



Brink

expedition

www.brinkX.org

*Survive the race
against time!*



Curriculum

Module 4

Global Warming

Investigation

Suitable for Upper Primary

Core Learning Outcomes Levels 3-4

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In partnership with: Department of Education and the Arts



Association of Independent Schools of Qld



Brisbane Catholic Education



Qld Catholic Education Commission



Earth Charter

GLOBAL WARMING – INVESTIGATION - MODULE OVERVIEW

Core learning areas

Studies of Society & Environment (SOSE) levels 3-4
Science levels 3-4

The Brink Expedition

In an epic test of endurance and resolve, a small team of Queenslanders are racing against time cycling and sailing around the world in just 1000 days, travelling through harsh and unforgiving terrain, relying on human power and non-fossil fuel energies on their expedition.. The Brink Expedition began in May 2003 and is scheduled to finish in Sydney Harbour during 2006. Apart from the adventure of the Expedition, the team has been spurred on by a passionate determination to educate the world's next generation about the environment. This module complements the actual journey of the Brink Expedition around the globe. Like the other Brink modules, "Global Warming" focuses on one of the 'hot spots' visited by the team. The team's progress across land and ocean is unpredictable, particularly because the members are determined to travel using natural sources of energy. So the Brink team cannot guarantee that they will arrive in a particular 'hot spot' at a specified time. This introduces an element of uncertainty for you and your students. The Brink team hopes that you can work with this uncertainty. It could mean that your students will study this module before the team arrives in Europe for the "Global Warming" 'hot spot'. It could mean that the team will have already left Europe before your students begin their study. Hopefully, however, your students will be studying the 'hotspot' while the team is there. Whatever the case, you'll see that the module writers have suggested ways that your students can make links with the Brink Expedition – its aims, its history, its actual travel program and its achievements. You might like also to use the 'uncertainty' positively – drawing attention to the fact that the uncertainty springs from the team's commitment to sustainable modes of travel, from the challenges of travelling through some difficult terrain and some tumultuous societies, and from the way the team members have seized unexpected opportunities for rich experiences. All of these have made a neat itinerary impossible!

The Earth Charter

The Earth Charter provides the background and the decision making filter for the Brink Expedition. The values and principles of the Earth Charter, together with the Brink Expedition, constitute a relevant and multi-layered opportunity for students to challenge and form their own ideas of democratic process, social justice, ecological and economic sustainability and peace.

Rationale

Many people believe that global warming is the greatest threat to the future of life on Earth. In this module, students will investigate global warming, refine their knowledge of and value positions in relation to it, think about individual and collective responses to the problem, and choose a way to advocate their position to a selected audience. They will realise that global warming is linked to the bigger picture of the sustainability of environments essential for life.

Keeping in touch with the Brink Team

Until 2006 you can keep in touch with the Brink Expedition Team through the Brink Expedition website at www.brinkx.org. Using the website, you and your students can read updates of the team's journal, visit the Web Forum or link with the Brink Schoolroom and register for "epals" or pen pals along the Brink route. The website also contains information about the places visited by the team. The team will be in Europe in early 2005 to highlight the issue of global warming.

Focus questions

1. What is global warming?
2. What if global warming exists?
3. Should we be concerned about energy use anyway?
4. How can we reduce our impact on the Earth?

Outcomes and Assessment

Science Strand	Science Outcomes	Activities that provide opportunities for students to demonstrate outcomes
Science & Society	3.3 Students make predictions about the immediate impact of some applications of science on their community and environment, and consider possible pollution and public health effects.	Reducing energy usage and greenhouse emissions
	4.3 Students present analyses of the short- and long-term effects of some of the ways in which science is used.	Examining the consequences of global warming
Energy & Change	3.3 Students identify different ways of obtaining energy.	Looking at energy sources
	4.3 Students present alternative ways of obtaining energy (including energy from the sun and from fossil fuels) for particular purposes.	Looking at energy sources
SOSE Strand	SOSE Outcomes	Activities that provide opportunities for students to demonstrate outcomes
Place & Space	3.2 Students create and undertake plans that aim to influence decisions about elements of a place.	Reducing energy usage and greenhouse emissions
	4.2 Students predict the impact of changes on environments by using comparative evidence.	Examining the consequences of global warming
	3.5 Students describe the values underlying personal and other people's actions regarding familiar places.	Exploring the debate
	4.5 Students explain whether personal, family and school decisions about resource use and management balance local and global considerations.	Reducing energy usage and greenhouse emissions
Systems Resources & Power	3.1 Students make inferences about interactions between people and natural cycles, including the water cycle.	Looking at changes to the natural greenhouse effect
Time Continuity & Change	3.4 Students organise information about causes and effects of specific historical events.	Examining the consequences of global warming
	4.4 Students critique information sources to show positive and negative effects of a change or continuity of different groups.	Examining the consequences of global warming

Module overview

Introduction: Following the Brink Expedition

Component	Suggested teaching and learning activities	Resource sheets
Introduction to the Brink website	A tour of the website Reading their Journals Posting questions on the Web Forum	A website guide Journal reflections
Planning an expedition	Planning for the adventure	
Mapping the journey	Following the journey in the classroom	A map of the route

Investigation: Global warming

Stage of inquiry	Focus question	Teaching and learning activities	Resources
Tuning in Preparing to find out	What is global warming?	Using photos From South America to Europe Asking questions Deciding what to investigate Linking to outcomes Keeping a journal	<i>Websites listed throughout the text</i>
Finding out Sorting out	What if global warming exists?	Finding out about the greenhouse effect Creating a greenhouse flowchart Looking at changes to the natural greenhouse effect Examining the consequences of global warming Exploring the debate	Resource 1: Global warming and climate change <i>Websites listed throughout the text</i> Resource 2: Consequence chart
Going further Making connections	Should we be concerned about energy use anyway?	Looking at energy sources Examining energy use	Resource 3: The ways we use energy <i>Websites listed throughout the text</i>
Taking action Reflecting	How can we reduce our impact on the Earth?	Reducing energy usage and greenhouse emissions Reflecting on thinking and doing	Resource 4: Project planning guide Resource 5: Using energy resources more wisely <i>Websites listed throughout the text</i>

Investigation: Global warming

Teaching and learning activities exploring global warming

This section provides a number of teaching and learning activities and resources based on the module focus questions.

The activities in this module correspond with outcomes at levels three and four. However this investigation can be undertaken with students working at higher levels. Web based resources for a range of levels are listed throughout the module. The table below shows how the selected outcomes are linked to focus questions.

Focus question	Outcomes
What is global warming?	SCIENCE: Science and Society 3.3, 4.3
What if global warming exists?	SOSE: Systems Resources and Power 3.1 SOSE: Time Continuity and Change 3.4, 4.4
Should we be concerned about our energy use anyway?	SCIENCE: Energy and Change 3.3, 4.3
How can we reduce our impact on the Earth?	SOSE: Place and Space 3.2, 4.2, 3.5, 4.5

TEACHING AND LEARNING ACTIVITIES

USING PHOTOS

Students view images of retreating glaciers

- Prepare for this activity by downloading the two photos of the Upsala Glacier in Argentina from <http://photos.greenpeace.org.au/Climate%20Change%20Impacts/Upsala2.jpg>. (These photos taken in 1928 and 2004 respectively show that part of the glacier has melted to form a lake. Greenpeace reports that rising temperatures are making glaciers in the Patagonia region melt faster than anywhere else. They say that climate change is the trigger. For a report go to: http://www.greenpeace.org.au/media/climate_details.php?site_id=12&news_id=1297)
- Show students the photos and facilitate a whole group discussion asking questions such as:
 - How would you describe the photos?
 - What is the relationship between the two photos? (same site photographed in 1928 and 2004)
 - What do you think the photographers are trying to say when they put these two photos together?
- Paraphrase the Greenpeace report and give students some background to the photos. (If you have access to The Sunday Mail online locate an article about the Upsala Glacier entitled “We’re on Thin Ice” published on 29/02/04.)

FROM SOUTH AMERICA TO EUROPE

Students catch up with the Brink Team

- Prepare for this activity by downloading photos of the Brink Boys in South America.
- Show students some of these photos and let them know that when the Brink Boys were in South America they saw the same photos of the Upsala Glacier published in *Clarín* (<http://www.clarin.com>) an Argentinean newspaper. The Brink Boys sailed to Europe where there was further evidence of retreating glaciers including news that:
 - Alpine glaciers in Switzerland, Austria, France and Italy are losing between one and five percent of their mass every year (with no acceleration of that rate they will have all but disappeared by the end of the century). (<http://www.planetark.com/dailynewsstory.cfm/newsid/30754/story.htm>)
 - An in-depth study, using aerial photographs spanning the past half century, of all 244 marine glaciers on the west side of the finger-like peninsular of Antarctica pointing up to South America found that 87 percent of them were in retreat. (<http://www.planetark.com/dailynewsstory.cfm/newsid/30502/story.htm>)
 - At a meeting (Energy and Environment Ministerial Roundtable) held in London in March 2005 representatives from 20 countries (Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Iran, Italy, Japan, Korea, Mexico, Nigeria, Poland, South Africa, Spain, Russia, the United Kingdom and the United States of America) viewed dramatic photographic evidence of global warming including:
 - ~ Tanzania's Mount Kilimanjaro burned almost bare of its 11,000-year-old icecap (<http://www.commondreams.org/headlines05/0314-10.htm>)
 - ~ Coastal defences in the Marshall Islands threatened with swamping from rising sea levels (<http://www.commondreams.org/headlines05/0314-10.htm>)
 - ~ In India, the Gangotri glacier which is receding at an average rate of 23 metres per year (<http://news.bbc.co.uk/2/hi/science/nature/4346211.stm>)

ASKING QUESTIONS

Students are invited to ask questions about global warming

- Invite students, working in pairs, to write questions about global warming that have arisen from the previous activity. Encourage students to write different types of questions such as what, when, where, why, who and how questions. Provide examples for each of these types of questions and elicit further examples from the students. (If your students have experience in asking different types

of questions you may wish to challenge them with more complex questioning strategies. See http://www.qsa.qld.edu.au/yrs1to10/kla/sose/docs/rp_pri00.doc

- and http://www.qsa.qld.edu.au/yrs1to10/kla/sose/docs/rp_sec00.doc for examples.)
- Ask pairs to share their questions with another pair. Invite each group of four to contribute questions to a whole group list. Record the questions so everyone can access them.

DECIDING WHAT TO INVESTIGATE

Students plan their investigation

Teacher directed

- The questions recorded during the above activity, reflecting student interest, could be used to guide student investigations throughout the unit. Link student questions to the module focus questions and choose activities that reflect student interest. By doing this students can see that their questions/interests are part of the investigation.

Student directed

- If negotiating with students, assist them to focus their investigation/s by inviting them to sort and rank their questions. To do this, invite students to scan the whole group list of questions and sort them into categories. Assist students to choose and organise the chosen questions into a logical sequence for investigation using this unit's focus questions as a guide if appropriate.
- Investigations can be done as a whole group, in small groups, individually or as a combination of these.

LINKING TO OUTCOMES

Students understand how their work will be assessed

- Refer to the outcomes and assessment section in the module overview to see how particular activities provide opportunities for students to demonstrate the listed outcomes.
- You may choose to make these outcomes explicit to students. If so, make an overhead transparency of the outcome/s you have decided to focus on. Advise students (or negotiate with students) about the types of activities they could/will undertake in order to demonstrate the chosen outcomes.

KEEPING A JOURNAL

Students begin a journal

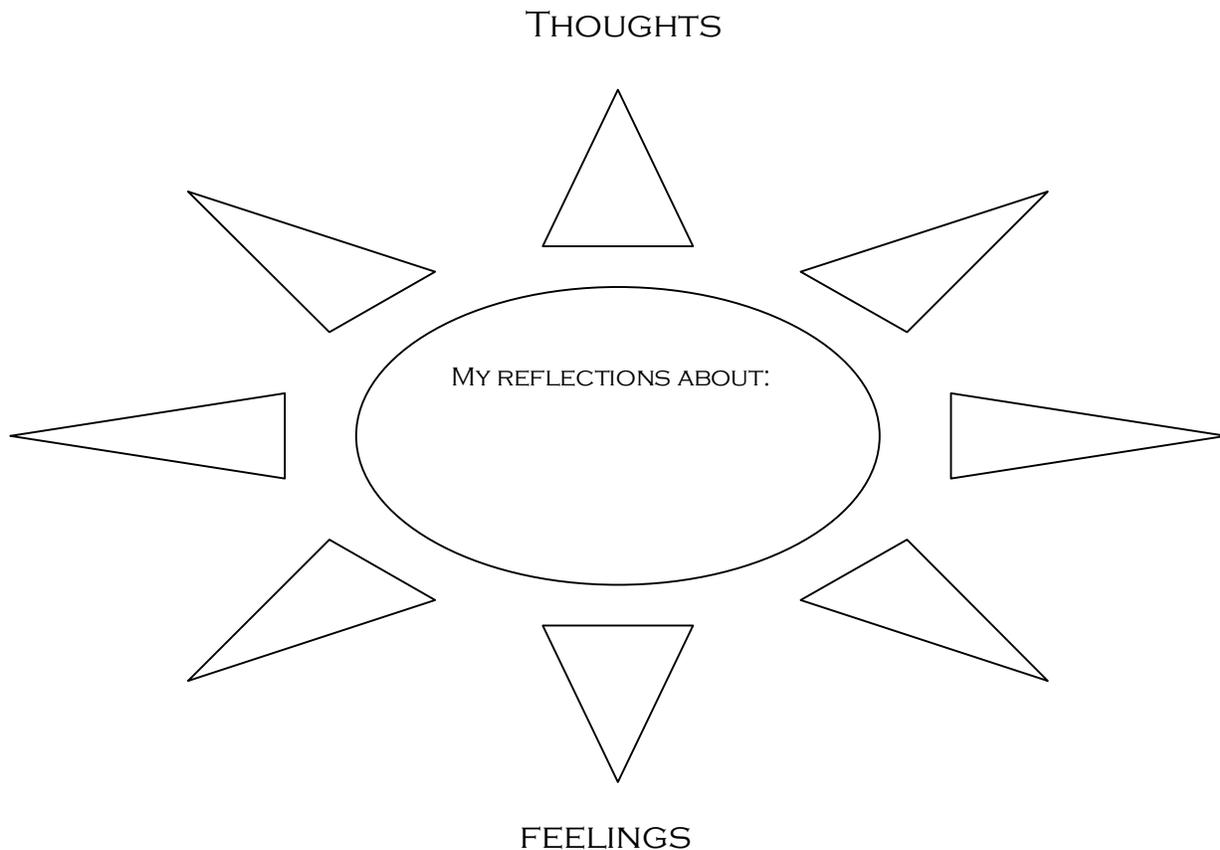
- Encourage students to keep a journal. Vary the type, frequency and length of entries to maintain student interest. Give students a choice about which activities they respond to or how they respond to them in their journal. Three possible formats are given below.

Name of activity	What will you rank? Enjoyment/Interest/Difficulty	Ranking					What did you do? OR What did you learn?
		Low	←	→	High		
		1	2	3	4	5	

The thing that interested me most was _____.

The thing I'm still not sure about is _____.

I still want to find out _____.



FINDING OUT ABOUT THE GREENHOUSE EFFECT

Students conduct an experiment to find out how the greenhouse effect works.

- Download the experiment 'How the greenhouse effect works' from: http://www.sustainableenergy.qld.edu.au/activity/activity1_1.html and the fact sheet 'Greenhouse effect' from (http://www.sustainableenergy.qld.edu.au/fact/factsheet_1.html)
- Invite students to read the fact sheet and do the experiment in small groups. The experiment demonstrates how the greenhouse effect works. Each group will need: two clear plastic bottles with the necks cut off, sand, a 150 W flood light, clear plastic wrap, two thermometers and masking tape.

CREATING A GREENHOUSE FLOWCHART

Students create a flowchart to illustrate how the greenhouse effect works.

- Download the activity 'How living and non-living things interact' from: http://www.sustainableenergy.qld.edu.au/activity/activity1_2.html
- Print out the greenhouse cards and make a copy for each student.
- Provide each student with a sheet and ask them to cut out the greenhouse cards.
- In the activity students are asked to make a flowchart to explain how the greenhouse effect works using as many cards as they can.

LOOKING AT CHANGES TO THE NATURAL GREENHOUSE EFFECT

Students add the impact of human activities to their greenhouse flowchart

- Download the activity 'Changes to the environment' from: http://www.sustainableenergy.qld.edu.au/activity/activity2_2.html the fact sheet 'Global warming from: http://www.sustainableenergy.qld.edu.au/fact/factsheet_2.html and 'Resource 1: Global warming and climate change'.

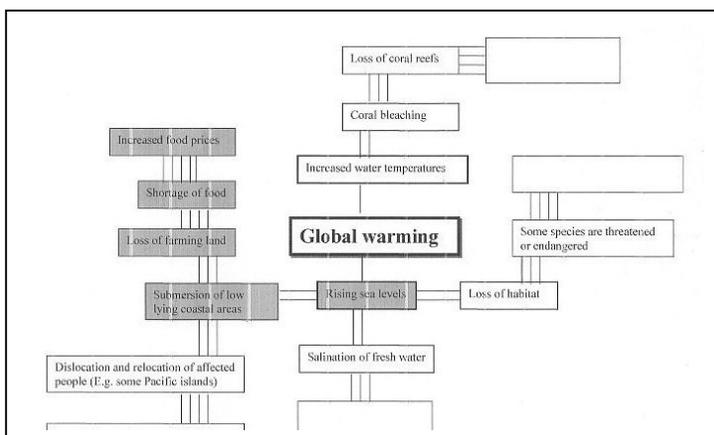
- Invite students to read the fact sheets and do the activity. To complete the activity students will need a copy of the global warming cards from the activity sheet. They need to have completed the previous activity before doing this one as they now add to the flowcharts they created earlier.

EXAMINING THE CONSEQUENCES OF GLOBAL WARMING

Students create a consequence chart to map the impacts of global warming

- Invite students to record the impacts of global warming on a consequence chart. (An example of how it may look is provided below.) Introduce students to the strategy using the following procedure and use 'Resource 2: Consequence chart' if desired. On the resource sheet there are two first order consequences included. One of these is 'rising sea levels'. A direct consequence of 'rising sea levels' could be 'submersion of low lying coastal areas'. This is a second order consequence. A direct consequence of this maybe a 'loss of farming land'. This is a third order consequence. A direct consequence of this could be 'shortage of food', and so on. There are many more consequences to add. The directions for drawing a consequence chart are:
 - In the centre circle, write an event or activity. (This is global warming.)
 - Think of and write a direct consequence of this event in an oval and connect it to the centre with a *single* line. This is a first order consequence. Think of some other first order consequences and draw/write them in.
 - Think of and record second-order consequences. These are things that resulted from the first order consequence. Join it to first-order consequence by a *double* line.
 - Keep going until you can think of no more consequences.
 - The consequence wheel can be added to as students learn more. (You may like to ask students to make any latter additions in different colours.)

Example



- Download, print or save into favourites on classroom computers the following fact sheets for students to use to create their consequence charts:
 - 'AGO Global warming in the 20th century' <http://www.greenhouse.gov.au/education/factsheets/planet.html>
 - 'AGO The heat is on' <http://www.greenhouse.gov.au/education/factsheets/heat.html>
 - 'AGO Changing for the future' <http://www.greenhouse.gov.au/education/factsheets/changing.html>
 - 'AGO Creatures in the spotlight' http://www.greenhouse.gov.au/education/factsheets/creatures_spotlight.html
 - 'AGO Farming in the future' http://www.greenhouse.gov.au/education/factsheets/farming_future.html
 - 'Global warming contributes to Australia's worst drought' http://www.panda.org/downloads/climate_change/wwf2002drought_ut3s.pdf
- For an activity and materials for examining the consequences for Queensland go to http://www.nrm.qld.gov.au/education/modules/primary/primary_greenhouse/climate_change_consequence.html

- For a level five activity download 'Global warming and changing weather patterns' from http://www.sustainableenergy.qld.edu.au/activity/activity2_3.html This activity explores the ecological, economic and social impacts of global warming.

EXPLORING THE DEBATE

Students look at dissenting opinions about global warming

- Present groups of students with a dissenting view on global warming from one or more sources. Some useful sites include:
 - 'Are the media giving you the whole story on global warming?' <http://capmag.com/article.asp?ID=2004>
 - 'Global Warming "Consensus" Claim Doesn't Hold Water' <http://www.nationalcenter.org/TP38.html>
 - 'Extreme Weather Events NOT linked to Global Warming' http://www.envirotruth.org/news_madhav.cfm
 - 'Global warming: myth or reality?' <http://www.bbc.co.uk/dna/collective/A3590011>
- Ask groups to report back on the content of the articles. Facilitate the discussion arising out of the reporting. Encourage students to consider how we deal with dissenting views and how and why we decide to take our own viewpoints.
- Provide each group with another article and ask them to compare and contrast the content, presentation and language with the earlier one. To do this they could use an online Venn diagram (see <http://www.readwritethink.org/materials/venn/index.html>) Some useful contrasting sites include:
 - 'AGO Getting a grip on global warming' http://www.greenhouse.gov.au/education/factsheets/global_warming.html
 - 'The risk of global climate change' <http://www.worldbank.org/depweb/english/beyond/global/chapter14.html>
 - 'Climate change: Science or theology' <http://www.democraticdeficit.org.uk/globalwarming.html>
- Facilitate a discussion inviting students to consider and share how they decide what to believe in when presented with conflicting information.
- Another debate centres around whether Australia should sign the Kyoto Protocol. Provide students with access to the websites listed below regarding Kyoto protocol and Australia's reluctance to sign the agreement. Invite students to identify the value positions of those involved, compare the opinions and consider the reasons for and against Australia becoming a signatory.
 - 'Kyoto would hurt Australian industry: PM' <http://www.abc.net.au/news/newsitems/200410/s1211162.htm>
 - 'The international response to climate change' <http://www.greenhouse.gov.au/international/>
 - 'Anti-Kyoto Aust may loose billions' <http://www.climateark.org/articles/reader.asp?linkid=39046>
 - 'Kyoto would not damage economy' http://www.abc.net.au/news/politics/2002/09/item20020916061319_1.htm
 - 'WWF warms of temperature change within 20 years' <http://www.abc.net.au/news/newsitems/200501/s1291900.htm>

LOOKING AT ENERGY SOURCES

Students explore different ways of obtaining and using renewable and non-renewable energy

- Ask students: Do we need to be thoughtful about energy use whether global warming exists or not? The discussion that follows may demonstrate that students need to know more about energy sources and uses. If so the following activities will be useful.
- Download the activity 'Identifying different ways of obtaining energy' from: http://www.sustainableenergy.qld.edu.au/activity/activity4_1.html and the fact sheet 'Sources of renewable and non-renewable energy' http://www.sustainableenergy.qld.edu.au/fact/factsheet_4.html
- Invite students to read the fact sheet and do the activity. This level three activity requires students to cut out text boxes that describe where each energy source comes from and match them with their name and illustration.

- Alternatively invite students to read the same fact sheet but do the activity entitled ‘Obtaining and using renewable and non-renewable energy’
http://www.sustainableenergy.qld.edu.au/activity/activity4_2.html This level four activity requires students to present information about the sources and uses of renewable and non-renewable energy sources on a graphic organiser.
- Students at level five can use the same fact sheet and the additional sites below to discuss and record the consequences of obtaining and using energy. One way of doing this is to allocate each energy source to a small group and ask them to discuss, record and present their findings to the whole group. Further useful sites include:
 - ‘AGO Getting friendly with the environment (wave, geothermal, biogas)’
http://www.greenhouse.gov.au/education/factsheets/friendly_environment.html
 - AGO Green power (solar, wind, water)
http://www.greenhouse.gov.au/education/factsheets/green_power.html
 - Energy Ed Education from Ergon Energy (advantages and disadvantages of coal, geothermal, hydro, landfill, nuclear, solar, sugar cane, wind, wave-tidal)
<http://www.ergon.com.au/energyed/education/>

EXAMINING ENERGY USE

Students measure their energy usage

- Make copies of ‘Resource 3: The ways we use energy’ and read through with students. Invite students make a list of the household appliances (like those listed in the text) they have in their homes. Beside each one ask students to estimate how many hours each appliance is used each day. Given what they know about usage in their own homes ask students to guess whether they think they would use more or less than the Qld average (percentage) for each of the energy services.
- Challenge students to conduct energy audits at school and home to work out how much energy they do use. The following sites will be helpful:
 - Australian greenhouse calculator
<http://www.epa.vic.gov.au/GreenhouseCalculator/calculator/default.asp>
 - ‘Saving energy in your school’
http://www.sustainable.energy.sa.gov.au/pages/advisory/education/saving_school/saving_school.htm:sectID=18&tempID=45
 - ‘Eco footprint’ http://journeytoforever.org/edu_footprint.html
 - ‘Ecological footprint calculator’ <http://www.bestfootforward.com/footprintlife.htm>
 - ‘Ecological footprint quiz’ <http://www.myfootprint.org/>
 - ‘Energy Audit proforma’
<http://townsvilleshs.eq.edu.au/tmsce/Programs/ProformaEnergyAudit.doc>
 - ‘Ranking the ecological impact of nations’
<http://www.ecouncil.ac.cr/rio/focus/report/english/footprint/ranking.htm>
 - ‘Energy Information Centre’ <http://www.iea.org/Textbase/subjectqueries/index.asp>

REDUCING ENERGY USAGE AND GREENHOUSE EMISSIONS

Students look at the actions that others are taking to reduce their impact and consider how they might reduce their own impact

- Show students the poster from the Brink factfile entitled ‘Taking action in Mallorca’. (This is where Kendon spent some time on his expedition.) Ask students what they think the poster is about. (It is in Spanish. The poster urges citizens in Palma, Mallorca to ride bicycles instead of using cars in order to reduce the production of greenhouse gasses.) Tell students that people all over the world are taking action to reduce greenhouse emissions and reduce their energy usage.
- Invite students to form groups and give each group one of the website addresses below and ask them to report back to the whole group on the types of things people are doing to reduce their impact. Assist students to record their findings by asking questions that provide structure E.g. What is the name of the project? Who is doing it? What are they doing? Where are they located?

- Australia's coolest communities
http://www.qccqld.org.au/climate_change/coolcom/coolestcom.htm
- 'Eneraction: Lights off' <http://www.greenlearning.ca/EnerAction1pager.php>
- 'One less tonne' <http://www.onelesstone.ca/>
- 'The BET' <http://www.thebet.de/>
- 'Greenpeace Plans Arctic Trek to Highlight Global Warming'
<http://www.planetark.com/dailynewsstory.cfm/newsid/30581/story.htm>
- 'Swiss Put Glacier Under Wraps to Slow Ice Melt'
<http://www.planetark.com/dailynewsstory.cfm/newsid/30754/story.htm>
- 'Dress down to save Japan' <http://news.bbc.co.uk/2/hi/asia-pacific/4397849.stm>
- 'Local greenhouse action award'
<http://www.dotars.gov.au/localgovt/nalg/factsheets/greenhouse.aspx>
- 'Cool kids for a cool climate'
<http://www.coolkidsforacoolclimate.com/Cool%20Kids%20Project/SYF.htm>
- 'Greenfleet projects' <http://www.greenfleet.com.au/planting/projects.asp>
- 'Fisher and Paykel: Conscious of the effect'
http://www.ergon.com.au/large_commercial/elements04/earth01.asp
- 'Clean energy'
http://www.ergon.com.au/environment/clean_energy/household.asp?nf=true&platform=
- 'Solar schools' <http://www.solarschools.net/qld/about.aspx>
- Brink expedition <http://www.brinkx.org>
- Invite students to find out what more about what they can do as a class, school, family and individual. Invite students to develop a collaborative and personal plan of action. 'Resource 4: Project planning guide' can be used for a group action plan. 'Resource 5: Using energy resources more wisely' can be used for an individual action plan. For a guided activity go to 'Being energy wise' http://www.sustainableenergy.qld.edu.au/activity/activity12_2.html and Using energy wisely http://www.sustainableenergy.qld.edu.au/fact/factsheet_12.html Some sites that may be helpful include:
 - 'Greenhouse effect and energy efficiency in schools' (how to develop a school action plan)
<http://kp.cgu.edu.au/energyefficiency/greenhouse.html>
 - 'AGO Energy saving tips: what can you do?' (home, school, transport and work)
<http://www.greenhouse.gov.au/education/tips.html>
 - 'At school what can you do?' (case studies of school action plans)
<http://www.greenhouse.gov.au/local/schools.html>
 - Choice magazine article – 'How to save the Earth and your money'
<http://www.choice.com.au/viewarticleonpage.aspx?id=100230&catId=100520&tid=100008&p=1> How two families fared using the Australian House Greenhouse Scorecard
 - 'Personal action plan'
http://www.nrm.qld.gov.au/education/modules/primary/primary_greenhouse/personal_action_plan.html
 - 'Global warming pledge' <http://www.rideyourbike.com/globalwarmingpledge.html>
 - 'What difference can I make?' http://www.sustainableenergy.qld.edu.au/fact/factsheet_16.html

REFLECTING ON THINKING AND DOING

Students reflect on what they've learnt and done

- Throughout the project planning and after encourage students to reflect upon what they have learnt and the extent to which that may alter their behaviour. Use the journal started at the beginning of this module. 'Resource 5: Using energy resources more wisely' has an evaluation component that lasts for two months.
- To encourage further reflection create a classroom journal. Make a book and write the first entry yourself reflecting on how you are progressing with a personal energy behaviour change. (You can also include a drawing.) Each day ask a different student to take the classroom journal home and write (and draw) an entry that reflects upon the most recent contribution before their own. In this way students reflect upon their classmates' and teacher's journal entries.

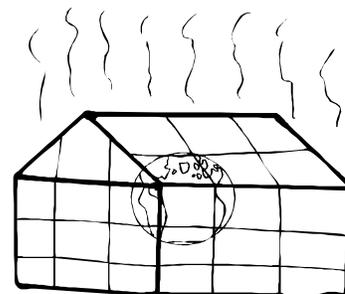
Resource 1: Global warming and climate change



Background information

In 1896, a Swedish Chemist (who later went on to win the Nobel Prize for Chemistry in 1903) by the name of Svante Arrhenius predicted that the burning of carbon based fossil fuels would significantly increase the concentration of carbon dioxide in the atmosphere, hence leading to a warming in the average global temperature. Arrhenius' prediction of Global Warming was largely ignored by his contemporaries and virtually nothing was done to reduce carbon dioxide emissions.

The effect that Arrhenius predicted is now known as the Greenhouse Effect, because carbon dioxide in the atmosphere acts like the glass in a greenhouse, letting the warm sun light in, but preventing the re-radiated heat from escaping into space. The Greenhouse Effect is a very important natural phenomenon, without it life on the Earth would be very different to the way it is today, as the Earth would be about 30°C colder than it is! However, the Enhanced Greenhouse Effect, or Global Warming could have dire consequences for the inhabitants of Planet Earth.



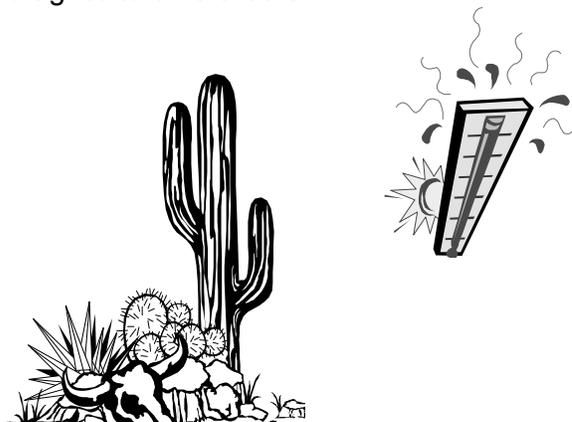
Key Principles

There is significant evidence and international consensus that the global climate is changing. The rate of change is faster than that which can be explained by natural phenomenon and climatic cycles. There have been significant increases in atmospheric greenhouse gases over the past two centuries, attributed to the activities of humans since the industrial revolution.

The main greenhouse gases that humans are contributing to the atmosphere are:

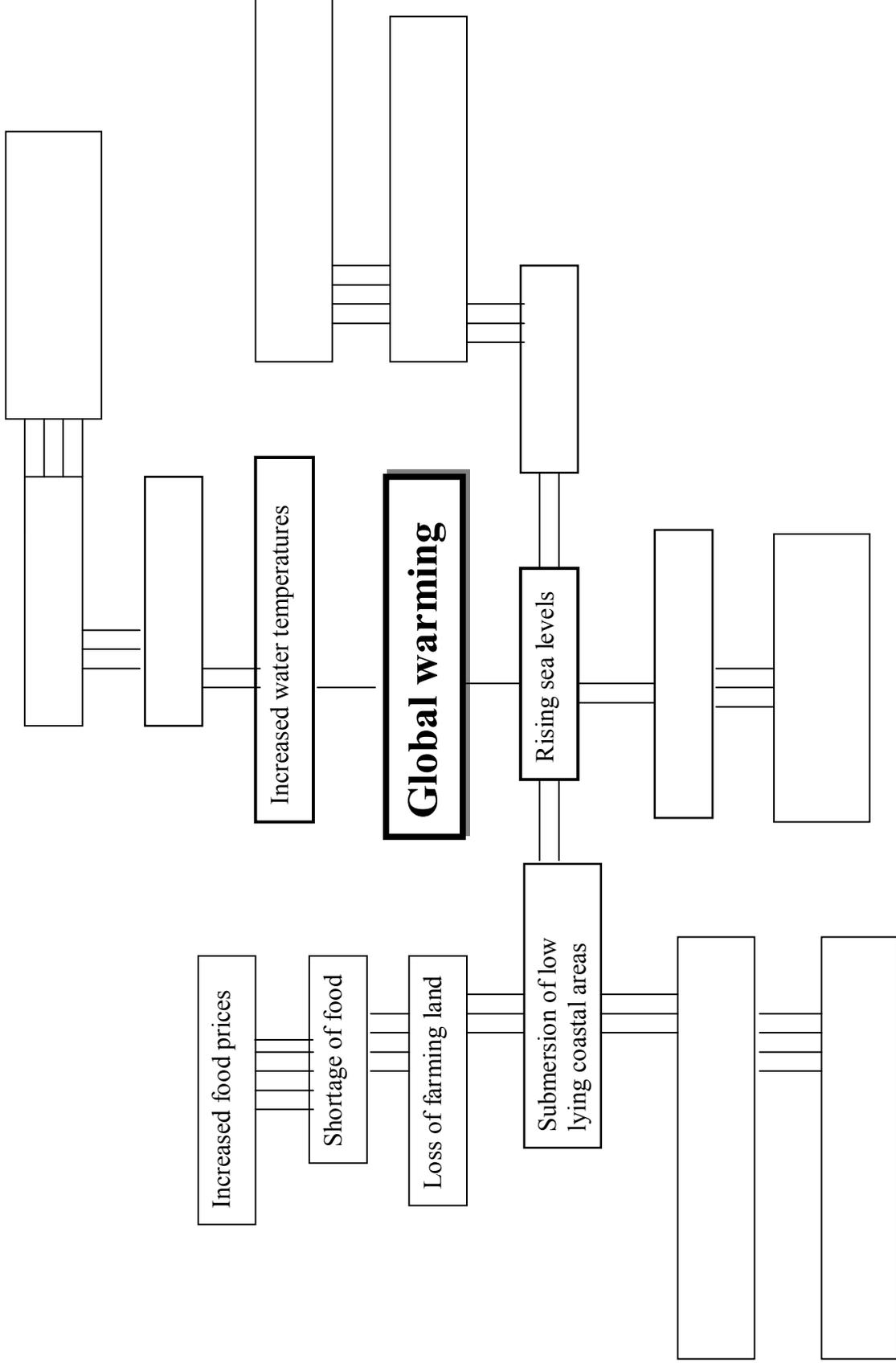
- Carbon dioxide, produced from burning fossil fuels for electricity production, manufacturing and transport. (Land clearing reduces the ability of the planet to absorb the CO₂.)
- Methane, produced from the anaerobic breaking down of organic matter. The main sources are landfills, rice paddies, the guts of ruminant animals, gas leaks and coal mining.
- Nitrous oxide, produced from coal combustion and agricultural fertilisers.

The expected changes to the Australian climate (E.g. increased intensity of extreme weather events, less rainfall in many parts, increased pests and diseases, sea level rises etc) will affect agriculture, forestry, tourism, infrastructure, human health.



Source: Queensland Sustainable Energy Industry Development Group, 2004, *Renewable Energy School Workshops: Global Warming and Climate Change*, Built Environment and Engineering, QUT, Brisbane
Note: These materials will be posted on Education Qld's Curriculum Exchange website in mid 2005

Resource 2: Consequence chart



Resource 3: The ways we use energy

Energy use

Prior to the **Industrial Revolution**, human societies were largely dependent on **renewable energy sources** such as solar energy. Solar energy was used to heat, cool and light homes and to dry crops. Wind and water power ground wheat and pumped water. Wood was used for cooking, crop drying and space heating. Now in most countries, we use a combination of **fossil fuels, nuclear fuels** and renewable energy.



In Australia, it is estimated that 94% of our energy demand is met from fossil fuels and only about 6% from renewable energy. However, the contribution of renewable energy to our total energy demand has been largely underestimated. For example, the contribution renewable energy makes to crop drying and production, or to space heating, cooling and lighting of buildings is not currently included in government estimates of energy consumption. The solar energy used to dry clothes on an outdoor clothes-line is never accounted for, yet when the same clothes are dried in an electric clothes dryer, the energy required is part of the official economy and is therefore counted.



Energy services

The whole purpose of our use of energy is that it provides us with services. Whether it is light to read by, refrigeration for food or just getting from place to place, it is the service that we are after, not the **joules**. Joules in themselves are of no use to us! Whenever we design an energy system then, we need to consider the system from the starting point of **energy services**.

Your lifestyle determines what energy services you require and this is where the whole story starts. In a **domestic dwelling**, these energy services are usually fairly clearly defined. They depend most of all on lifestyle. They also depend to some extent on location. A list of the major categories of energy services are as follows:

Heating: space heating, water heating and cooking

Cooling: space cooling, refrigeration

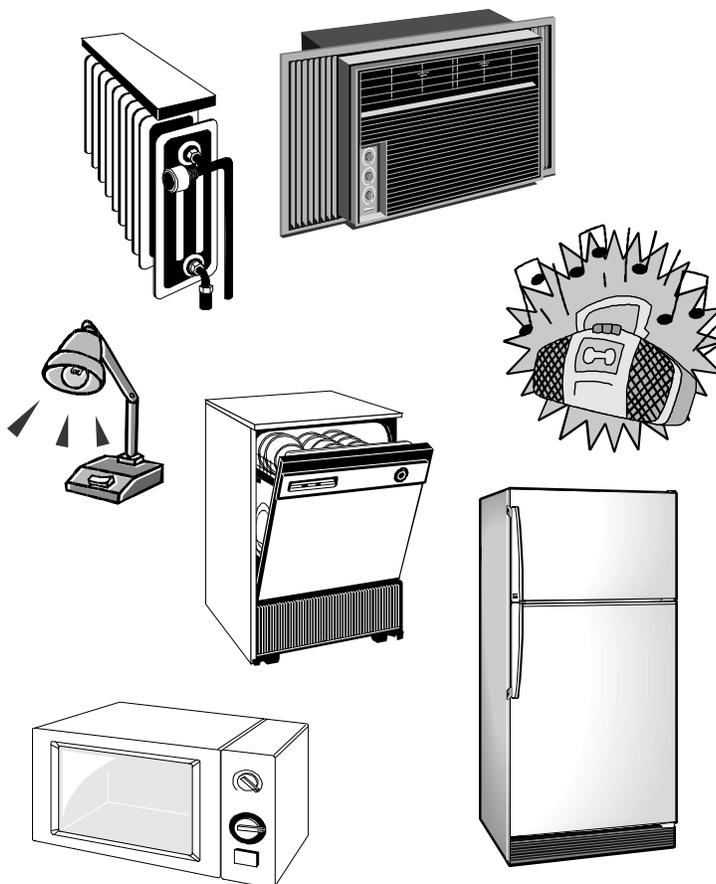
Lighting: visual (task oriented) & mood

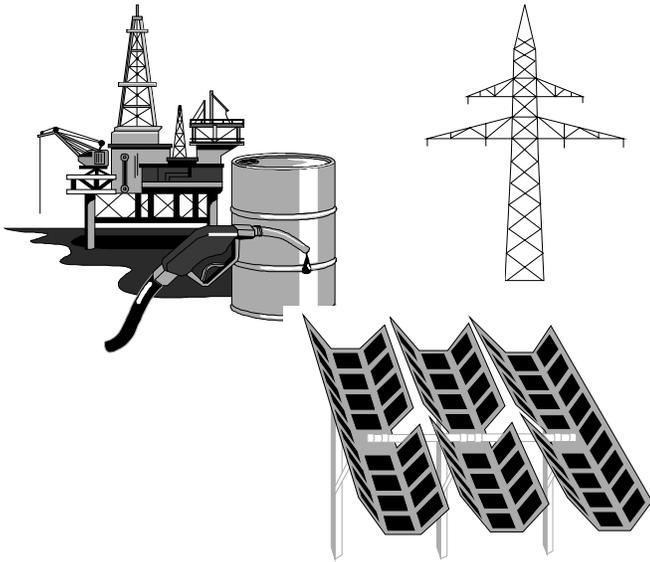
Entertainment: TVs, DVDs, music systems, Computers, electronic games etc.

Communication: phones, computers, office equipment

Work: cleaning and maintenance appliances and tools (e.g. washing machines, dishwashers, vacuum cleaners, power tools, lawn mowers etc), office equipment

Other: water pumping, waste disposal





Energy could be supplied for these services from different energy sources and in different combinations. Where energy is supplied by a **utility**, this will usually be electricity or gas. Where a dwelling is remotely situated, a **generator** and **portable gas cylinders** are often used to provide the same services. Our aim should be to select the source that is most appropriate for each service. This means taking into account **the first and second laws of thermodynamics** (i.e. efficiency and energy quality), other factors such as **environmental impacts**, as well as the usual **economic constraints**. This often means replacing fossil fuel energy sources with renewable energy sources, and it always means maximizing the efficiency of energy use.

The following table shows the proportions of energy use in the home in Queensland. Water heating is usually the largest consumer of energy, often accounting for more than one third of the energy use in the household. The energy required for space heating, cooling and refrigeration depend very much on climate. It is interesting to note the dramatic increase in air-conditioning in many parts of Australia in recent years. Is it because the climate is much hotter or because our lifestyle expectations have changed?

Energy Service	Australian average* Proportion of household energy use (end- use)	Brisbane average** Proportion of household energy use (end- use)
Water heating	27%	38%
Refrigeration	9%	16%
Cooking	4%	10%
Lighting	5%	11%
Space heating & cooling	39%	11%
Standby / ghost power	4%	6%
Other / appliances	12%	8%

Composition of household energy use in Australia and a sample for Brisbane.

*Data from AGO 1999 ** Data from RMIT – Green Plumbers (data for 1998)

NOTE 1: For Brisbane between 1994 and 2001 there has been an increase in the daily average energy use per person of 20.4% (Courier Mail. Oct 2001)

NOTE 2: the typical standby power is now said to be around 11% of the daily energy use.

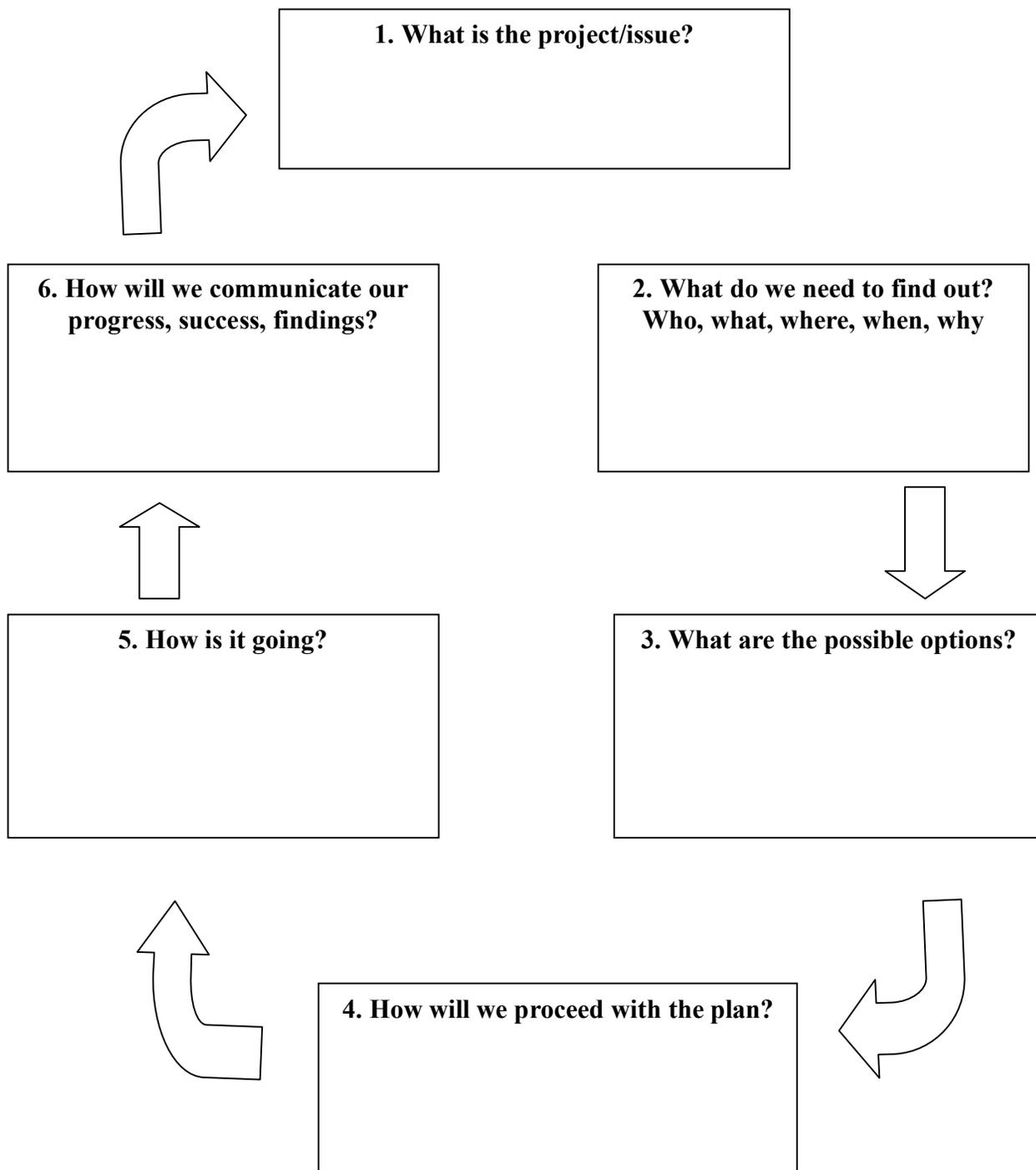
Of course there is no such thing as an ‘average’ home, and your household energy use may vary from these figures considerably. Variations are largely dependent on climate and life style choices.

Source: Queensland Sustainable Energy Industry Development Group, 2004, *Renewable Energy School Workshops: Global Warming and Climate Change*, Built Environment and Engineering, QUT, Brisbane

Note: These materials will be posted on Education Qld’s Curriculum Exchange website in mid 2005

Resource 4: Project planning guide

Using an action research sequence



Resource 5: Using energy resources more wisely

1. Find out things that people can do to use energy resources more wisely. Add them to the lists below.
2. Choose two or three things that you think you can do. Tick the boxes of the things you decide to do.
3. Rate how well you have stuck to your decisions after one and two months.

	Tick the boxes of the things you will do	Self evaluation	
		After 1 month	After 2 months
AT SCHOOL/WORK:			
AT HOME:			
GETTING FROM ONE PLACE TO ANOTHER:			

Some additional Internet resources

1. www.qse.org.au Queensland Sustainable Energy Industry Development Group (QSEIDG) has produced five activity sets entitled; Global Warming and Climate Change, Passive Solar Building Design, Photovoltaics (Solar Electricity), Wind Power, and Solar Cooking. The materials provide a range of activities, suitable for mid-primary through to senior secondary school. Background information and lists of additional resources are also provided.
2. www.greenhouse.gov.au Australian Greenhouse Office has lots of information about renewable energy in Australia and government programs.
3. www.ata.org.au Alternative Technology Association is a not-for-profit environmental organization which provides information, advice and publications about renewable energy and other sustainability issues to the community.
4. www.epa.qld.gov.au/environmental_management/sustainability/energy Environmental Protection Agency (Qld Government) has specific information about Queensland's programs and resources on this site.
5. www.rise.org.au Research Institute for Sustainable Energy (Murdoch University) has a series of fact sheets on renewable energy technologies and global warming called the RE files.
6. www.bcse.org.au Australian Business Council for Sustainable Energy site contains information about renewable energy projects and issues in Australia including strategies for reducing our greenhouse gas emissions.
7. www.nrme.qld.gov.au/energy Department of Natural Resources, Mines and Energy (Qld Government) provides a list of energy policies and regulations (including Queensland's Greenhouse Strategy) as well as energy resources on this site.
8. www.ghgonline.org Greenhouse gas news and publications.
9. www.panda.org World Wildlife Foundation (WWF) is an international non-profit organization very active in global warming and nature preservation projects and lobbying.
10. www.cana.net.au Climate Action Network Australia (CANA) is an alliance of over 30 regional, state and national environmental, health, community development, and research groups from throughout Australia. Climate Action Network Australia develops policy positions outlining ways we can tackle climate change.
11. www.ipcc.ch Intergovernmental Panel on Climate Change assesses scientific, technical and socio- economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation.