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- Stimulate the students' interest in the topic by showing excerpts from the film K19: The Widowmaker.
- Organise a class debate on the advantages and disadvantages of nuclear powered submarines. Students can access the websites listed above to develop their arguments.

**Gathering evidence about student learning**

Some evidence may now have been gathered which may assist in making a judgement on the students' demonstration of Science outcome energy and Change 5.3.

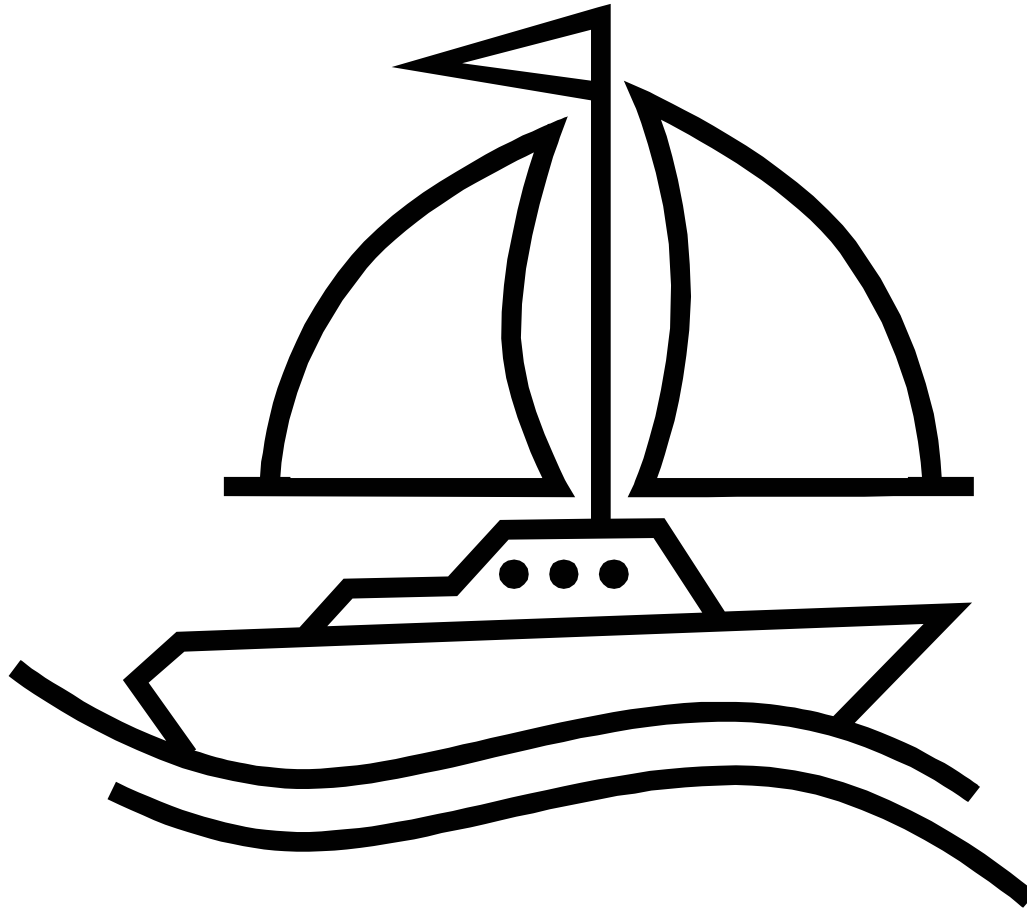
Teachers may gather evidence by focussing on:

- Students' understanding of how nuclear powered submarines work.
- Student participation in debate presentation
- Student research of information relevant to the topic of discussion.

## Resource 1

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### Forces Acting on a Boat



## Resource 2

# Energy

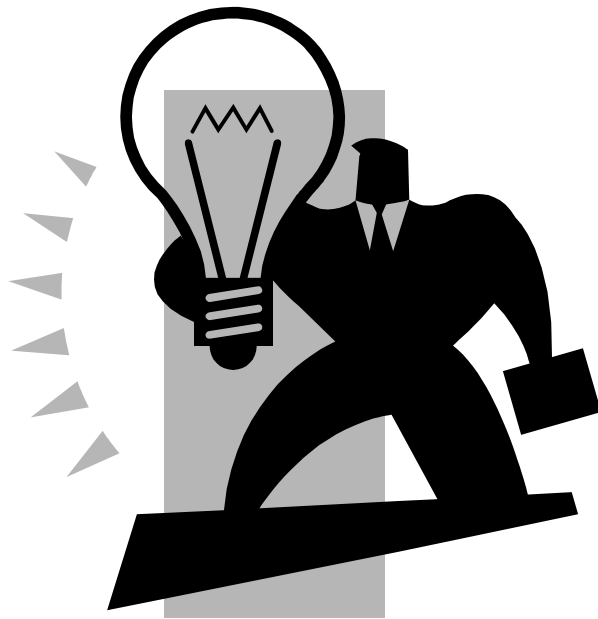
Energy is the ability to do work.

There are two types of energy:

- ➡ Potential (stored) energy. Potential energy is work waiting to be done!
- ➡ Kinetic (movement) energy. Kinetic energy is work being done!

Energy exists in different forms:

- Chemical
- Electrical
- Heat
- Light
- Mechanical
- Nuclear
- Sound

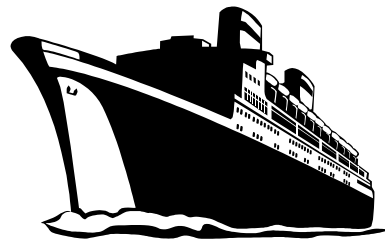
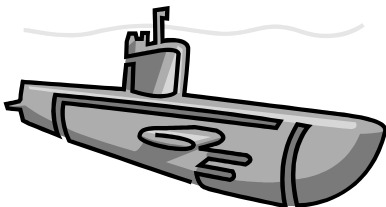
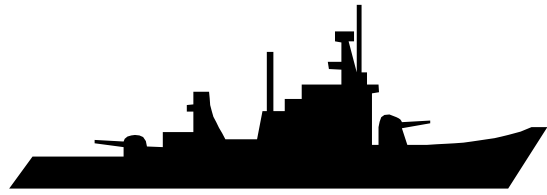
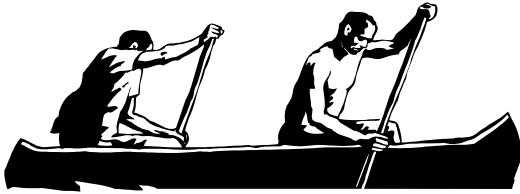


Energy can be transformed (changed) from one type to another but cannot be created or destroyed.

For example:  
Electrical energy is transformed into light energy *and* heat energy when you switch on a light.

## Resource 3

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**Activity: What makes a boat move in the water?**

Examine the card you have been given. It shows one form of water craft. In groups discuss in terms of energy types, forms and transformations how the water craft moves through the water. Enter your conclusions in the following table:

	1	2	3	4	5	6
Type of water craft						
Energy forms						
Energy transformations						

## Resource 4

### Developments in ship Propulsion

The earliest record of a ship with sails (in Egypt).

The first paddle-driven steamboat (the *Pyroscaphe*) was constructed by Frenchman Marquis Claude de Jouffroy D'Abbans.

The screw propeller (patented by Francis Pettit Smith) was first used on the *Archimedes* an American River Steamer.

The worlds' first steam turbine driven ship the *Turbina* was developed by Sir Charles Parsons.

The first sea vessel with a diesel engine was the *Vulcanus* built for the Dutch East India company.

The first ship powered by a gas turbine was the Shell oil tanker *Auris*.

The worlds' first nuclear powered submarine was the *USS Nautilus*.

The first commercial Hovercraft was the *Mountbatten* operating as a ferry across the English Channel.

## Resource 5

Light has always been used to guide ships or warn them of dangers. For example ancient people used fires on hills.

The first known famous lighthouse was built at Alexandria in Egypt about 280 BC. It was a tower with a fire burning on the roof the light from which could be seen up to 50 Km away. (Why do you think the Egyptians built a special tower? Hint: Think about the landscape at the mouth of the Nile).

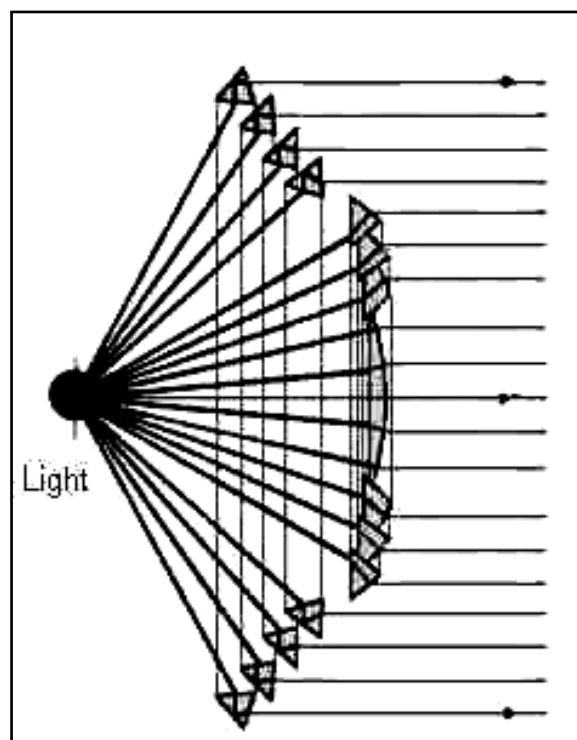


After about 1500AD coal became the main source of fuel for lighthouses although some used oil.

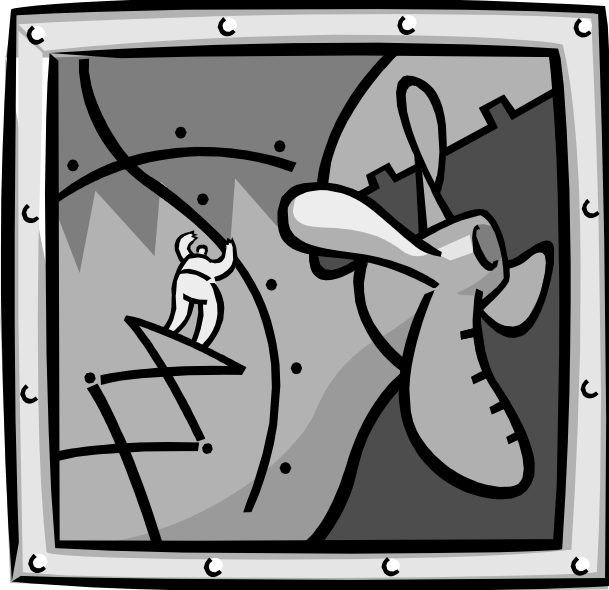
In 1781, a Swiss physicist and chemist Aimé Argand designed a new type of lamp for lighthouses in which a single wick was able to emit as much light as seven candles. The lamp consisted of a lens and parabolic reflector.

But in 1822, Augustin Fresnel invented the Fresnel lens which uses concentric prisms around a lens to focus scattered light from a source into parallel beams.

How a  
Fresnel lens  
works



**Resource 6**



**Lights,  
Engines,  
Action!**

**Excursion to the Queensland Maritime  
Museum**

**Name**

**Date**

**As you tour the exhibits at the museum look for information to enable you to complete the tasks.**



**S**elect 3 vessels from different eras (an older and a newer vessel and one in between) and make a comparison of the technology and design feature of the boats. Use scientific concepts and terminology such as friction, propulsion and energy to make your comparisons and use the data table below to help you organise your information

Name of vessel	Technology	Design Features

What generalisations can you make from your observations?



**I**dentify examples in the museum that illustrate the use of the following scientific concepts


Concept	Example
Friction	
Propulsion	
Light	
Energy transformation	




**D**uring your tour of HMAS *Diamantina*, identify examples of the use of different forms of energy

Energy form	Example
Chemical	
Electrical	
Heat	
Light	

<b>Mechanical</b>	
<b>Sound</b>	

 **U**se the data table to collect data on the power, capacity and year of manufacture of the engines on display. Back at school, calculate the power / capacity ratio, plot this against the year on a graph and comment on any trends.

<b>Year of manufacture</b>	<b>Power</b>	<b>Capacity</b>

 **D**evised a timeline showing the changes in lighthouse technology shown at the museum



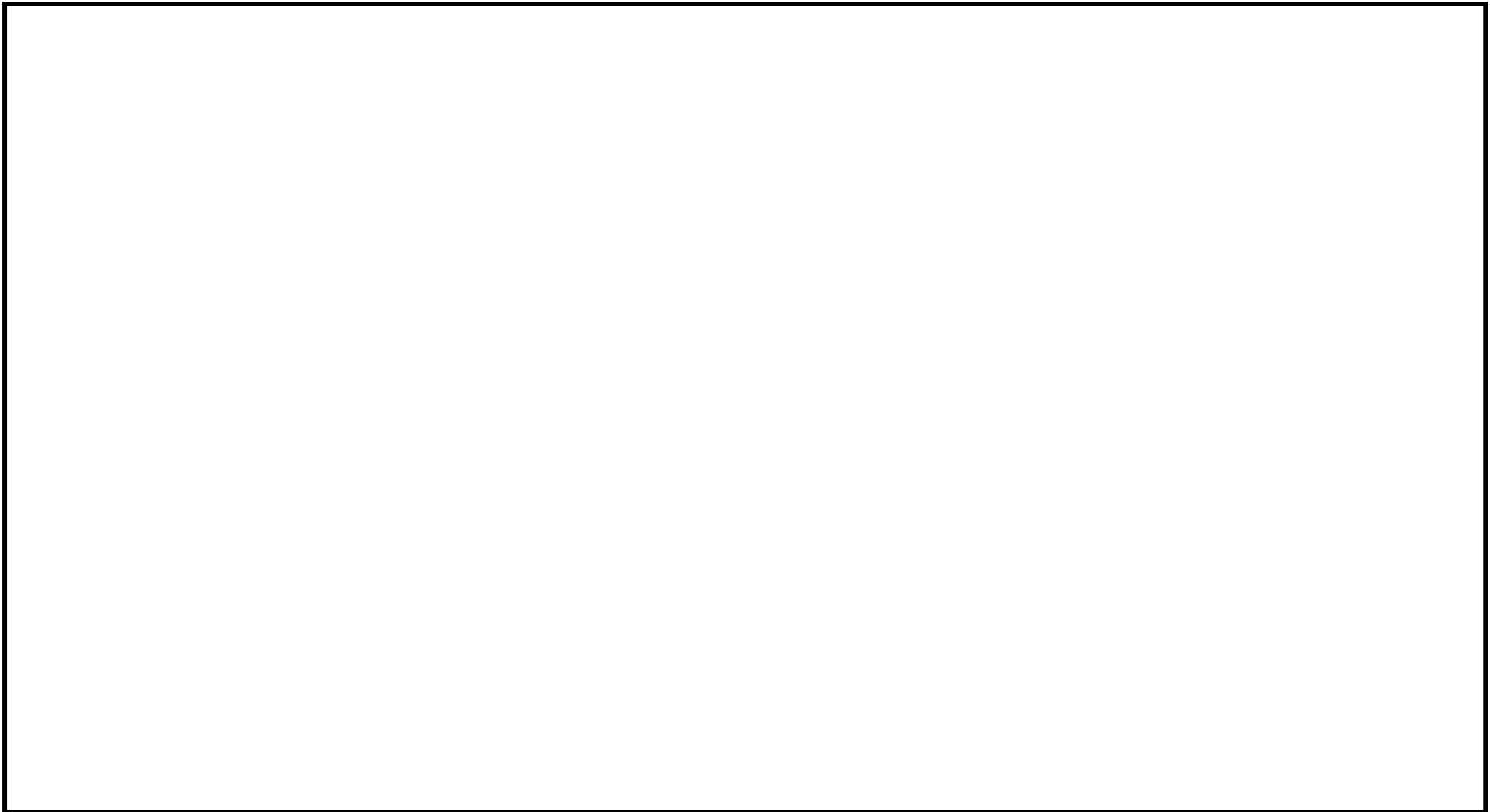
**E**xamine the half models of boats shown in *Gallery 3* and comment on the principles of force and motion illustrated in the hull shape of three of the models.

Example	Comment

Sketch the shape of the hull which you think would be the fastest through water.



 Examine the working model of the engine in Gallery 4 and make a sketch to show how it works.



## Support material and references

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### Curriculum documents

- Queensland School Curriculum Council 2000, Science Module Level 4: *Force and Motion*.  
Queensland School Curriculum Council, 1999, *Science Years 1 – 10 Syllabus*, State of Queensland.  
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Queensland Studies Authority, 2003, Technology Early Primary Sourcebook module: *Blast Off*, State of Queensland.  
Queensland Studies Authority, 2003, Technology Lower Secondary Sourcebook module: *Solving a Problem*, State of Queensland.  
Queensland Studies Authority, 2003, *Technology Years 1 – 10 Sourcebook Guidelines*, State of Queensland.  
Queensland Studies Authority, 2003, *Technology Years 1 – 10 Syllabus*, State of Queensland.

### Websites

- Explore Science dot com <http://www.explorescience.com/>  
How Stuff Works <http://science.howstuffworks.com/>  
<http://people.howstuffworks.com/submarine.htm/printable>  
K19 and other subs in peril: National Geographic Magazine <http://www.ngmag.com/k19/>  
K19: The Story behind the movie  
[http://www.click2flicks.com/k19\\_widowmaker/k19\\_widowmaker\\_ch1.htm](http://www.click2flicks.com/k19_widowmaker/k19_widowmaker_ch1.htm)  
Queensland Studies Authority <http://www.qsa.qld.edu.au/index.html>  
Royal Australian Navy: Virtual Fleet <http://www.navy.gov.au/vf/default.htm>  
See inside a submarine [wgbh/nova/subsecrets/inside.html](http://wgbh/nova/subsecrets/inside.html)

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