4. Alternative Energy

Background Information

The Coal Loader Centre for Sustainability is using alternative energy to reduce its environmental impact. Alternative energy is defined as energy from sources that do not use up natural resources or harm the environment. One of the biggest sources of alternative energy is the sun.

The Coal Loader has not always been a place where alternative energy has been promoted and used. As its name suggests the Coal Loader was once a transfer depot for coal from the bulk carriers to smaller coal-fired vessels. It has only been recently that the old infrastructure of coal that powered our economy for 150 years has been overlaid with new 'clean' technologies that reduce pollution and energy use.

When you visit the Coal Loader make sure you look up on the roof. North Sydney Council has installed solar power (photovoltaic, or PV, panels) to generate electricity from the sun.

The 16 PV panels at the Centre produce 2.96 kilowatts of power at their peak. They have a long life span and produce over 3000kWh of electricity every year. This reduces greenhouse gas emissions from the Centre by 2.7 tonnes annually.

Power generation varies throughout the day with the majority of power generated at the peak of the day. Excess energy can be stored for later use. The solar panels work in all weather but are best on clear cool days.

Solar power is used to heat water on site. Hot water is generated by a solar boosted integral heating and hot water storage system. All the hot water pipes are insulated to minimise loss from the system. Hot water at the Coal Loader is used not just for showers and washing hands, but for heating the building as well.

Did you know that water heating is responsible for 25% of the energy used in an average home? That makes it a very good reason to consider a less intensive way to heat water. Installing an energy efficient solar hot water system can save a family $300 to $700 off electricity bills and a massive three tonnes of greenhouse gas emissions each year.

The original caretakers cottage also has a passive lighting system that collects sunlight using a light tube lined with reflective material. The light tube directs sunlight into the building, lights up the work areas and helps to reduce overall energy consumption.

Other examples of alternative energy sources include wind turbines, solar thermal, biomass energy, fuel cells, geothermal and wave and tidal energy.

Curriculum links:

- ✓ Stage 3 English, Mathematics and Science
- ✓ Stage 4 English, Mathematics and Science
- ✓ Stage 5 English, Mathematics and Science

See the Curriculum Matrix (Appendix 1) for more detail.

For more information on alternative energy

Before your visit, watch the 'Alternative Energy' three minute video which will give your class an overview of what you will find at the Coal Loader.

Or check out the following useful sites:

- Clean Energy Council *www.cleanenergycouncil.org.au*
- Climate Clever Shop *www.climatecleversshop.com.au*
- Australian Government *www.climatechange.gov.au*
- Australian Technology Association *www.ata.org.au*

Activity 1 – The Cottage Caretaker – an Energy Decision Making Role Play

Activity Summary:

Students will be allocated various roles including cottage caretaker, different types of energy company representatives, a local resident or the mayor. In these roles, student will think of, and discuss the positive and negative aspects of different energies, and make a decision about which type of energy should be used to run the caretakers cottage and Coal Loader site. Students will then present their decision to the rest of the class, and explain why they chose their particular energy type.

Aim:

To explore the concept of alternative energy sources.

Outcomes:

- To increase knowledge and awareness of the different types of energies, and to illustrate the positives and negatives of each
- To encourage students to consider more sustainable energy choices at school or home
- To learn about civic leadership and what decision making processes are used at a local government level to make decisions on sustainability and other issues.

Materials:

- Teachers will need to bring butchers paper, and students will need to bring writing materials for this activity.
- Note that role playing cards eg Col Richie – "Electricity company representative" and Joe Quimby "Mayor" will be provided by the Coal Loader Centre for Sustainability.

Preparation:

Teachers may choose to provide students with the reference posters below or to discuss them as a class prior to coming to the site.

Note that these posters are displayed on site, so time could be allowed for viewing them at the Coal Loader. They can be downloaded from *www.northsydney.nsw.gov.au/coalloader*, and a copy is included in Appendix 2.

- Poster: "Critical Decade for Climate Change"
- Poster: "Powered by the Sun"

Student Worksheet – The Cottage Caretaker – an Energy Decision Making Role Play

Introduction:

This activity will involve both role playing and group work. During the activity you will be asked to help the appointed Cottage Caretaker decide which energy type should be used to run the Centre. The purpose of the activity is for energy company representatives to try and convince the Cottage Caretaker, the Mayor and the community that their energy type is the most appropriate.

The activity works best in small groups with a minimum of four and maximum of eight people in each. Prior to the activity you will each be given a card with a key role eg cottage caretaker, solar company representative, wind company representative, coal company representative and natural gas company representative etc printed on one side and an explanation on the back. Use this card as a basis for your role playing but also use other relevant information you may have learnt to help build your case. Remember try and stay in character and act based on your role not on your own opinions!

Activity:

1. Look at the card you have each been given. You have 10 minutes to plan your argument by recording the following information.
   Energy company representatives – write down both positive and negative aspects of your energy type. Other stakeholders – such as residents, environmentalists and the Mayor, use this table to record the perceived benefits and concerns for each energy type.

Energy Type	Positives (benefits)	Negatives (concerns)
Coal		
Wind		
Solar		
Natural Gas		

The Cottage Caretaker should list all the things that he/she will require energy for.

1. eg lighting office space
2.
3.
4.
5.
6.
7.
8.

2. Now the role playing can begin!
   The setting is a community meeting held at North Sydney Council. The appointed Mayor should run the meeting and maintain order at all times. You can begin by asking each person attending to introduce themselves.
3. The Mayor should ask each of the company representatives to explain what their energy is, detail one positive aspect of their energy, and one negative aspect and finally why it should be used at the Centre. The Cottage Caretaker should record for each energy type the positive and negative aspects on butchers paper.
4. Others stakeholders may ask questions at any time with permission of the Mayor.
5. After listening to the positive and negatives aspects, and the concerns from the other stakeholders, the Caretaker should choose one or more preferred type(s) of energy to run his/her cottage. The Caretaker may seek further input from other stakeholders eg the Mayor or residents, to help make this decision.
6. The Caretaker must present their final decision on which energy type to use, and explain why they chose the energy type(s) over the others available.

Extension Activity:

7. Discuss various ways that the Coal Loader has reduced its electricity consumption.
   -
   -
   -
   -
   -
8. How could you implement these initiatives at school or home?
   -
   -
   -

Activity 2 – Count the Kilowatts

Activity Summary:

This activity will use real time energy consumption data collected by the Coal Loader to calculate how much energy is consumed at different intervals in time. Students can calculate the amount of energy generated by alternative energy such as solar power, using the smart energy meter located on-site. This activity will encourage students to interpret the data to help determine what factors cause variation of energy consumption at the Centre.

Aim:

To calculate the energy consumption of the Coal Loader and be able to identify the energy saving features used at the Coal Loader.

Outcomes:

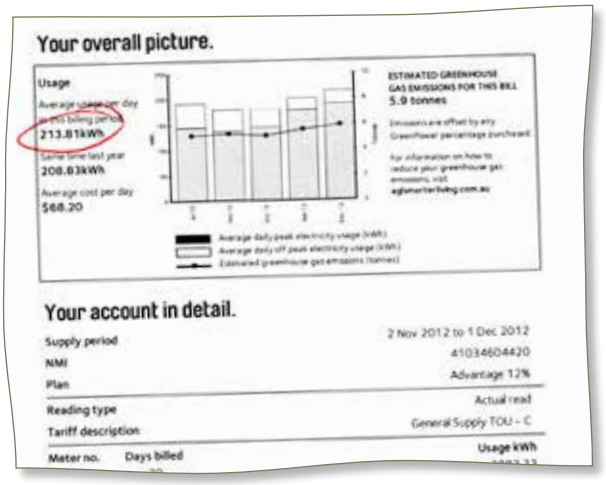
- Learn to calculate energy consumption
- Learn how to interpret energy consumption data in order to make conclusions about what factors influence consumption patterns.

Materials Needed:

- Students will need to bring a calculator, clipboard and writing equipment

Preparation:

Teachers are asked to hold a pre-excursion class discussion about energy consumption and energy data. A useful pre-excursion activity is to analyse a typical energy bill beforehand so students are familiar with the units of measurement and terminology used.



Student Worksheet – Count the Kilowatts

Introduction

This activity will allow you to calculate how much energy is consumed at the Coal Loader. You will also be able to calculate the amount of energy generated by solar power. By being able to track the energy performance of the Centre you will able to identify what factors contribute to the variation of energy use during the day and what behaviours or devices could help reduce energy consumption even further.

Activity:

Locate the energy monitor inside the former Caretakers Cottage. Use the information displayed to help you answer the following questions.

1. Record the average amount of energy consumed in kilowatts each day_____
2. What would be the amount in kilowatts consumed each year? _____
3. Look at the variation in the amount of energy used at different times of the day.
   List some possible reasons for this below

   _____

   _____

   _____

   _____
4. If the cost of electricity is 24c per kWh how much would the electricity bill for the Coal Loader be per quarter? _____
5. The solar PV system produces over 3000kWh of electricity every year. How many kWh is that per day?

   _____
6. How much money does this save the Coal Loader each year when compared to electricity?

   _____
7. How many additional PV solar cells would need to be installed to cover 100% of the Coal Loader's electricity consumption?_____

   Note: The kilowatt-hour (symbolised kWh) is a unit of energy equivalent to one kilowatt (1 kW) of power expended for one hour (1 h) of time, and 1000 watts = 1kW.

Extension Activity:

Alternative energy is one great way to reduce our use of non renewable resources. However the way we use energy is also an important consideration. Look around the Coal Loader and list (3) energy saving devices and/or pieces of equipment you can see.

1. _____
2. _____
3. _____

Identify (2) practical behaviours you would use to reduce overall consumption at the Coal Loader?

1. _____
2. _____

Activity 3 – Energy Audit

Take away activity – for home or back at school

Activity Summary:

Students will conduct a simple school energy audit using a Save Power Kit which includes an energy meter. Students will report back ways that they could reduce their energy use at school. Note this activity could also be conducted at home if enough energy meters are available or students could take turns in borrowing.

Aim:

To increase awareness of the amount of energy that is consumed at school by common appliances, identify some practical steps that can be taken to save money and power, and reduce the school's impact on the environment.

Outcomes:

- Be able to identify the most energy intensive appliances/ equipment
- Identify strategies to reduce energy at school and home

Materials Needed:

Borrow a Save Power Kit (which includes an energy meter) free of charge from your local library.
See *www.savepower.nsw.gov.au* for a list of locations and for more information.

Preparation:

1. Conduct a class discussion around why we need to reduce our energy usage. Also discuss how we can reduce energy use, (eg. switching off the lights when we leave, opening a window instead of using the air-conditioning, making sure that computers are turned off at the end of the day.)
2. Demonstrate how to use an energy smart meter (note the Save Power Kit will come with instructions and activities). Explain why measuring how much energy an appliance uses can help raise awareness of issues eg we can measure the impact of standby power and we can also locate potentially inefficient equipment.
3. Use classroom examples to measure the energy consumed. This could be a computer in the classroom, fridge in the canteen, microwave or kettle in the staff room.
4. If conducting this activity as a take home exercise students are given a note and worksheet to take home which explains to parents/guardians how to use the energy meter.
5. A worksheet is filled in, with the assistance of the parent/guardian if required.
6. After students have returned their worksheets, conduct a class discussion about the different energy saving measures reported.

Student Worksheet – Energy Audit

Introduction:

Inefficient use of appliances and equipment such as leaving a computer on overnight or leaving a television on standby mode can lead to a surprisingly large use of energy.

This activity is a fun and educational way to learn more about power use and how to reduce power consumption, and bills, at your school. The activity makes use of energy smart meters to measure the amount of energy used by individual appliances. Note this activity could also be conducted at home if an energy smart meter is available.

Activity

Follow the instructions and complete the worksheets in the Save Power Kit.

Extension Activity

- Locate a recent school or home energy bill. How much energy was used in the last quarter?

- How much does that equate to for each person in your home?

- Who has the lowest energy consuming household in the class?