

UNIT 5: Energy Efficiency at School

This unit is comprised of 3 activities which are outlined in table 5.1. These activities have been informed by the ENERGE Energy Literacy Framework. A guide to the ENERGE Energy Literacy Framework has also been provided. This unit explores the theme of energy efficient schools through the implementation of action projects. Designing and implementing action project gives students the opportunity to develop their energy literacy by focusing on issues concerning energy and thermal comfort that directly affect them. This unit allows students to consider their ability to bring about positive and significant change in their schools and in their communities and will develop their energy literacy. In activity 5.1 students conduct an audit of the factors that affect the indoor environment in their classroom. Activity 5.2 builds on the previous activity 5.2 and asks students to use the information collected in the previous activity to design and implement an action plan for improving thermal comfort and improving energy efficiency in the school or classroom. Activity 5.3 is a design challenge that asks students to apply their knowledge of energy efficient building solutions to design using materials or multimedia a model energy efficient school or classroom. Students will work collaboratively and employ problem solving, decision making communication and critical thinking skills. In particular, the energy literacy outcomes, the associated skills & competencies addressed and how the activities link to the national curricula are outlined in tables 5.2-5.4.

OVERVIEW of UNIT 5 Energy Efficiency at School

Table 5.1 Activities and titles are given, the time required to complete the activity and the ISCED classification.

	Activity Title	Estimated time (min)	Level	
			ISCED 2	ISCED 3
Activity 5.1	Assessing thermal comfort in the classroom	30-45	X	X
Activity 5.2	Taking action improve thermal comfort in classroom	60-90	X	X
Activity 5.3	Design an energy efficient school	45-60	X	X

Activities Mapped to Subjects in National Curricula

Table 5.2 Activities are mapped to subjects in National Curricula

	Science	Technology Informatics	Engineering	Mathematics	Home Economics	Geography	English	Design & Architecture	Civics & politics	Society & Health	Business & Economics
Activity 5.1	X				X				X	X	
Activity 5.2	X				X		X		X	X	
Activity 5.3	X	X	X		X			X	X		

Activities Mapped to Energy Literacy Characteristics

Table 5.3 Activities are mapped to Energy literacy Characteristics.

	C1	C2	C3	C4	C5
Activity 5.1	X	X		X	X
Activity 5.2		X	X	X	X
Activity 5.3		X	X	X	

Skill & Competencies Addressed

Table 5.4 Activities are mapped according to Skills & Competencies addressed.


	Decision Making	Problem Solving	Design/innovating	Data Analysing	Collaborating	Communicating	Research	Critical Thinking	Numeracy
Activity 5.1		X		X		X	X		
Activity 5.2	X	X			X	X	X	X	
Activity 5.3	X	X	X				X		

Activity 5.1 Assessing thermal comfort in the classroom

Thermal comfort is an important factor in a classroom which affects student's performance. The evaluation of thermal comfort takes into consideration parameters related to individuals and their environments including radiant heat, less ventilation, high humidity levels and unsuccessfully performing building envelopes. The assessment of thermal comfort helps us to find the quality of indoor environment and also helps in the optimization of energy required to achieve desired comfort levels. In this activity, students assess parameters that affect thermal comfort in their classroom or school building using a checklist tool that has been published by the Health and Safety Executive in the UK.

Activity 5.1 Assessment of thermal comfort in the classroom

ENERGE activity template



Parameter	Description	Yes	No	Comment
Air temperature	Does the temperature in the classroom feel warm or hot?			
	Does the temperature in the classroom fluctuate throughout the school day?			
	Does the temperature in the classroom change a lot during hot or cold seasonal variations?			
Radiant temperature	Are there heat sources in the classroom? How many can you identify?			
	Is the temperature inside the classroom affected by the weather outside?			
	Humidity			
Air Movement	Does the air in the classroom feel too dry?			
	Does the air in the classroom feel too humid?			
	Does the humidity in the classroom fluctuate throughout the school day?			
Activity Level	Would you say that there is a seasonal fluctuation in classroom humidity?			
	Is cold air or warm air blowing directly into the classroom?			
	Is there a draught in the classroom?			
Clothing & Insulation	Do you find that the classroom becomes stuffy throughout the school day?			
	Would you say that you are more aware of your thermal comfort when you are seated for a long period of time?			
	Would you say that you are less aware of your thermal comfort when you are more active and engaged?			
Clothing & Insulation	Does poor thermal comfort affect your ability to concentrate?			
	Would you say that you are more aware of your thermal comfort when you are seated for a long period of time?			
	Can you as a student make individual alterations to your clothing in response to the thermal environment? (i.e. adding or removing layers)			

Fig. 1. Activity 5.1 Student Worksheet

2. After completing the worksheet, the teacher can ask students the following questions:

- Based on your knowledge of concepts related to thermal comfort, what do you think are ideal conditions of temperature, humidity, and air flow to maintain thermal comfort and productivity in the classroom?
- What improvements do you think could be made to your classroom or school to improve thermal comfort?
- Do you feel that you have a lot of control over your thermal comfort? Would you like more control over your thermal comfort throughout the school day?
- How much control or responsibility over thermal comfort do you think students should be given?

Materials

- [Activity 5.1 Student Worksheet](#)
- Resource: [Introduction to Thermal Comfort](#)

Duration

- 30-45 minutes

Energy Literacy Characteristics addressed:

- | | |
|-----------|--|
| C1 | Has a grounded understanding of the science and how energy is harnessed and used to power human activity. |
| C3 | Students are sensitive to the need for energy conservation and the need to develop alternatives to fossil fuel-based energy resources. |

Skills & Competencies addressed:

- | | |
|-------------------|-----------------|
| • Problem Solving | • Research |
| • Data Analysis | • Communicating |

Subject links in National Curricula:

- | | |
|----------------------------|---------------|
| • Technology & Informatics | • Science |
| • Design & Architecture | • Engineering |

Level:

- ISCED 2
- ISCED 3

Suggestions for use:

1. Begin with a discussion about thermal comfort. The teacher can use their own resources or incorporate the resources that accompany this unit. Ask the students:
 - Do you think that your classroom a thermal comfort problem?

Activity 5.2 Taking action to improve thermal comfort in the classroom

Actions that manage thermal comfort and indoor air quality use varying amounts of energy. Changes in behaviour and modifications to the school environment can manage our thermal comfort and indoor air quality and reduce our environmental footprint. In this activity, students work through the steps in the sustainability action process to take actions to promote sustainable strategies for indoor air quality and thermal comfort. In this activity, students develop and implement actions that relate to improving thermal comfort in the classroom and then evaluate and reflect on their success and their learning. This activity has been developed by the NSW Environmental and Zoo Education Centres and Cooler Classroom Program in Australia.

Duration	
<ul style="list-style-type: none"> 60-90 minutes 	
Energy Literacy Characteristics addressed:	
C2	Understands the impact that energy production and consumption have on all spheres of our environment and society;
C3:	Students are sensitive to the need for energy conservation and the need to develop alternatives to fossil fuel-based energy resources.
C4	Students are cognisant of the impact of personal energy-related decisions and actions on the global community.
C5	Strives to make choices and decisions that reflect these attitudes with respect to energy resource development and energy consumption
Skills & Competencies addressed:	
<ul style="list-style-type: none"> Decision Making Problem Solving Critical Thinking Research 	<ul style="list-style-type: none"> Designing Communicating Collaborating
Subject links in National Curricula:	
<ul style="list-style-type: none"> Science Technology Design & Architecture Home Economics 	<ul style="list-style-type: none"> Civics & Politics English Social & Health
Level	
<ul style="list-style-type: none"> ISCED 2 ISCED 3 	

Suggestions for use:

- The sustainability action process provides a scaffold for teachers and students to investigate real issues and needs. It supports authentic problem solving through active student participation. Students should undertake the following steps:
 - Make the case for change
 - Explore options for action
 - Develop the proposal for action
 - Implement the proposal for action
 - Reflect and evaluate
- Give students a copy of the Student worksheet which outlines these steps in more detail.

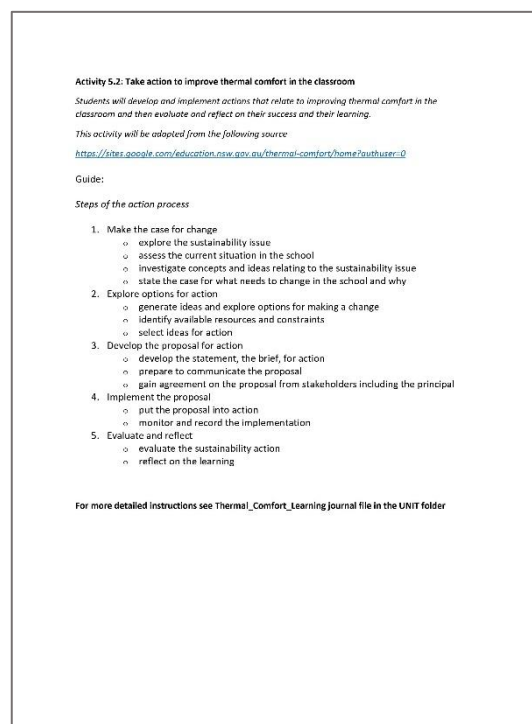


Fig. 2. Activity 5.2 Student Worksheet

Extensions to Activity 4.2

Materials

- Activity 5.2 Student Worksheet
- Original Source: [Thermal Comfort Action Plan NSW](#)

Activity 5.3 Design an energy efficient school

In this activity, students redesign their school to make it as energy efficient as possible, presenting their plan as a model or chart. Students use sustainable design principles to redesign a familiar environment such as the school to minimize energy use. This activity has been developed by Cool Australia.

Duration	
<ul style="list-style-type: none"> 30-45 minutes 	
Energy Literacy Characteristics addressed:	
C2	Understands the impact that energy production and consumption have on all spheres of our environment and society;
C3:	Students are sensitive to the need for energy conservation and the need to develop alternatives to fossil fuel-based energy resources.
C4	Students are cognisant of the impact of personal energy-related decisions and actions on the global community.
Skills & Competencies addressed:	
<ul style="list-style-type: none"> Critical Thinking Problem Solving Research 	<ul style="list-style-type: none"> Designing collaborating
Subject links in National Curricula:	
<ul style="list-style-type: none"> Design & Architecture Home Economics Technology 	<ul style="list-style-type: none"> Science Engineering Civics & Politics
Level	
<ul style="list-style-type: none"> ISCED 2 ISCED 3 	

Suggestions for use:

- Working in groups, students can research one option for increasing the energy efficiency of the school. This might include looking at the windows, doors, lighting, food service and computers and photocopiers. Ask students to think about where the problem areas might be. Examples: rooms that are draughty in winter or too hot in summer? Is there a room that is always dark and that always needs the lights on?

- Students should think creatively. There are some truly strange and amazing green building designs being conceived and constructed.

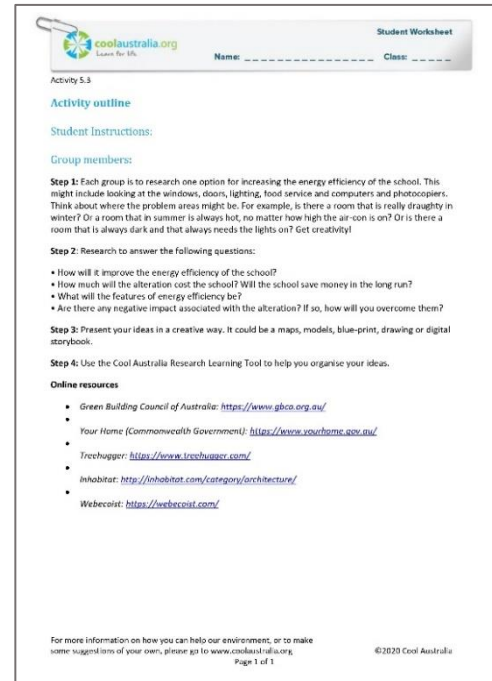


Fig. 3. Activity 5.3 Student Handout

- Once each group has one specific option for increasing the school's energy efficiency, they should conduct research to answer the following questions:
 - How will it improve the energy efficiency of the school?
 - How much will the alteration cost the school? Will the school save money in the long run?
 - What will the features of energy efficiency be?
 - Are there any negative impact associated with the alteration? If so, how will you overcome them?
 - Students can present their ideas in a creative way. It could be a map, model, blue-print, drawing or digital storybook.

Extensions to Activity 4.2

- Consider asking your students to present their model to the class, principal or school council.

Materials

- [Activity 5.3 Student Handout](#)