



Hydro Turbine with Housing

**Curriculum
Levels 3-4
Science**

Activity Description

Students will use the a Hydro Turbine with Housing see School-gen maker projects to harness rotational energy to lift a small weight. The activity will require them to work collaboratively as a team to solve a STEM challenge.



Teaching rationale

Students will:

- Investigate how the energy of falling water can be used for a specific purpose.
- Investigate how the rotational energy can be harnessed to do work.

Note: The activity is linked to the physical world strand of the science curriculum (Levels 3-5) and could also be linked to the technology, maths and social science curriculums.

Curriculum Links

SCIENCE	Level 3 - 5 Achievement Objectives	Student Learning Outcomes
Nature of Science	<p>Investigating in science Ask questions, find evidence, explore simple models, and carry out appropriate investigations to develop simple explanations.</p>	<ol style="list-style-type: none"> 1. Use the hydro turbine model to harness the energy in falling water 2. Work collaboratively to solve a practical STEM problem
Physical World	<p>Physical inquiry and physics concepts:</p> <p>Level 3- 4 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.</p> <p>Level 5 Identify and describe the patterns associated with physical phenomena found in simple everyday situations involving movement, forces, electricity and magnetism, light, sound, waves, and heat. For example, identify and describe energy changes and conservation of energy, simple electrical circuits, and the effect of contact and non-contact on the motion of objects.</p> <p>Using physics Explore a technological or biological application of physics.</p>	<ol style="list-style-type: none"> 3. Identify the contact force of water on the blades of the turbine 4. Identify gravity as the cause of the water being pulled downwards. 5. Describe the effect of the water's force on the turbine (causing rotational motion) 6. State that energy is being transformed (changed) from one form to another 7. State that the water in the container (before it is poured) has stored energy (gravitational potential) 8. State that as the water falls it loses potential energy and gains kinetic energy

Running the activity

- Prior to this activity you will need to have printed and constructed
 - (a) hydro turbine with housing
 - (b) winch attachment
- Students will work in teams of 3-4 students.
- Print out the student worksheet (this notes all the equipment needed).
- Provide students with access to water (**Note** – it is preferable to do this activity outside or in a dedicated science lab).
- Allocate 1 litre of water per team but be prepared to top it up, especially at first as they get to grips with the technicalities of the activity.
- The mass that is lifted needs to be increasable (from 30 grams) in 10 g amounts - a feasible way of doing this is to use a balloon filled with increasing amounts of water (tied at the opening), or use small fishing sinkers (1/4 or 1/2 ounce).

Extending your students

- See the other School-gen maker projects on schoolgen.co.nz.
- See the challenges on the maker projects sheets on schoolgen.co.nz.

Supporting resources

- Use the 'How to make a hydro turbine with housing' video and steps on schoolgen.co.nz.
- Hydroelectricity background on schoolgen.co.nz.
- History of hydroelectricity in New Zealand on schoolgen.co.nz.

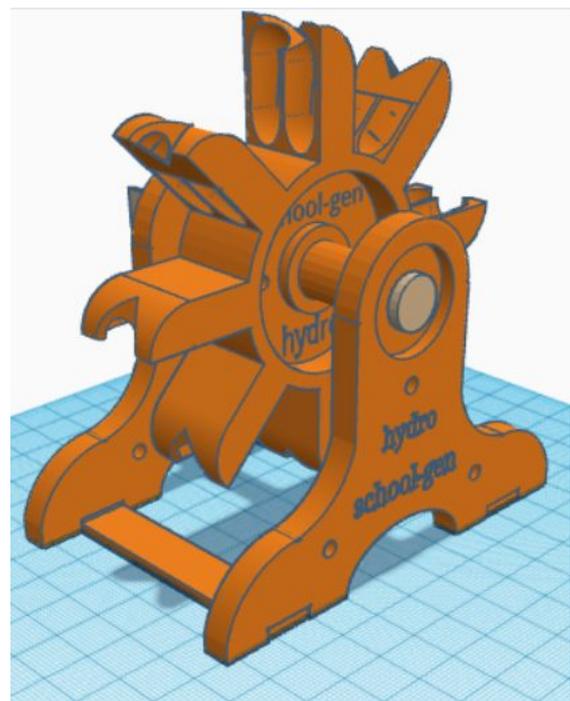
Haul it up with hydro - Harnessing the hydro turbine

In this activity, you will learn

- How much energy there is in moving water
- How you can harness the energy in moving water to lift an object
- What energy is required to lift a mass

Instructions

1. If you haven't been supplied with a hydro turbine with housing, then use the How to make a hydro turbine with housing steps from the School-gen website.
2. Your challenge is to work together with your team to use the hydro turbine with housing to lift as much mass as you can by a height of 1m using the energy of falling water. You only have 1 litre of water and need to reuse it as much as possible.
3. Note the following rules:
 - (a) The water must be poured from a height of no greater than 1 metre above the turbine.
 - (b) The starting mass is 30g.
 - (c) Once you have lifted the mass by 1 metre, add 10g more and then repeat.
 - (d) The team that lifts the most mass up by 1 metre in the shortest amount of time wins the challenge.



Equipment

You will need:

- Completed hydro turbine with housing mounted on a small block of wood including the winch attachment
- 1 litre empty plastic milk bottle filled with water
- Kitchen funnel and/or hose-pipe (optional)
- 2 litre ice-cream container (or similar container)
- > 1 m of string
- Small mass (recommend a normal balloon starting with 30 ml of water)
- Scales to measure mass accurately
- Tape measure

Things to know:

It takes about 10 Joules of energy to lift 1 kg of water by 1 metre.

- 1 ml (millilitre) of water has a mass of 1g (gram)
- 1 L (litre) of water has a mass of 1 kg (kilogram)
- You will not be given all of the details as this is a challenge that you need to work on collaboratively as a team (probably 3-4 people) to solve, however to get you started see the setup diagram below.

Diagram not too scale

