and a third or a quarter of CRT monitors.

**Useful site:** http://michaelbluejay.com/electricity/computers.html
Activity 1

• Measure power consumption of desktop appliances

Refer to Activity sheet
To maximize power savings, set computers to enter system standby or hibernate after 30 to 60 minutes of inactivity. To save even more, set monitors to enter sleep mode after 5 to 20 minutes of inactivity. The lower the setting, the more energy you save. On laptops, be sure to activate these settings in the AC power profile — not just the DC (battery power) profile.

Power Management

- All modern operating systems have power management facilities built in
- Decreases power consumption by more than 50%
- Reduces the need for cooling
Should you Turn Them Off?

- Turning PCs off will reduce the power consumption but will reduce productivity
- Use power management during work hours and turn off at other times.
- Use Server Policies to force shutdown after hours

Often using hibernation will give the same results as power off without the time wasted on reboot.

Useful site: http://www.computersoff.org/
ComputersOff.org

- Did you know that putting your PC to “sleep” or turning it off when you’re not using it, can save you up to $80 on your power bill and reduce your computer’s carbon emissions by up to 100kg over 12 months. That’s the same amount of CO₂ you emit by flying from Sydney to Canberra! (www.computersoff.org)
Mobile Computing

• Laptops, Netbooks and PDAs
• Use less power than desktops but can still have savings
• Use power adapter when possible
• Turn off features when not in use
• Use wired network if possible
• Enables teleworking, reduces travel
• Shorter life span means more disposal

• Laptops and netbooks use more power charging than working with a full battery. Where possible use power adapter and don’t run battery flat.
• Bluetooth and WiFi features will use power even if they are not being used. Turn these features off if they are not necessary.
• Use a wired network connection rather than wireless if available and turn the wireless adapter off.
• Mobile devices generally have a lifespan of about 2 years. These must be disposed of properly as they contain toxic chemicals like all electronic devices.
Printers and Print Management

• Does duplex printing help?
• Don’t print as much and use print settings to reduce output
• Use fewer printers with better power management.
• Use billing to change behaviour

• Duplex printing – print on both sides – may reduce the amount of paper used but all other consumables are the same.
• Other costs associated with duplex printing may cause more problems. More expensive printers and more maintenance
• Rationalise printing facilities and use printer management software to control consumables and printing output
• Commonly, pay per use (PPU) introduced to raise end user awareness
Activity 2

- Make calculations using EnergyStar website
- Make suggestions for reducing power consumption – this must be submitted for assessment.

Refer to Activity sheet
Other ways of reducing the Carbon Footprint

• Procurement
• Reuse, refurbish, redeploy and recycle
• Ethical Disposal
• Video – Toxic Trade

So far we have focussed on power consumption. There are other environmental considerations for desktops
• Procurement – Green suppliers, EnergyStar ratings
• Purchase second-hand or refurbished equipment or redeploy within for low requirement users.
• Where redeployment within is not viable, consider reselling or donating to staff or charities
• Offloading to charities is not always ethical. You may be passing the disposal process to someone who is not in a position to dispose properly.
• View video and discuss environmental impact of e-waste, security implications of current disposal methodologies, what can your company/organisation do to minimise production of e-waste?
Other energy efficiency/ IT topics

• Datacentre power consumption
  – Virtualisation
  – Cooling
  – Cloud Computing
• IT as an enabler for reducing enterprise carbon footprint
  – Carbon Emissions Reporting
  – Teleworking

• This lesson aimed to show how reducing power consumption will lower IT costs and improve the Carbon Footprint
• Further teaching sessions on this topic might include consideration of datacentre power and the use of virtualisation as a power saving method
• The IT department is probably only responsible for about 3% of enterprise power bills. Any saving in IT is not going to make a big difference. However, IT can be used as an enabler for the rest of the enterprise to reduce power and therefore costs.
Useful websites

- http://www.computersoff.org/
Acknowledgement

These resources were developed by Patrick Crittenden, Sandra Nichols, Suzanne Benn and Anna Knutzelius from the Australian Research Institute for Environment and Sustainability, with the generous support of the Australian Government Department of Education, Employment and Workplace Relations.