Keep Your Cool:
Energy Transfers and Transformations

YEAR 8 – PHYSICS: ENERGY

QGC | FUTUREMAKERS | QUEENSLAND MUSEUM NETWORK | Queensland Government

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Need to know information

Future Makers is an innovative partnership between Queensland Museum Network and Shell's QGC project aiming to increase awareness and understanding of the value of science, technology, engineering and maths (STEM) education and skills in Queensland.

This partnership aims to engage and inspire people with the wonder of science, and increase the participation and performance of students in STEM-related subjects and careers — creating a highly capable workforce for the future.

Cover Image: Woven fan, Torres Strait Islands. Source: Queensland Museum, Bruce Cowell.

Australian Curriculum Links

YEAR 8

While this resource has been developed to support the delivery of the Year 8 Science Curriculum, it is possible to connect learning with other year levels. You are encouraged to adapt the resource to meet your individual needs and learning context.

Science Understanding

Physical sciences

Energy appears in different forms, including movement (kinetic energy), heat and potential energy, and energy transformations and transfers cause change within systems *(ACSSU155)*

Science as a Human Endeavour

Use and influence of science

Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations *(ACSHE135)*

Science Inquiry Skills

Communicating

Communicate ideas, findings and evidence based solutions to problems using scientific language, and representations, using digital technologies as appropriate *(ACSIS148)*

Design and Technologies: Knowledge and Understanding

Engineering principles and systems

Analyse how motion, force and energy are used to manipulate and control electromechanical systems when designing simple, engineered solutions *(ACTDEK031)*

Design and Technologies: Processes and Production Skills

Investigating and defining

Critique needs or opportunities for designing and investigate, analyse and select from a range of materials, components, tools, equipment and processes to develop design ideas *(ACTDEP035)*

Generating and designing

Generate, develop, test and communicate design ideas, plans and processes for various audiences using appropriate technical terms and technologies including graphical representation techniques *(ACTDEP036)*

Producing and implementing

Select and justify choices of materials, components, tools, equipment and techniques to effectively and safely make designed solutions *(ACTDEP037)*

Aboriginal and Torres Strait Islander Histories and Cultures

Aboriginal and Torres Strait Islander Peoples' ways of life are uniquely expressed through ways of being, knowing, thinking and doing *(OI.5)*

Learning area statement: Science

Students will have opportunities to learn that Aboriginal and Torres Strait Islander Peoples have longstanding scientific knowledge traditions and developed knowledge about the world by:

— observation, using all the senses

— prediction and hypothesis

— testing (trial and error)

— making generalisations within specific contexts such as the use of food, natural materials, navigation and sustainability of the environment.

Introduction

Physics in the Museum

This learning resource has been developed to utilise real objects to explore energy transfers and transformations in the past and present, and is intended as an example of cross-disciplinary learning.

Queensland Museum collections provide valuable primary and secondary sources of information that can be used to analyse the way in which physics principles are a part of our everyday lives, and the history and development of technology.

Keep Your Cool: Energy Transfers and Transformations is a cross-curricular resource providing a framework for investigating energy in the real world using fans from Queensland Museum's social history collection, and culminating in students making a museum display of their own designs for an independently power-sourced cooling device.

As this resource has been designed to complement teaching and learning experiences within your classroom, students are assumed to have developed knowledge about the following concepts:

— Energy appears in different forms including kinetic energy, potential energy, and energy transformations and transfers cause change within systems.

— Energy transfers involve the movement of the same energy type between two mediums.

— Energy transformations are changes from one energy type to another.

Keep Your Cool: Energy Transfers and Transformations

MUSEUM PERSPECTIVES

Museum objects can help us to reflect on the way energy has been used in the past and provide ideas for future innovations.

Which Fan is That?: Object Investigation

Investigate three fans, showcased on Queensland Museum Collections Online, that utilise different energy sources.

View the Collections Online database entries below:

Woven Fan	Registration Number: QE11690
Water-driven Fan	Registration Number: H22716
Gas Powered Fan	Registration Number: H43540

Optional: Students can use Object Analysis: Artefacts to summarise their observations of each object.

Describe the energy inputs and outputs of each fan.

Use Table 1 to record your observations.

- What are the energy transfers and transformations that take place when the fan is in use?
- What are the limitations of using the fan? Consider scenarios where its use would be sustainable or non-sustainable, and why.
- Consider the cultural environment the fans were used in, for example, time period, location, access to energy from external sources. How did these aspects influence the design of the fan?

Compare and contrast the energy efficiency of the collection fans with modern cooling devices. Record your responses in Table 2.

Table 1: Energy Analysis

Describe the energy inputs and outputs of each fan from QM Collections Online.

Device	Energy Input	Energy Output	Energy transfers or transformations	Sustainable or not? Why?	Possible improvements?
Woven Fan					
Water-driven Fan					
Gas Powered Fan					

Table 2: Energy analysis

Compare and contrast the energy efficiency of the collection object fans (Table 1) with modern cooling devices.

(Note: the last line of this table can be completed either before or after the Design Challenge activity)

Device	Energy Input	Energy Output	Energy transfers or transformations	Sustainable or not? Why?	Possible improvements?
Modern Electrical Ceiling Fan					
Modern Bladeless Fan					
Air Conditioner (wall mounted)					
New Inventions or Ideas (your own or somebody else's)					

Design Challenge

Design your own independently power sourced fan/cooling device.

1. **Make a prototype or design drawing of your device. Consider including details such as:**
   - Materials that could be used
   - Scientific drawing with measurements
   - Labels
   - Notes on functionality

2. **List the types of energy utilised in your device.**

3. **Draw a flow diagram showing the energy transformations that occur when your fan is in use.**

4. **Complete the last row in Table 2: Energy Analysis to summarise the proposed energy transfers and transformations of your new cooling device.**

5. **Write your own museum collection object label for your fan following the format used on QM Collections Online, extending the story of your object by including information about the energy types, transfers and transformations.**

Name or title:
Brief description:
Collection:
Production place:
Production date:
Materials:
Measurement:
History and use:
Energy type:
Energy transformations:

6. **Make a museum display of your classes' devices, ensuring each prototype or design drawing is accompanied by its object label.**