

Queensland Museum Learning

Teacher's notes

Sustainable energy:
you can make a difference

Overview

Target groups:

This activity is designed for **middle school students** studying aspects of sustainable energy use.

Curriculum:

This fits with current KLA's Study of Society and the Environment; Australian Science Curriculum and the Cross-curriculum priority: sustainability. See Appendix for details of curriculum matching.

Pedagogy:

The pedagogy of the unit is based on the Bybee's Five E's model although the five phases are not labelled explicitly. The unit seeks to engage students by making the issues personally relevant to their everyday lives as well as calling them to make decisions and take action.

Learning context: (Scenario)

Students are invited to construct solutions to the problem of using energy more sustainably for the future. Their solutions are presented to an audience (to be determined) in order to convince others to take similar action. The strong message is that: *together we can make a difference*. For example, students could be given the role of the *Commissioner for Sustainable Energy* to present an argument to the wider public to use energy in a more sustainable way. Teachers should make their own choices about suitable contexts for their students.

Student task: (example)

The student task needs to be defined according to the chosen learning context. Taking the context of the *Commissioner for Sustainable Energy*, a possible task could be:

- Your task is to help others **make personal decisions** about **how to use energy more sustainably**.
- You will need to **research some changes in life habits** for people so that collectively they can make a difference to our energy consumption.
- Using appropriate media you are **construct a five minute presentation** to children in the age group 8-14 years to convince them to make changes that will make a difference.

Assessment task:

No specific assessment task has been designed as this would depend on year level and the chosen learning context. However, there is an opportunity to create a formal assessment task based on the final presentation of solutions to the problem.

Monitoring:

Students are provided with the opportunity at intervals to construct a learning log or blog as the investigation proceeds. An online blog would provide the teacher with an opportunity to monitor student progress with the task requirements as well as the learning that is developing. It also provides a forum for sharing ideas and forming deeper understandings of issues.

Research tasks:

The suggested research tasks provide opportunities for accessing online and printed resources as well as visiting the ENERGEX Playasaurus Place at Queensland Museum. Key web resources include:


- ENERGEX
- PTUA – Public Transport Users Association
- DERM
- Energy Rating Labels

Notes to teacher:

Appear in green boxes throughout the activity.

Introduction


Your task is to ... (teacher decides)

 Start a **blog** (or **learning log**) to record all the development of your project. This will allow ongoing feedback from others to help you. You should also make helpful comments to others. Your teacher will help you set the rules and procedures for conducting a blog.

You first need to understand what **using energy sustainably** means.

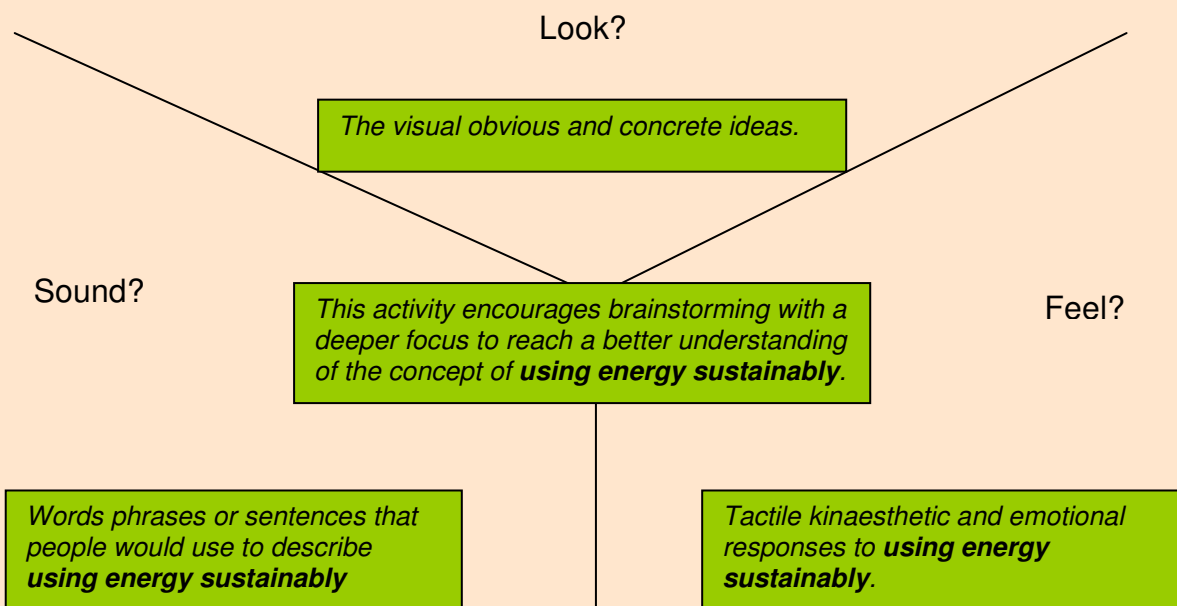
Activity: Think Pair Share (can be conducted through a blog)

- Write down what you think **using energy sustainably** means.
- Discuss your idea with a partner and reach an agreement on what it means.
- Share your understanding with the whole group then modify your understanding if necessary.

 Make an entry in your blog


What does **using energy sustainably** look, sound and feel like?
Write down some descriptive words or phrases in the Y Chart below.

Activity: Y chart for key term



Research Design (KWHL)

Topic question: How can I use energy more sustainably?			
What I know K	What I want to know W	How will I find out? H	What I have I learnt? L
• • • • • •	• • • • • •	<input type="checkbox"/> Library <input type="checkbox"/> Internet <input type="checkbox"/> Museum exhibition <input type="checkbox"/> Experts <input type="checkbox"/> Investigation activities	• • •

 Make an entry in your blog

Research

You need to find out how you currently use energy so that you can make decisions about the future.

To achieve this you will need to consider:

- How much energy different appliances use in the home
- How much energy different modes of transport use

Your **first research activity** involves looking at the **energy use of different appliances**.

This will help make decisions about what might be useful ideas for using energy more sustainably.

Activity 1: Energy Rating Labels

1. Find out about energy rating labels.
2. How can energy rating labels be used to compare appliances of the same type? E.g. two different air conditioners?
3. How can energy rating labels be used to compare appliances of different types? E.g. dishwasher compared with washing machine.

Activity 2: Appliances I use


1. Make a list of ten of the appliances used at home
2. Find out how much energy each one uses in one hour.
3. Rearrange the list from most to least energy used.
4. You could display this information in a bar graph.



This activity requires access to the following websites:

<http://www.energyrating.gov.au/>

<http://www.livinggreener.gov.au/energy/energy-efficiency-home/buy-energy-efficient-appliances>

 Make an entry in your blog

Your **second research activity** involves looking at **different modes of transport**. This will help make decisions about what might be useful ideas for using energy more sustainably.

Activity 3: Transport energy analysis

1. List the transport options available to you on the *transport energy analysis* sheet.
2. Refer to the PTUA website.
3. Perform a transport energy analysis on each listed transport type.

Attached at end of activity document. Copy for student use.

Activity 4: Sustainable transport energy

1. List the transport options on the *sustainable transport energy* sheet.
2. Refer to PTUA website.
3. Perform sustainable transport energy analysis on each type of transport.

Activity 5: Find out more

1. Research answers to questions that you that you would to more about from the previous activity.

This activity requires access to the following websites:

<http://www.ptua.org.au/myths/energy.shtml>

<http://www.transport.wa.gov.au/1708.asp>

<http://www.sustainableschools.qld.edu.au/Default.aspx?tabid=743>



What did you learn that is surprising? Make an entry in your blog

Your **third research activity** requires you to visit ENERGEX Playasaurus Place to find out more about energy efficiency and appliances.

Activity 6: Museum visit to ENERGEX Playasaurus Place

1. Energy on the move

- a. What transport type uses the most energy per person?
- b. What transport type uses the least energy per person?
- c. How could you reduce your transport energy?

2. Energy hungry appliances and Ride the energy bike

- a. What appliances use the most energy?
- b. What appliances use low energy?
- c. How many people would be needed to pedal power an air conditioner?
- d. How can I use less energy through appliance choice?

3. Balance your home energy

- a. What would be the best way to reduce energy usage at home?
- b. How can you help to reduce peak demand for electricity at home?

Guide notes: The focus questions for each activity station are designed to guide thinking about the issues and how to use energy more sustainably. It is important that students be given opportunities for reflection rather than just completing answers to questions.



Make an entry in your blog that answers 1c, 2d and 3b in Activity 6.



Share one of these ideas on the Energy Action Wall in ENERGEX Playasaurus Place.

Solution proposals


You should now have considered the issues that allow you to suggest some solutions to the problem of **using energy more sustainably**.

Activity:

This collaborative solution model may need to be modified to suit your own circumstances.

In groups of four:

1. Create your own first draft drawing of your **solutions** on A4 paper.
2. Share your idea with the other three in your group and discuss different ideas.
3. Create a combined **set of solutions** and write these **with some explanations** on A3 paper.
4. Post the **solutions** on the wall and nominate a group explainer.
5. The remaining group of three circulates and asks questions about other **solutions**.
6. Return to home group and discuss findings. Make changes to your **solutions** as necessary.
7. The remaining group of three circulates and asks questions about other **solutions**.
8. Return to home group and discuss findings. Make changes to your **solutions** as necessary.

 Make an entry in your blog


Presentation

Activity: Presentation

*Sufficient time and resources need to be allocated for this part of the project. Schools should make their own decision about the level of expectation. This presentation task could be developed into a suitable **assessment task** for the unit.*

- a. Using a suitable presentation medium, construct a suitable presentation that will convince others* to take up your ideas.
- b. The presentation should be no more than five minutes and should include appropriate ICT's but could also be a short role play.

*Consult with your teacher about who the audience will be.


 Make an entry in your blog

This is an important phase of the project process. Here the blog entries can be useful in determining the learning journey undertaken by students. More formal assessment may also be appropriate.

Evaluation and feedback

What have you learned about **using energy more sustainably**?
How well do you think you answered this problem?

Look back at your **solutions** and all your blog entries that you have made and the comments that you have received. Make some final entries summarising what you have learned and how you might improve your **solutions**.

 Make an entry in your blog

Sustainable transport ratings

1. List the transport types in the first column.
2. For each next four columns write a rating in each box
3. Find the total score for each transport method.
4. Use the rating system to decide whether the transport is sustainable or not.

0 – very low; 1 – low; 2 – medium; 3 – high; 4 – very high

0-4 **future** sustainable transport
 5-9 **possible** sustainable transport
 10-16 **not** a sustainable transport

Energy	Overall cost	Environmental problems	Difficulty of access	Energy resource reduction	Total Score	Rating

Notes:

- **Overall cost** is the cost of use by the consumer. This represents how much the consumer would have to pay to use this transport method.
- **Environmental problems** include the impacts on the environment for both production and continued use of the transport method. In some cases there may be a disposable impact eg. batteries
- **Difficulty of access** refers to the ability of average consumers to access this resource. E.g. Some transport methods are only available in urban areas whereas others are available to everyone.
- **Energy resource reduction** refers to the total reduction in the energy resource used by this transport method. This is a judgement about how renewable it is.
- **Total score** is found by adding across the columns for each transport method. The total score can be used to determine a method's sustainability rating. This score is taken only as a guide for further discussion and should not be used as a definitive

Australian Curriculum

General capabilities

The skills, behaviours and attributes that students need to succeed in life and work in the twenty-first century have been identified in the Australian Curriculum as general capabilities. There are seven general capabilities:

- literacy
- numeracy
- information and communication technology (ICT) competence
- critical and creative thinking
- ethical behaviour
- personal and social competence
- intercultural understanding

Engaging with the activities associated with the Energex Playasaurus Place will provide specific opportunities to explore the first six of the seven capabilities.

Cross curriculum priority: sustainability

- The new Australian Curriculum identifies Sustainability as one of the cross curriculum priorities.
- Sustainability addresses the ongoing capacity of Earth to maintain all life.
- Sustainable patterns of living meet the needs of the present without compromising the ability of future generations to meet their needs. Actions to improve sustainability are both individual and collective endeavours shared across local and global communities. They necessitate a renewed and balanced approach to the way humans interact with each other and the environment.
- Education for sustainability develops the knowledge, skills and values necessary for people to act in ways that contribute to more sustainable patterns of living. It is futures-oriented, focusing on protecting environments and creating a more ecologically and socially just world through action that recognises the relevance and interdependence of environmental, social, cultural and economic considerations.

Australian Science Curriculum Aims

Aims	Relevance to energy activities in ENERGEX Playasaurus Place
<p>an interest in science as a means of expanding their curiosity and willingness to explore, ask questions about and speculate on the changing world in which they live</p>	<p>High Opportunities to ask questions about... Impacts of changes in patterns of energy use;</p>
<p>an understanding of the nature of scientific inquiry and the ability to use a range of scientific inquiry methods, including questioning; planning and conducting experiments and investigations based on ethical principles; collecting and analysing data; evaluating results; and drawing critical, evidence-based conclusions</p>	<p>High Evaluating data to make decisions about ... Effects of using different energy efficient appliances on energy resources</p>
<p>an ability to communicate scientific understanding and findings to a range of audiences, to justify ideas on the basis of evidence, and to evaluate and debate scientific arguments and claims</p>	<p>Medium Present an evidenced-based argument for ... Choosing a particular alternative energy appliance</p>
<p>an ability to solve problems and make informed, evidence-based decisions about current and future applications of science while taking into account ethical and social implications of decisions</p>	<p>High Consider and make a decision about ... The alternative arguments for choosing different energy appliances</p>
<p>a solid foundation of knowledge of the biological, chemical, physical, Earth and space sciences, including being able to select and integrate the scientific knowledge and methods needed to explain and predict phenomena, to apply that understanding to new situations and events, and to appreciate the dynamic nature of science knowledge.</p>	<p>Medium Apply scientific knowledge to an understanding of ...</p>

Science Understanding

Science Understanding	Relevant key concepts	Relevance to ENERGEX Playasaurus Place
Physical sciences: nature of forces and motion, and matter and energy	<ul style="list-style-type: none"> forces affect the behaviour of objects energy can be transferred and transformed from one form to another 	<p>High</p> <p>Energy resources are transformed for human use</p>

Sustainability is a cross curricular priority across all year levels. The year levels listed below show direct links to content.

Year	Sub-strand	Descriptor
Year 6	<p>Physical sciences</p> <p><i>Forms of energy</i></p>	<p>Electrical circuits provide a means of transferring and transforming electricity</p> <p>Energy from a variety of sources can be used to generate electricity</p>
Year 7	<p>Earth and space sciences</p> <p><i>Renewable Energy Sources</i></p>	<p>Some of the Earth's resources are renewable, but others are non-renewable.</p> <ul style="list-style-type: none"> - considering what is meant by the term 'renewable' in relation to the Earth's resources - comparing renewable and non-renewable energy sources, including how they are used in a range of situations
Year 8	<p>Physical sciences</p> <p><i>Forms of Energy</i></p>	<p>Energy appears in different forms including kinetic energy, heat and potential energy, and causes change within systems.</p>
Year 9	<p>Physical sciences</p> <p><i>Transferring and Transforming Energy</i></p>	<p>Forms of energy can be transferred in a variety of ways through different mediums.</p>

Matching interactives to Science Inquiry Skills Matrix

Science Inquiry Skills	Descriptor	Energy use at home	Ride the energy bike	Energy on the move
Questioning and predicting:	Identifying and constructing questions, proposing hypotheses and suggesting possible outcomes.	How can I reduce our home energy use but still be comfortable? If I choose to use a heater at peak times then energy consumption will exceed preferred targets.	How different is the energy consumption among different types of appliances? How much physical energy is required to power different appliances?	How different is the energy efficiency among different modes of transport? There is a significant difference in energy efficiency of different transport modes and these differences can be predicted.
Planning and conducting:	Making decisions regarding how to investigate or solve a problem and carrying out an investigation, including the collection of data.	Testing combinations of appliance uses is based on pre-knowledge of appliance energy consumption. Energy thermometer readings provide data feedback on choices.	Choosing different inputs of energy has an effect on energy required to operate different appliances.	Modes of transport efficiency can be ranked and tested to determine differences. Energy inputs to operate the wheels provide data to inform decisions about efficiency rankings.
Processing and analysing data and information:	Representing data in meaningful and useful ways; identifying trends, patterns and relationships in data, and using this evidence to justify conclusions.	Recognising patterns of thermometer readings provides feedback for making improved decisions.	Recognising patterns of energy requirements to power appliances provides feedback on amount of physical energy required and how this can be achieved.	Recognising patterns of energy requirements to operate wheels provides feedback on efficiency of different transport modes.
Evaluating:	Considering the quality of available evidence and the merit or significance of a claim, proposition or conclusion with reference to that evidence	Conclusions based on evidence gathered are made about the hypothesis on the effect of using a heater on preferred energy consumption targets.	Conclusions based on evidence obtained from trials reveals the extent to which physical energy is required to power different appliances.	Conclusions based on evidence obtained from trials reveal the comparative energy efficiency of different modes of transport.
Communicating:	Conveying information or ideas to others through appropriate representations, text types and modes.	Discussion with peers or family justifies decisions made. Comments are displayed on "Energy Action Wall" about the outcomes of the testing of ideas.	Discussion with peers or family justifies decisions made. Comments are displayed on "Energy Action Wall" about the outcomes of the testing of ideas.	Discussion with peers or family justifies decisions made. Comments are displayed on "Energy Action Wall" about the outcomes of the testing of ideas.

Studies of Society and Environment (Queensland Essential Learnings)

STUDIES OF SOCIETY & ENVIRONMENT (SOSE)		
By the end of Year 3	By the end of Year 5	By the end of Year 7
<p>Place and space Local natural, social and built environments are defined by specific features and can be sustained by certain activities.</p> <ul style="list-style-type: none"> Resources and environments can be used, conserved and protected by valuing and applying sustainable practices <p>e.g. <i>reducing water use; turning off appliances to conserve electricity; picking up litter to protect wildlife.</i></p>	<p>Place and space Environments are defined and changed by interactions between people and places.</p> <ul style="list-style-type: none"> Sustainability of local natural, social and built environments can be influenced by positive and negative attitudes and behaviours <p>e.g. <i>positive responses to water management can influence the quality of river systems; negative responses to town planning principles can lead to traffic problems.</i></p>	<p>Place and space Environments are defined by physical characteristics and processes, and are connected to human activities and decisions about resource management.</p> <ul style="list-style-type: none"> Sustainability requires a balance between using, conserving and protecting environments, and involves decisions about how resources are used and managed <p>e.g. <i>“rethink, reduce, reuse and recycle”; renewable versus non-renewable energy sources.</i></p>
		By the end of Year 9

