How do hydro stations work?

Years 5-8 (ages 9-12)

Overview

Show your students the video "How do hydro power stations work?"
www.meridianenergy.co.nz/who-we-are/our-power-stations/hydro

Curriculum areas	Achievement objectives	Years	Learning	Success criteria
Level 3				
The nature of science	**Investigating in science** Build on prior experiences, working together to share and examine their own and others' knowledge. Ask questions, find evidence, explore simple models and carry out investigations to develop simple explanations. **Communicating in science** Begin to use a range of scientific symbols, conventions, and vocabulary. **Participating and contributing** Use their growing science knowledge when considering issues of concern to them.	Years 5-8	✓ Design and make a turbine.	✓ Describe and observe how a turbine works. ✓ Reflect on turbine design and suggest improvements for next time.
Science – The physical world	**Physical inquiry and physics concepts** Explore, describe, and represent patterns and trends for everyday examples of physical phenomena, such as movement, forces, electricity and magnetism, light, sound, waves, and heat. For example, identify and describe the effect of forces (contact and non-contact) on the motion of objects; identify and describe everyday examples of sources of energy, forms of energy, and energy transformations.	Years 5-8	✓ Explore and explain the process of water turning into electricity.	✓ Explain or illustrate how hydro stations work.

Curriculum areas	Achievement objectives	Years	Learning	Sucess criteria
Level 4				
The nature of science	**Investigating in science** Ask questions, find evidence, explore simple models, and carry out investigations to develop simple explanations. **Communicating in science** Begin to use a range of scientific symbols, conventions, and vocabulary. **Participating and contributing** Use their growing science knowledge when considering issues of concern to them.	Years 5-8	✓ Design and make a turbine and reflect on their design and prototype.	✓ Describe and observe how a turbine works. ✓ Reflect on turbine design and suggest improvements for next time.
Science - The physical world	**Physical inquiry and physics concepts** Explore, describe, and represent patterns and trends for everyday examples of physical phenomena, such as movement, forces, electricity and magnetism, light, sound, waves, and heat. For example, identify and describe the effect of forces (contact and non-contact) on the motion of objects; identify and describe everyday examples of sources of energy, forms of energy, and energy transformations.	Years 5-8	✓ Explore and explain the process of water turning into electricity.	✓ Explain or Illustrate how hydro stations work.

What you'll need

- ☐ Cross-section of a Hydro power station worksheet for each student
- ☐ How do Hydro stations work video on the Meridian website
- ☐ K-W-L master for each group
- ☐ 360 degree footage of Ōhau A or Manapōuri power station
- ☐ Electricity and water flow diagrams
- ☐ Turbine planning sheet
- ☐ Design your water turbine

Lesson progression

01. Get your students to partner up and talk about what they know about electricity. Get them to collate/draw their ideas on the Know-Wonder-Learnt worksheet. Go around the room and get each group to share their ideas.

02. Watch the 360 degree footage of Ōhau A or Manapōuri on the Meridian website https://www.meridianenergy.co.nz/whare-ako

03. Get your students to complete the cross section of a hydro power station. There are several options for you here:

- labelling the parts of the cross section of the hydro power station
- sketching in parts of the hydro power station, suitable for years 7-8
- a simple cut and paste version for younger students
- a writing version.

Choose the version which is most suitable to your students.

04. Use the Ōhau A or Manapōuri water and electricity flow diagrams and get your students to draw the path the electricity takes in red from the generator to its destination. Then get the students to draw the path the water takes from the head of water through the power station to its destination. This is a good activity for the students to understand that the water flows back into the river system once it has generated electricity.

05. Get your students to design a water turbine using our planning sheet. They can do this individually or in a group. Download the make a turbine instruction sheet. Get your students to have a go making a prototype turbine from their design and reflect on the design and performance of their turbine.

Vocabulary

Dam	Lake	Reservoir
Hydro	Control gate	Tail race
Electricity	Generator	Transmission lines
Power house	Drive shaft	Transformer
Turbine	Intake	Earthfill dam
Runner	Penstock	Concrete
Gravity	Water	Water pressure
Spins	Kinetic energy	Electrical energy
Voltage	Switchyard	Network
Inlet gate	Potential energy	Canal
Tunnel	Hertz	National grid
Renewable	Flow	Force
Spillway	Mechanical energy	Blades
Axis	Buckets	Shaft
Rotor	Stator	Rotation

The vocabulary is useful to display on the wall for students to access at all times and to help them become familiar with these topic specific words.

Assessing your students

Learning Intentions

Students are learning to:

» Explore and explain the process of water turning into electricity.

» Design and make a turbine and reflect on their design and prototype.

Success Criteria

Students can:

» Explain or illustrate how hydro stations work.

» Describe and observe how a turbine works. Reflect on turbine design and suggest improvements for next time.

Notes to help you teach

- Typically, a dam stores water in a reservoir. Water released from the reservoir falls through a pipe called a penstock to a turbine. These turbines look like large wheels with wide spokes. The water hits the blades and pushes them to make the turbine spin. The turbine's rotation drives a generator to produce electricity. In other words, this spinning 'changes' the force of falling water into electricity.
- Most of Meridian's electricity is made from the energy of falling water. Our hydro stations generate enough electricity to power around 1.4 million homes each year.
- It's not possible to store large amounts of electricity. But it is possible to store water in dams.

Next steps

» Book a visit from one of our engineers to run a **STEM programme** building earth dams.

» Book a visit to tour one of **our Power stations**.

There will be times when an in-school visit or power station tour is not possible due to a variety of matters. However we will always try and accommodate when and where possible.

Links to other resources

» **Power Article** by Alex Taylor - School Journal Level 2 Aug 2011.

» **Power Alternatives** by Anna Meyer and Andrew Dickson, Connected No 3 2010

» **Electricity - Science kids** https://www.sciencekids.co.nz/electricity.html

» **NZ's Hydro electricity story** https://teara.govt.nz/en/hydroelectricity

» **Hydro electricity by the Science learning hub** https://www.sciencelearn.org.nz/resources/1574-hydro-power