Title: What is the environmental impact of our wants?

Topic	This learning sequence provides students with opportunities to investigate the matter and energy flow in our environment. How materials are produced, transported, used and disposed of as goods that have social, economic, environmental and political consequences. How energy and water is generated and use and the impacts of that. Students will evaluate the impacts of different products and learn how to make ethical choices and transform their behaviour.
Standard	4/5
Stages	10-15
Year level (s)	9/10
Curriculum area/s	Science
Strand/s	1. Science as a human endeavour 2. Scientific Inquiry 3. Scientific communication 4. Science as a body of knowledge • Energy and Force • Matter • Living Things • Earth and Space
Understanding goals	1. Students will understand the concept of environment and how scientists work by breaking it up into compartments especially atmosphere, biosphere, hydrosphere and lithosphere. 2. Students will understand the raw materials; economic, environmental and social costs associated with consumer goods and will be able to make sustainable choices. 3. Students will understand the role of various industries in Tasmania and consider the economic, social and environmental impacts and outline a preferred future for Tasmania. 4. Students will understand how energy is transformed and captured for use in society and the benefits and costs associated with different types of energy generation.

Unit at a glance

What is the environment?

- How did the earth begin?
- Why is it important to study the environment?
- How do scientists study the environment?
- How do living things change the environment?

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What is my environmental/ecological footprint (locally, nationally and globally)?

- Is it a want or a need?
- What is my ecological footprint?
- What are the patterns of use of small electronic devices across generations?
- What is the lifecycle of these products that I use in my everyday life?
- What is the cost of metal in a mobile phone?
- How can these metals be recycled?
- What is the impact of my need for electronic devices on Indigenous people here in Australia and across the world?
- Case Study of the Congo and Tantalum

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How do humans use and recycle energy?

- What happens to solar radiation?
- What is light?
- Why is the sky blue with red sunsets?
- Why are plants green?
- How does light provide us with energy?
- How is electricity generated in our community?
- What is the difference between passive solar energy and photovoltaic cells?
- What is the greenhouse effect?
- How can we construct a solar water heater?
- How well do different materials heat up?
- How much solar energy is used in our community?
- What are the alternative energies being used in Tasmania or Globally?
- Student investigations into Alternative energy
- Local Case investigation: Audit of the Ulverstone Pool for water and energy usage and Return of Investment analysis.

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What changes are occurring in the Tasmanian Environment?

- What is biodiversity?
- How can populations be measured?
- What are the effects of introduced species in Tasmania?
- How can we measure change in the abiotic and biotic environment
- Case study: Study of Native Forest compared with Plantation forest
- What is your preferred future for the earth for your children and grandchildren?

Links to the Science strands and sub-strands

Strand/sub-strand	Key questions
Science as a human endeavour (SHE)	• What are the ranges of jobs relating to the environment in Tasmania? • How has science influenced our knowledge and management of the environment? • What is the history of the natural resource management in Tasmania? • How do competing interests impact on the sustainability of the environment?
Scientific inquiry (SI)	• How does a scientist measure change in the environment? • How do scientists study forests? • How do changes in the environment affect society?
Scientific communication (SC)	• How can I evaluate the reliability of information about the environment? • How is scientific information about the environment presented to society? • How can I best communicate my understanding about environmental science?
Energy and force (EF)	• How is energy transformed and cycled in the environment? • How is energy generated, distributed and used in society? • What is your preferred future for energy generation, why? • What are the impacts on society, economy, humans and the environment of different energy production and usage?
Matter (M)	• How is matter transformed and used and disposed of by consumers? • What are the effects of function and use of different materials on people and the environment?
Life and living (LL)	• How are organisms dependent on other organisms in Tasmanian ecosystems? • What are the consequences of changes to an ecosystem? • How do matter and energy flow in ecosystems?
Earth and space (ES)	• What are the merits of using resources in the Tasmanian environment? • What are the consequences of human activity on the atmosphere, biosphere, hydrosphere and lithosphere?

Links to the Financial Literacy Descriptions of Learning Year 9

Dimensions	Key questions
Knowledge and Understanding	• Understand that income is derived from a range of sources, including wealth, with different levels of reliability *For example how scientists work to earn a living and the risks and return from investing in resources in the environment.*
Competence	• Use critical thinking and problem solving skills to make informed consumer and financial decisions *Students analyse the costs of creating, transporting and waste associated with particular materials or products and consider what individuals, community groups and governments could do to make a difference.*
Enterprise	• Recognise opportunities to generate income and wealth and the risk management of those opportunities *Students will analyse the income generation of various resource based industries and compare these with the cost of goods made of these resources.* *Students will audit and analyse the cost of running a heated swimming pool and make recommendations to introduce efficiencies to enable savings for the community.*
Responsibility	• Develop ethical behaviours *Students will take action to recycle products in the home and at school;* • Demonstrate informed and assertive buying behaviours *Students will understand that life style decisions may affect the environment; they will develop buyer resistance strategies and transform their own behaviours in energy and water usage.*

Science concepts and main ideas that the unit develops

Strand/sub-strand	Main ideas/concepts
Science as a human endeavour (SHE)	• Scientists work, think, inquire and know in particular ways • Applications of science have shaped and changed the world • Applications of science have systems impacts
Scientific inquiry (SI)	• Scientific inquiries are generated from observations, questions and predictions • Scientists plan and conduct investigations in particular ways • Scientists draw conclusions after considering various interpretations of their data
Scientific communication (SC)	• Scientists consider accuracy, relevance and credibility when acquiring information • Scientists need to communicate information in a variety of ways
Energy and force (EF)	• Energy can be transferred and transformed • Humans use energy and this raises ethical and sustainability issues
Matter (M)	• The chemical and physical properties of materials are determined by their structure • Humans use materials and this raises ethical and sustainability issues
Life and living (LL)	• The structure and characteristics of living things affect their behaviour and functioning • A diverse range of living things has evolved on the Earth • Humans interact with ecosystems and this raises ethical and sustainability issues
Earth and space (ES)	• Earth and space have characteristic features and patterns of activity • Earth and space systems continue be shaped by the changes they experience • Humans use the Earth and this raises ethical and sustainability issues

Detailed unit overview

Title • Concepts / main ideas	Learning opportunities	Assessment	Length
1. How did the earth form, and why should we study it. ***Science ideas:*** • What does environment mean? • Origins of the earth • What are materials on Earth made from? • Periodic table of elements • Why study the environment? ***Financial literacy ideas:*** • Understand that income is derived from a range of sources, including wealth, with different levels of reliability	***What is the environment?*** Students share in community circle ideas relating to the environment. Students define in their own words, the meaning of 'environment'. Students refine their definition with their partner and with the whole class. Watch the BBC video of the Lyrebird filmed by David Attenborough available: http://www.youtube.com/watch?v=VjE0Kdfos4Y This is to show the awe and wonder of the wildlife here in Australia Students share what animals and environments they want to see and visit in the future. ***How did the earth begin?*** Watch the BBC video *Star stuff* from the series Space – or a similar video. This shows the big bang and how hydrogen was transformed into all the matter that makes up the earth. It suggests a theory of how life originated on earth. Have students highlight hydrogen on a Periodic Table. This demonstrates all of the matter, all of the different elements. Explain how when atoms of hydrogen are fused, new elements can be made e.g. helium with 2 protons, neutrons and electrons and carbon with 6 protons, neutrons and electron etc. ***Why is it important to study the environment?*** Students work in pairs to brainstorm reasons why it might be important to study the environment; Create a whole class list of reasons for scientists to study the environment (draw out reasons such as biodiversity, endangered species, clean water, access to food an resources, politics, farming, mining, pollution and to measure change etc.) Show the video for the Lyrebird Unseen footage available: http://www.youtube.com/watch?v=KOFy8QkNWWs This will reveal the need to be a critical consumer of advertising and scientific information. Emphasise to students that this is likely to be particularly important in considering environmental issues, due to the diversity of opinions that exist and the strong opinions that individuals hold.	Assess students' understanding of: • why it is important for scientists to study the environment • All substances on Earth being formed from elements listed in the Periodic Table	1 week or 250 mins

2. How do scientists go about studying the earth and the environment? ***Science ideas:*** How do living things change the environment? • ways in which scientists work • scientists divide the earth into spheres • living things can change their environment • Photosynthesis and respiration ***Financial literacy ideas:*** • Understand that income is derived from a range of sources, including wealth, with different levels of reliability	***How do scientists study the environment?*** Impress on students that the earth is a very large and diverse space and hence difficult to understand. Have students consider how scientists might go about studying such a complex and interactive system. Have a dialogue about how scientists divide the earth up into smaller parts, how these parts are studied, and some of the systems interactions that occur. Explain to students that scientists use models to make predictions for the future e.g. modelling around climate change, modelling the effects of human activity on reefs etc. Show different spheres of the earth (biosphere, lithosphere, hydrosphere, atmosphere) and also consider different models with the cryosphere and the anthrosphere (Images available: http://www.uwgb.edu/dutchs/PLANETS/earth.htm) ***How do living things change the environment?*** ***Terrarium datalogging experiment:*** Students set up two environments/terrariums one with sand only, while the other has soil and plants (eg, cyclamens, liverworts, mosses, ferns) These environments are sealed and data loggers measure the concentration of carbon dioxide and oxygen and the air temperature in the terrariums over a 24 hour period with light and dark. Students analyse the patterns of temperature and change in the gases over the day and night. Students need to explain the changes using their understanding of photosynthesis, respiration and radiation. Some explicit teaching/reading about these ideas will be necessary here. ***Snail and pond weed experiment:*** Students set up an investigation with pond weed and snails in the light and in the dark and use bromothymol blue to measure CO^2 changes. For example, see http://www.biologycorner.com/worksheets/ecosystem.html or http://www.nohum.k12.ca.us/ahs/ebridge/images/uploads/larmin/Plant-animal_activity_lab.pdf or http://web.mac.com/thompsonron/Site/Biology_Inquiry_Lab_Activities_files/Snail%20Lab.pdf In brief, students set up vials containing variations of plants, snails and pond water with bromothymol blue in both light and dark conditions. Before setting up the vials, students will breathe using a straw into the bromothymol blue and pond water and notice the colour change. Explain that CO^2 causes the colour to change from blue to yellow, as it is an indicator of pH. Have students complete a POE (Predict; Observe; Explain) before, during and after completing this experiment.	Assess students' understanding of: • some ways in which scientists use models to study the Earth • some ways in which living things can impact on and change their environment	1 week or 250 mins
3. Investigating ecological footprints	***Is it a want or a need?*** Students classify everyday objects as being a personal need or a want (eg. TV, mobile phone, bed, clothes, computer, fruit, meat, family, friends, books, house, garden, pets, air conditioner, lighting). They then compare their classification of these objects with Abraham Maslow's Hierarchy of needs. You can find a	Assess students understanding: • of ways in which the products they	5 weeks or 5 x 250min

Science ideas:
• Needs and wants
• Ecological footprint
• Humans impact on the environment
• Properties of metals
• Product lifecycle (matter, energy, economic, social and environmental costs)
• Coltan mining of the Congo
 	
Financial literacy ideas:
• Values
• Resources that people use
  • Use critical thinking and problem solving skills to make informed consumer and financial decisions
  • Develop
	diagram showing Maslow's hierarchy at sites such as http://en.wikipedia.org/wiki/Maslow's_hierarchy_of_needs
	Play the needs and wants game. Available: http://www.unicef.org.uk/tz/games/index.asp
	Reflect on what the game and the hierarchy suggest are our actual needs. Write a new list as a whole class.
	
	What is my ecological footprint?
	Students calculate their own personal footprint using a greenhouse emissions calculator or a school ecological footprint calculator, such as those available at http://www.epa.vic.gov.au/ecologicalfootprint/default.asp or http://www.powerhousemuseum.com/education/ecologic/games.htm Discuss the types of choices that lead to an increased ecological footprint.
	
	Survey: Lifetime use of small electronic devices?
	Students construct a survey of the number of mobile phones, mp3 players that members of the school community have owned in their life so far. Have the survey include questions about the disposal of these devices. Discuss whether the devices are a need or a want.
	
	Ewaste: Literacy reading task (Graphic Outline)
	Students read a newspaper article such as 'Spurned technology a toxic rubbish mix' and summarise it using a graphic outline. This reveals the valuable metals that end up in landfill (eg. gold, copper and aluminium) as well harbouring the toxic substances (eg. lead, mercury, arsenic, beryllium and cadmium) that leach into the environment. Discuss ways that the problems outlined in the article could be overcome or lessened. Mark the elements referred to in the article on a Periodic Table and discuss which groups they are part of.
	
	What is the lifecycle of some products that I use in my everyday life?
	Ores and Metals
	Students work in small groups to identify the metals and the ores that are commonly used in everyday life. Find their location on the periodic table. Draw up a table showing where the metals are used and the properties that are important from a consumer / manufacturing perspective (eg. colour, melting point, cost, are they magnetic)
	
	Identifying metals and ores in the environment?
	Flame tests
	Students identify metal elements with the fingerprint flame colour. This technique is used for testing of soils and creeks and in mineral exploration. For instructions, see Resource list - *The Science of Mining*.
		purchase and use can have systems impacts
		• of characteristics of metals	

ethical behaviours • Demonstrate informed and assertive buying behaviours	***Extracting Copper*** ***Obtaining Metals – copper by electrolysis*** Compare two methods of copper extraction. Method 1: Ore ($CuCO_3$ in plaster of paris rocks) extracted with electrolysis in sulphuric acid. 1 teaspoon of copper carbonate to 1 cup of plaster of paris with water to mix. Once plaster has set, it can be broken into small pieces with a hammer. Students then grind a measured amount of the 'ore' in a mortar and pestle. Add Dilute Sulphuric Acid (2M) to dissolve the 'ore'. Extract the copper using the electrolysis method. Method 2: $CuCO_3$ heated to form CuO which is then added to sulphuric acid and warmed to make copper sulphate solution and copper is extracted by electrolysis. Refer to Unit 2.2 Prac 1 *Electrolysis of Copper* p 38 Phillips et al. (2002) SCI 4 Longman outcomes: Melbourne. Analyse the chemical reactions and their potential impact on the environment. ***What is the cost of the metal in a mobile phone?*** Students complete a retrieval chart (see http://www.discover.tased.edu.au/SOSE/charts.htm for an example of a retrieval chart) from a list of Internet resources to calculate the costs of different mobile phones, proportions of the mass of a mobile phone made of different metals and the cost of metals in the market. They then weigh their own mobile phones and calculate an average mass for the class. This information is used to calculate the cost of the metal in the phone and compare this with the actual cost of the phone. Explanations for the price discrepancy are then considered by the students. Was it what they expected? ***Recycling Copper: A chemical reaction illustrating the conservation of mass*** Using a weighed mass of waste copper turnings, a series of chemical reactions are completed to convert the copper to copper nitrate, then to copper hydroxide, then to copper oxide, then to copper sulphate and finally the copper is displaced out of solution. **This set of chemical reactions does produce some toxic chemicals and this risk needs to be planned for and completed safely.** Refer to this protocol available: http://www.uq.edu.au/_School_Science_Lessons/topic12.html#12.1.3 [18th December 2009]. ***Guest Indigenous speaker*** Invite a guest speaker to share the Indigenous perspective on the relationship of Australian Aboriginal people with the environment and the impacts (positive and negative) that mining has had for Australian and Torres Strait Islander people. Research the impact that mining has had for indigenous people in other parts of the world. Have students complete a personal reflection: • What was one new thing that you became aware of?		

	• What are the main features of the relationship between Indigenous people and the environment? • What are some impacts that mining has had on indigenous people? ***Case study: Mobile phones, eating Ape and Tantalum (Coltan mining in the Congo)*** Engage: Watch Foreign Correspondent: The Congo Connection Available: http://www.abc.net.au/foreign/content/2009/s2680172.htm (18th October, 2009). Key questions to investigate or research: • What is the issue? Students participate in a jigsaw activity to read the article Guns, Money and Cell Phones (2001) available: http://www.globalissues.org/article/442/guns-money-and-cell-phones to get a sense of the problem. • Where is the issue? Locate on a map, the Congo, the mines, the distribution of the apes • Why is tantalum important? • How is tantalum mined and manufactured into mobile phones? • What are the social, economic and environmental impacts of this mining? • Complete a classification table identifying both the positive and negative impacts of the use of this metal? • What decisions can I make as a consumer to reduce my impact in the Congo? Students use a decision making matrix (examples at http://www.enchantedlearning.com/graphicorganizers/decision/) to evaluate 3 decisions and justify their answer. ***Research Task*** Research the lifecycles and impacts of different products and, hence, the impacts of choices that we make as consumers. Have each student select a product such as: • iPod • Toilet paper • Soap • A4 paper • Light bulb • A packet of crisps • Babies bottled milk • Disposable nappies • A apple • A lamb chop They then research and decide on answers to the following questions: • What are the molecules or elements that this product is made of? • Where do these molecules or elements come from?		

	• How is this product processed? • How far does this product travel to the consumer? • What energy is required to make it? • How many times do consumers use the product? • What is the life of the product? • How is the product disposed or recycled? • How much do you pay for the product? • Is this price reflecting the true cost or value of the product including the social and environmental costs? Explain why? • What choices does a consumer have to overcome the impacts of this product on society and the environment? Negotiate how students will present the results of their research (e.g. PowerPoint , mind map created with the *Inspiration* software)		
4. **Energy consumption** ***Science ideas:*** • Characteristics of light • The greenhouse effect • Alternative energy sources • Scientific inquiry method ***Financial literacy ideas:*** • Understand that income is derived from a range of sources, including wealth, with different levels of	***What happens to solar radiation?*** ***Spectroscope investigations*** This investigation is about the reflection, absorption and scattering of light. Students use a spectroscope to investigate why objects appear different colours. They need to find the effect that various materials have on the spectrum of white light. Students will use coloured filters, opaque materials, fabrics and coloured paper and black cardboard, as well as green leaves and see the interactions of the light - what colours are absorbed and / or reflected in different situations? Refer to p 17 ASEP Solar Energy Booklet (1974) ISBN 0 7241 3102 7 for this and below investigations. ***Why is the sky blue with red sunsets?*** ***Experiment*** Students use a vial of water with 8 drops of milk to investigate the scattering of light. This requires a dark room and a narrow beam of light (torch with a cardboard mask). Students look at the light from at 90 and 180 degrees from the light source and write down their observations. Explain that the particles of milk act in a similar way to the dust and water vapour particles in the atmosphere that scatters the light. In the vial the white light is scattered. The red pulses are scattered less than the blue light pulses. Refer to p 21 ASEP Solar Energy Booklet (1974) ISBN 0 7241 3102 7. ***Why are plants green?*** ***Experiment*** Students make a solution of chlorophyll the green pigment in plants. They use a spectroscope to view the spectrum after white light passes through the green solution. This can explain that plants absorb green light and trap the energy via photosynthesis that is passed on up the food chain as chemical energy. Refer to p 24 ASEP Solar Energy Booklet (1974) ISBN 0 7241 3102 7.	Assess students understanding: • of the importance of the sun as a source of energy • of ways in which humans meet their energy requirements and the systems impacts of these choices • of changes that may occur as a result of the greenhouse effect • about how to plan, conduct and interpret a scientific investigation	8 weeks or 8x 250 mins

reliability • Use critical thinking and problem solving skills to make informed consumer and financial decisions • Recognise opportunities to generate income and wealth and the risk management of those opportunities • Develop ethical behaviours • Demonstrate informed and assertive buying behaviours	***How does light provide us with energy?*** ***Energy flow diagrams*** Students construct energy flow diagrams to show some different transformations that can occur for light that has the sun as its source. Include: • Light for solar panels • photosynthesis > timber (fuel) > coal / oil / natural gas • Light transforms to heat in thermal mass • Light > photosynthesis > plants grow > animals eat plants and other animals > keep them warm etc. ***How is electricity generated in our community?*** ***Mind map activity*** Students work in groups to construct a mind map that shows the various ways that energy is generated and used in our society (eg. electricity, food, light, movement) ***What is the difference between passive solar energy and using photovoltaic cells to generate solar electricity?*** ***Definition diagram activity*** Students construct two definition diagrams to define passive solar energy and solar electricity. These diagrams are a box divided in to four parts. The word goes in a box in the middle. Each box has one of the following headings: Student's definition, Picture of the word's meaning, Examples, Non-examples or teacher definition (depending on what is appropriate). ***What is the greenhouse effect?*** ***Experiment*** Make a greenhouse and measure the trapped energy to demonstrate the greenhouse effect using a temperature probe in a data logger. Explain how this effect is important for the temperature of the atmosphere that is currently so liveable here on Earth compare with other planets. ***How can you construct a solar water heater?*** ***Demonstration with data logger*** A large test tube is filled with coloured water and clamped into a retort stand and boss head. Glass tubing (2 pieces) is placed into the top of a beaker and the bottom of a piece of large glass tubing the same size as the beaker with two cork stoppers. A data logger is set up to record the temperature of the water in the large glass tubing. The test tube is painted black and a lamp is shone on it. The experiment is allowed to run for 30-40 minutes and observations are made each 5 minutes about the colour of the water. Refer to p 51 ASEP Solar Energy Booklet (1974) ISBN 0 7241 3102 7.		

	How well do different materials heat up? ***Experiment*** This investigation is to measure how different materials warm up and cool down at different rates because of latent heat. Students set up test tubes with a cork and thermometer in each one (one for each student so that each material has at least 3 replications). Test tubes can be filled with different materials (eg. water, black soil, brown sand, air). The temperature is measured each minute for 15 minutes outside in the sun and 15 minutes inside out of the sun. A set of class data can be collated and averaged on excel and analysed as a whole class. ***Reading activity*** Read the *Australian Geographic* article*, The Prodical Sun* (see resources list). Compare the pros and cons of 5 solar power technologies in Australia. ***How much solar energy is used in our community?*** Students investigate the solar energy used in their own home, school or community. There is a checklist and resources for this at www.originenergy.com.au/education This search has the links to the investigations. Available: http://www.originenergy.com.au/384/Search-results?query=investigation&section=site [Date Accessed 16th Dec 2009]. Investigation 1: Students calculate the hours of sunshine per day and the average output of solar panels in your area. This is compared with the annual household consumption of electricity as a proportion of energy that is solar power. Investigation 2: Students find the solar energy (passive, thermal, and photovoltaic solar) used in our community and they can compare it with the solar energy being used in another community (Blacktown, NSW, North Adelaide, SA and Townsville, Qld). ***What are the alternative energies being used in Tasmania or globally?*** ***Group research task*** Students complete research to answer the following key questions about a particular alternative energy sources (passive solar, photovoltaic cells, nuclear, hydro, tidal, wave, wind, hydrogen cars, geothermal etc): • What is the alternative energy? • How does it work? • Where does it come from? • How is it made?		

	• Who is it made by? • What are the disadvantages of this alternative energy? • What are the advantages of this alternative energy? • What are the current uses of the energy now in 2009? • Who benefits or is disadvantaged by this alternative energy production/usage? • How much does it cost to buy this energy? This research should be completed in small groups with each group member researching 3-4 questions each. Each group then shares their findings by presenting their research orally to the class. ***Student investigations into alternative energies*** Student select an alternative energy source and brainstorm what they think they know and what they want to know about it (TWLH chart). They then design an investigation that allows them to collect information about the energy source. Examples of possible investigations include: • Effect of a barrage on tidal energy and electricity generation • Which is the best location in our community for a wind turbine to be located? • How do the number and the shape of the blades in the hydro system affect the electricity generated? • Which is the best source of power for Lego cars (solar or battery)? • The effect of orientation of a glass window on the passive solar heating of a house. Students then work through the following process: 1. Students complete a CAF tool (Consider all factors) to identify the factors that affect the situation that they will be investigating. (These are the variables of the experiment). Note: Consider All Factors (CAF) Tool is a table with one column/a brainstorm of all of the variables. 2. Students decide on a research question by identifying the variable that they will change (independent variable), what they will measure (dependent variable) and what they will keep the same (controlled variables). 3. Students make a prediction/hypothesis that describes what they predict the measurements will be as they change the independent variable. 4. Students complete a planner sheet to plan the equipment, resources and method that they will use and book it with the lab technician. 5. Students complete a risk assessment. 6. Carry out the experiment and collate the data in tables. 7. Use and Excel spreadsheets to analyse the patterns in the data. 8. Complete a scientific report on the investigation. 9. Complete TWLH charts to reflect on what was learnt and how it was learnt.		

	Return on Investment: Alternative energy and Water efficiency at a local indoor pool ***Audit exercise*** Students complete an audit of the energy and water usage at the local indoor pool. They consider how installing new technology (such as solar heating, solar panels, water tanks) might reduce the running costs of this facility. Students complete an audit of all of the energy and water usage and wastage. Students search for new technology that could improve the efficiency of the building. They examine the return on the investment aiming for recovery of costs within two years. A report will be written up for the Council listing recommendations.		
5. Impacts on Tasmanian biodiversity - What changes are occurring in the Tasmanian Environment? ***Science ideas:*** • Change • Biodiversity • Monitoring the environment • Monitoring populations ***Financial literacy ideas:*** • Understand that income is derived from a range of sources, including wealth, with different levels of reliability • Develop ethical	***Change agents*** As a class, brainstorm *What are some of the changes occurring in the Tasmanian environment?* Likely change agents that will come up are: • Fire • Logging • Mining • Forestry • Agriculture • Tourism • Introduced species • Drought • Flood • Building developments Students work in small groups to consider what effects these changes are likely to have on living things? You could watch the Catalyst Episode on the Victorian Bushfires (see http://www.abc.net.au/catalyst/bushfires/) and use it as a case study before the groups commence working. This might include reading and having a conversation around the *Prepare, Act, Survive* booklet about bushfire readiness – the Tasmanian version is available at http://www.fire.tas.gov.au/mysite/publications/BushfirePrepareToSurvive.pdf ***What is biodiversity?*** Definition of Key term: Biodiversity Complete a definition diagram to explain the meaning of biodiversity. ***What is a population? How can you count the number of organisms?*** ***Activity: Estimating Populations*** - Quadrat Method and Capture-Mark-Recapture Method (See resource such as Wilkinson (2002-04) a) Quadrat Method model: Using ~ 50 paperclips (exact number should be unknown to the students)	Assess students understanding: • of the variety of factors likely to impact on biodiversity in Tasmania • of how to monitor abiotic an biotic factors	4 weeks or 4 x 250mins

behaviours	and a 10 x 10 cm square made from paddle pop sticks, you can model the quadrat method of estimating population. Spread the paperclips over the bench and measure the area over which the population is spread. Randomly place the paddle pop stick quadrant over the population and tally the number of organisms. Repeat this step a minimum of 3 times. Calculate and average for the samples. Now multiply the average number of organisms in the sample size by the number of times the 10 x 10cm quadrat will fit in the area that the population covers. b) Quadrat Method: Once students have done this in the classroom, take them outside to measure real populations e.g. Lichens on a tree, weeds in a lawn or newly germinated seedlings in some leaf litter. c) Capture-Mark-Recapture: Use shells, beans, coins paperclips or similar to model your population of animals. Spread your population out on a table and use an agreed technique to capture some individuals. Mark them with a permanent marker or some fingernail polish. Record the number that was marked. Then redistribute your population on the table, and use the same technique as previously collect a sample. Record the number of marked individuals recaptured and the total number of individuals captured on the second occasion. Use the following equation to calculate the equation: Population estimate = (number caught first time x total number caught second time) ÷ number of marked crickets caught the second time Examples of this practical which you might like to modify can be found at http://fish.washington.edu/classes/fish210/data/labs/Mark_Recapture_Lab-1.doc (uses beans) or http://www.bioed.org/ECOS/pubs/DissertationChapters/AWhiteleyChapter5.pdf (uses crickets) ***Activity: Dingos, Wallabies and Grasses*** This game is played outside in a large space. It represents the flow of energy and matter in a food chain and demonstrates the effect of predator and prey populations as they increase and decrease over time. See Wilkinson (2002-04) or visit http://webs.mn.catholic.edu.au/science/wilko/LE85/notes/len01.doc , page 10 or www.parkweb.vic.gov.au/education/park_ferals/pf.doc p.21 ***Case Example: Comparing Plantation and Native Forests*** Students measure the impact of plantations on the abiotic and the biotic environment at a suitable excursion site that has both native forest and plantation areas. They present the result of their investigations as a report. Students will complete 2x100m transects measuring: • Light • CO^2 • Oxygen		

	• Biomass • Plant diversity • Soil types • Insect diversity • Soil temperature • Soil pH • Tree height • Plant density • They can take photographs and use GPS to locate data on a map.		
6. What is my preferred future for my community and my children's children? ***Science ideas:*** • Preferred futures ***Financial literacy ideas:*** • Understand that income is derived from a range of sources, including wealth, with different levels of reliability	***What is Tasmania's current land use?*** Students consider what they see as being current or potential problems in the Tasmanian environment (e.g. Pollution, endangered species, feral animals) Students work in small groups to create a graphic organiser that shows the likely impacts of one of the following for the Tasmanian economy, environment and people. Display the organisers and allow time for groups to examine them. • Forestry • Mining • Tourism • Fishing • Agriculture • Energy generation • Housing Ask students to consider: What is your preferred future for your children and your children's children? – What kind of place would you like Tasmania to be in the future? Students create a collage, diagram image or poem about their preferred future for Tasmania. Have students share their reflections in a community circle. Are there common themes that come through? List these. Ask students to consider: What could be done to create our preferred future for Tasmania? In a whole class or small group discussion, have students suggest strategies that will enable Tasmania to be sustainable with a viable economic, social and environmental future. Students then work individually to evaluate the strategies.	Assess students understanding: • of the systems interactions that must come into play in making any environmental decisions	1 week or 250 mins

Possible Resources

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Endangered species of Tasmanian information available: http://www.dpiw.tas.gov.au/inter.nsf/WebPages/RLIG-5446TS?open

Greenhouse calculators

http://www.epa.vic.gov.au/Eco-footprint/
The calculators accessible from this site will allow you to calculate the eco-footprint for your household, office or school.

The Australian Greenhouse Calculator
http://www.epa.vic.gov.au/GreenhouseCalculator/calculator/default.asp
The Australian Greenhouse Calculator is a program that will calculate your yearly greenhouse gas emissions based on the information you provide. The calculator will also compare your greenhouse emissions with that of a 'typical' house and a 'green' house.

Bigfoot Powerhouse Museum
www.powerhousemuseum.com/education/ecologic/games.htm
Bigfoot is an interactive program in the EcoLogic exhibition and playable on this site. It estimates the size of your ecological footprint from your answers to 15 questions. Bigfoot is the first ecological footprint calculator to use Australian data and terminology. A footprint is measured in 'units'. Each unit corresponds to one hectare of biologically productive space — about the size of one playing field. As people use resources from all over the world, and affect far away places with their pollution, the footprint is the sum of these areas wherever they are on the planet.