Renewable Energy Education Trailer | Stage 3,4 & 5 | Science

Summary	Duration
This excursion addresses outcomes from the NSW BOSTES Stage 3, 4 & 5 Science Syllabus. *Focus* – 'Physical World' This unique and highly engaging program allows students to learn about energy and perform a first-hand investigation using various equipment and data collection methods to critically analyse the different energy generation methods and their impacts. Students are guaranteed to be involved in a number of engaging and hands on experiences during the course of the day. Through these students will further develop their knowledge and understanding, group work and working scientifically skills.	Approximately 4 hour **on-site** excursion to Penrith Lakes Environmental Education Centre **OR** as a school based **incursion**. *Arrival time* - 10:00am Departure time – 2:00pm Arrival and departure times are guides only. Distance and bus schedules may require modifications to the timetable.

About Penrith Lakes	Learning across the curriculum
Penrith Lakes Environmental Education Centre (PLEEC) provides quality curriculum related fieldwork programs for students (K-12) across different KLA's. These engaging programs support students in achieving syllabus outcomes as well as in appreciating their application in the 'real world context'. In addition to that PLEEC also provides programs that address 'Sustainability' as a cross curriculum priority of the new Australian Curriculum. Around 7,000 students undertake our programs each year .	*Cross-curriculum priorities enable students to develop understanding about and address the contemporary issues they face.* **Sustainability** is concerned with the ongoing capacity of the Earth to maintain all life. It provides authentic contexts for exploring, investigating and understanding systems in the natural and made environments. Relationships, cycles and cause and effect are explored, and students develop observation and analytical skills to examine these relationships in the world around them to design solutions to identified sustainability problems.

'Science Stage 3, 4 & 5' Syllabus Outcomes

ST3-4 WS Working Scientifically

Investigates by posing questions, including testable questions, making predictions and gathering data to draw evidence-based conclusions and develop explanations

Content:

Students question and predict by:

• with guidance, posing questions to clarify practical problems or inform a scientific investigation (ACSIS231, ACSIS232)

• predicting what the findings of an investigation might be (ACSIS231, ACSIS232)

• applying experience from similar situations in the past to predict what might happen in a new situation

Students plan investigations by:

• with guidance, planning appropriate investigation methods to test predictions, answer questions or solve problems including surveys, fieldwork, research and fair tests (ACSIS086, ACSIS103, ACSHE081, ACSHE098)

• deciding which variable should be changed and measured in fair tests while keeping everything else the same (ACSIS087, ACSIS104)

Students conduct investigations by:

• working individually and collaboratively in conducting a range of appropriate investigation methods, including fair tests, to answer questions or solve problems using suitable equipment and materials, checking observations and measurements by repeating them where appropriate

• using equipment and materials safely, identifying potential risks (ACSIS088, ACSIS105)

• accurately observing, measuring and recording data, using digital technologies as appropriate (ACSIS087, ACSIS104)

• using formal units and abbreviations for measuring and recording data

• suggesting improvements to the methods used to investigate a question or solve a problem (ACSIS091, ACSIS108)

Students process and analyse data and information by:

• constructing and using a range of representations, including tables, graphs (column, picture, line and divided bar graphs) and labelled diagrams

• using numerical techniques to analyse data and information, including calculating the means and percentages of small sets of data

Physical World Outcomes

A student:

› describes how scientific understanding about the sources, transfer and transformation of electricity is related to making decisions about its use ST3-6PW

› uses scientific knowledge about the transfer of light to solve problems that directly affect people's lives ST3-7PW

Content

Electrical circuits provide a means of transferring and transforming electricity. (ACSSU097)

Students:

• identify potential risks and demonstrate safe use when using electrical circuits and devices

• demonstrate the need for a circuit to be complete to allow the transfer (flow) of electricity

• observe and describe how some devices transform (change) electricity to heat energy, light, sound or movement, eg hair dryers, light globes, bells and fans

Energy from a variety of sources can be used to generate electricity and this knowledge can inform personal and community-based decisions about using these sources sustainably. (ACSSU219)

Students:

• research and present ideas about the different ways electricity can be generated, eg burning coal or natural gas; solar, hydroelectric, geothermal, wind and wave-generated electricity

• describe how scientific knowledge can be used to inform personal and community decisions about the use and conservation of sustainable sources of energy (ACSHE217, ACSHE220)

Stage 4&5 Skills

Students:

• develop knowledge, understanding of and skills in applying the processes of Working Scientifically

Stage 4 & 5 Outcomes:

SC4-6WS & SC5-6WS: follows a sequence of instructions to safely undertake a range of investigation types, collaboratively and individually

SC4-7WS & SC5-7WS : processes, analyses and evaluates data from first-hand investigations and secondary sources to develop evidence-based arguments and conclusions

SC4-8WS & SC5-8WS: applies scientific understanding and critical thinking skills to suggest possible solutions to identified problems

Physical World - Stage 4 Outcome

› explains how scientific understanding about energy conservation, transfers and transformations is applied in systems SC5-11PW

Content:

- investigate how magnets and electromagnets are used in some everyday devices or technologies used in everyday life

PW3 Energy appears in different forms including movement (kinetic energy), heat and potential energy, and causes change within systems. (ACSSU155)

- identify objects that possess energy because of their motion (kinetic) or because of other properties (potential)
- relate electricity with energy transfer in a simple circuit
- investigate some everyday energy transformations that cause change within systems, including motion, electricity, heat, sound and light
- identify that most energy conversions are inefficient and lead to the production of heat energy, eg in light bulbs
- research ways in which scientific knowledge and technological developments have led to finding a solution to a contemporary issue, eg improvements in devices to increase the efficiency of energy transfers or conversions
- discuss the implications for society and the environment of some solutions to increase the efficiency of energy conversions by reducing the production of heat energy

Additional content: debate intergenerational implications of the use of non-renewable energy resource

Physical World- Stage 5 Outcome

- explains how scientific understanding about energy conservation, transfers and transformations is applied in systems SC5-11PW

PW3 Scientific understanding of current electricity has resulted in technological developments designed to improve the efficiency in generation and use of electricity

- describe qualitatively the relationship between voltage, resistance and current
- outline recent examples where scientific or technological developments have involved specialist teams from different branches of science, engineering and technology, eg low emissions electricity generation and reduction in atmospheric pollution

PW4 Energy conservation in a system can be explained by describing energy transfers and transformations. (ACSSU190)

Students:

- apply the law of conservation of energy to account for the total energy involved in energy transfers and transformations
- describe how, in energy transfers and transformations, a variety of processes can occur so that usable energy is reduced and the system is not 100% efficient
- discuss, using examples, how the values and needs of contemporary society can influence the focus of scientific research in the area of increasing efficiency of the use of electricity by individuals and society (ACSHE228, ACSHE230)
- discuss viewpoints and choices that need to be considered in making decisions about the use of non-renewable energy resources

Additional content:

- explain the relationship between resistance, voltage and current, using Ohm's Law
- investigate the energy efficiency of appliances and relate this to a house

Teaching and Learning Activities	Resources
LESSON Plan - **Energy** (60 mins approx) Introduction to 'Energy' and its importance in our society (5mins) ▪ Activity 1 'Bikes & Lights (10 mins) (Put students into groups of 6) 1 student pedalling to power (3-5 LED's) light sequence quite easily, then teacher presses a switch to the 1 halogen (heat) light – discuss the impact of this higher use of energy on the effort required on the bike (pedal resistance should increase); then one by one other students join in pedalling to ease the workload and help power the hot halogen light (2-6). (Explain the concepts of work = energy; current, voltage and the role of electrons; energy transformations occurring).	Provided by REEP: ▪ X6 Foldout Small Bikes (Portable Generators) & Transformer Box ▪ Variety of Lights florescent, halogen LED ▪ Video & Audio Equipment

Teaching and Learning Activities	Resources
▪ Activity 2: Riding to max (kWh) Group Competition (10 mins) In their groups of 6, students try to pedal as hard as possible for 30 sec and see how much power they can generate individually (W) and as a group; and try to power as many LED lights in a sequence as possible; (W) is displayed & converted to kWh; other groups follow and the winning group is observed. Why did they win? (Write down each group's result in laminated A3 table). Complete pge 1 on worksheet. ▪ Activity 3: Can you beat the solar panels? (10mins) A switch is again pressed and now the solar (W) output is displayed against students group results. Calculate its output in kWh. It also now powers the LED lights in a sequence. Why is it higher or lower than theirs? (Explain this depends on cloud cover, season etc.,) An explanation of how a solar system works (including its energy conversions efficiency & role of battery storage). (Average cost of solar kWh included). ▪ Activity 4: Wind Power (10mins) Wind turbine is powered by the wind from a leaf blower (EEC teacher operated). A switch is again pressed and it is now powering the LED lights sequence and its (W0) & kWh output is measured. Using the wind turbine explain how it works, including large scale wind turbines (including its energy conversions efficiency & role of battery storage). (Average cost of wind kWh included). ▪ **Activity 5:** Coal Boiler. (10 mins) Pre start and run the (Wilscoe D9 Steam Engine) boiler along the workshop to symbolise industrial revolution & current Australian mainstream electricity generation. Show students the pollution produced using filter paper on a mounted crucible above its chimney. Explain how it works (including its energy conversions efficiency). (Average cost of coal kWh included). ▪ Activity 6: Wrap Up (10mins) Students complete worksheet attached and their overall judgement. ▪ **Activity 7:** 'Dance Party' (5 mins). An MTV party is organised that needs audio and visual energy requiring equipment (LCD/Projector & Speakers), and as a class we have to power it! Students take turns at being on the bikes and keeping the party going for at least 5 mins. (Further explanations (stage appropriate) of the concepts of work = energy; current, voltage and the role of electrons; energy transformations occurring). Who normally does all the work to power our lifestyle?	