



3. Sustainable Retrofit



Background Information:

The original caretakers cottage at the Coal Loader is a great example of how retrofitting can be achieved on an existing building. Retrofitting is the process of modifying something after it has been manufactured. For buildings, this means making changes to the systems inside the building or even the structure itself at some point after its initial construction and occupation. Retrofitting an existing building can save money, energy, water, and waste, and provide a more comfortable environment.

The cottage uses wind-assisted turbo ventilators to drive airflow through the building and ceiling-mounted fans increase cool air movement in summer and distribute warm air in winter. This means there is no need for air conditioners and therefore a reduced electricity bill.

The cottage is achieving a reduction of energy use of up to 55% by installing ceiling and wall insulation, utilising natural ventilation and natural lighting, using solar hot water for winter heating, and glazing windows. An electronic display measures how much solar power and recycled water the building uses which can be demonstrated in real time.

The Coal Loader has also retrofitted the bathrooms to become more sustainable. The bathrooms include 4 star WELS rated toilets which use only 3.5L water per flush compared with 12L for a traditional toilet. The bathrooms also include 6 star WELS rated taps, using only 4.5L water per minute compared to a normal tap using up to 18L per minute.

The materials that have been used to furnish and finish the building have been selected to be as low impact on the environment as possible. For example the carpet is made from natural and recyclable materials and the paint used is low in volatile compounds (VOCs).

More than 95% of the timber used in the refurbishment is either recycled or FSC (Forestry Stewardship Council) certified, and the light-weight structural steel is 100% recycled.





3. Sustainable Retrofit

Reusing and recycling building materials (up to 80%-90%) on site has resulted in the saving of energy and water used to make new products, less truck movements to transport materials and less waste to landfill.



A discussion about any recent retrofitting undertaken in the school or home environment will help frame the activities and learning to be undertaken at the Coal Loader Centre for Sustainability.




Curriculum links:



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

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

For More Information:

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

Check out the 'Your Home Guide' at www.yourhome.gov.au



Activity 1 – Spot the Sustainable Design Features

Activity Summary:

In this activity students will learn about sustainable retrofitting and how it has been implemented at the Coal Loader Centre for Sustainability. They will be able to identify sustainable retrofit features at the Coal Loader and consider how these can be carried out at school and at home. Students will design their own sustainable home as an optional extension of this activity.



Aim:

To identify the design features and retrofits that help make the original caretakers cottage more sustainable.

Outcomes:

- Learn about sustainable retrofitting
- Investigate the environmental and cost saving benefits
- Apply learning to own home and school environment

Materials Needed:

Each student will need a clipboard, writing equipment, and a copy of the Student Worksheet.

Teachers may choose to provide students with the reference posters (note these posters are available for download from www.northsydney.nsw.gov.au/coalloader, can be viewed on display at the Coal Loader Centre for Sustainability, and a copy is included in Appendix 2).

- 'Keeping Our Cool In the Caretakers Cottage'
- 'Powered By The Sun'
- 'Is Your Home Climate Friendly?'

Preparation:

Before students begin the activity worksheet, the teacher should read the class the 'Background Information' provided and engage the class in a discussion on 'what recent retrofitting has been undertaken in the school or the student's home environments?'





Extension Activity:

The following table summarises the properties of three different types of lightbulbs, each providing the same amount of light. Look at the information provided and answer the following questions:

1. Which type of light bulb
 - Lasts the longest? _____
 - Is the most expensive per bulb? _____
 - Uses the least amount of electricity over 50,000 hours? _____

2. You will notice that both LED and CFL light bulbs save a similar amount of money compared to incandescent light bulbs. Considering the fact that CFL bulbs contain mercury (which is harmful to the environment), and LED contain no mercury, which would you choose for your own use?

Light Bulb Comparison Table*

	LED Light-emitting Diode	CFL Compact Fluorescent Lamp	Incandescent
			
Light bulb projected lifespan	50,000 hours	10,000 hours	1,200 hours
Watts per bulb (equiv. 60 watts)	10	14	60
Cost per bulb	\$35.95	\$3.95	\$1.25
KWh of electricity used over 50,000 hours	400	700	3000
Cost of electricity (@ 0.10per KWh)	\$50	\$70	\$300
Bulbs needed for 50,000 hours use	1	5	42
Equivalent 50,000 hours bulb expense	\$35.95	\$19.75	\$52.50
Total cost for 50,000 hours	\$85.75	\$89.75	\$352.50

Energy Savings over 50,000 hours, assuming 25 bulbs per household:

Total cost for 25 bulbs	\$2143.75	\$2243.75	\$8812.50
Savings to household by switching from incandescents	\$6668.75	\$6568.75	0

*Source: www.eartheasy.com/live_led_bulbs_comparison.html



Activity 2 – Sourcing Sustainable Fixtures and Fittings

Activity Summary:

This activity will encourage students to consider why certain fixtures and fittings have been used for the Coal Loader site. It will also demonstrate that retrofitting existing materials can save money and lessen the impact on the environment. This activity involves students putting themselves in the shoes of the Coal Loader Coordinator by deciding what other sustainable fixtures or fittings could be purchased, built or salvaged for the site.



Aim:

To increase knowledge and awareness of what factors make a product a more sustainable alternative.

Outcomes:

- Be able to determine what qualities make a product, fixture or fitting a more sustainable choice.
- To be able to apply a set of sustainability criteria to help make purchasing decisions.

Reference:

“Low Impact Materials” Poster – downloadable from www.northsydney.nsw.gov.au/coalloader, can be viewed on display at the Coal Loader, or a copy is included in Appendix 2.

Materials Needed:

Each student will need a copy of the Student Worksheet, writing materials and clipboard.

Preparation:

Prior to beginning this activity teachers should lead a discussion about what is retrofitting and why it is of benefit to the environment. Teachers can refer to the background information provided below to assist.

Background Information:

The life cycle of a product is often thought of as the journey of materials from cradle to grave. Many of the fixtures and fittings have been retained or retrofitted at the Coal Loader in order to save resources and reduce the environmental impact. Fixtures are items that are secured or bolted to the walls or floor eg light fixtures, kitchen units and bathroom suites and ‘fittings’ are free standing items eg carpets, fridge and furniture.

Retrofitting is the process of making changes to an already existing building, re-using and recycling materials that have already been manufactured rather than spending resources on making new ones.

For example the carpet in the former caretakers cottage is made from natural and recyclable materials. Other materials that have been used for retrofitting include hand basins in the public amenities, windows in the cottage, rainwater tanks, solar panels and recycled timber for balconies.



Student Worksheet – Sourcing Sustainable Fixtures and Fittings

Introduction:

In this activity you will investigate the fixtures and fittings installed at the Coal Loader and determine which ones have been retrofitted to become more sustainable. You will also be able to put yourselves in the shoes of the Coal Loader Coordinator and make a decision about how you would allocate an extra \$500 to improve the Centre and make it even more sustainable.

Activity

1. Look around, inside and outside the original caretakers cottage and list the fixtures or fittings that have been retrofitted to become more sustainable. Look for things that may have recycled content are energy or water efficient, low waste, non toxic or are sustainable in another way.

2. List three fixtures or fittings that you find interesting. Using the information provided, describe why they are a better alternative for the environment.

(a)

(b)

(c)

3. If you had an extra \$500 to allocate to the improvement of the building what other sustainable item(s) would you purchase, build or salvage for the site? What factors make them a sustainable choice?

Extension Activity

4. Consider your school building. What fixtures or fittings could potentially be modified to make it more sustainable? What impact would this have on the environment?



Activity 3 – Design Your Own Sustainable Home or School



Take away activity – for home or back at school

Activity Summary:

This activity will inspire students to use technology to redesign their own home to incorporate more sustainable features. Google SketchUp www.sketchup.com (free to download) or other design software can be used to replicate a 3D model of an existing building. Markers can be added to point out the sustainable design features.



Aim:

For students to redesign their home to become more sustainable using the information they have learnt from the Coal Loader Centre for Sustainability.

Outcomes

- Students will use design skills and new technology to integrate sustainability into an existing building.

Materials Needed

- Floor plan of student's homes (or a tape measure to estimate)
- Google SketchUp free design program (or a scale ruler if you don't have access to a computer)

Preparation

- Before the students begin this activity, the teacher should engage the class in a discussion on sustainable design and retrofitting. Use examples of sustainable retrofitting at the Coal Loader to prompt students into thinking about their own homes and what could be done to make them more sustainable.
- Ask students to measure the rooms within their own homes or locate an existing floor plan.
- Ask students to download Google SketchUp www.sketchup.com or another design software package.
- If students don't have access to a computer they can use a scale rule to do a technical drawing



Student Worksheet – Design Your Own Sustainable Home or School

Introduction:

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This activity will allow you to imagine you are modifying your existing home or school to become more sustainable. You will use online software to help create a model of your retrofitted home. This could be presented to your parents or Principal as a plan for a sustainable retrofit or the beginnings of a future design project!



Activity:

1. Locate a floor plan of your home or school or measure it yourself using a tape measure.
2. Use actual dimensions and orientation to recreate your existing layout on Google SketchUp or another software program.
3. Add design elements that you think would make it more sustainable.
4. Retrofit existing fixtures and fittings to save money and reduce your environmental impact.
5. Clearly label those features that you consider most important and highlight why they are a sustainable alternative.

Extension Activity:

- Consider adding a rooftop garden to your retrofitted building!
How much roof space do you have available?

- Do you need to modify the existing roof to accommodate growing plants?

- Now calculate how much soil you will need (10cm height max)

- What plants eg natives, edible plants, flowers would you plant and why?

- What water system would you use? Can you use recycled water?
