Year 6 - Science

Teacher Guide: What is hydropower?

Hydropower is electricity generated from one of Earth's natural and renewable resources – water. The word 'hydro' comes from the Greek word for water, so hydropower simply means electricity generated by water.

Electricity is a form of energy. Energy cannot be created or destroyed – it can only be changed from one form to another. Hydropower stations convert the gravitational potential (stored) energy of water retained at high elevation in lakes to electrical energy. Therefore the transformation of energy from one form to another occurs.

Generating electrical energy

Water is passed through canals and large pipes (penstocks) to a lower elevation which transforms its potential energy to kinetic energy, the energy of motion.

The water flows at great speed and under high pressure into the power station where it is directed onto the blades of a turbine. As the water hits the turbine it spins, transferring the kinetic energy of the water to the turbine through contact.

The turbine is connected to a generator. The generator transforms the kinetic energy of the turbine spinning into electrical energy.

Inside the generator is a rotor and stator. The rotor contains a series of magnets and it spins inside the stator which is made up of coils of copper wire. As the rotor is spun by the turbine it creates a magnetic field which energises the electrons inside the wire causing an electric current.

The amount of energy available from a hydropower station depends on two major factors: water pressure and flow.

Water Pressure

The water pressure on a turbine depends on the height from which the water has to fall to reach the turbine. The greater the height of the water column above the turbine the greater the water pressure and greater the electrical energy output of the generators.

Flow of water

The greater the quantity of water available, the greater the number (or size) of the turbines that can be spun and the greater the electrical energy output of the generators.

The electrical energy (electricity) is converted to a higher voltage (to minimise losses) in transformers and then transported long distances in transmission lines. The voltage is then reduced at substations before it can be used by homes and businesses (typically 240V for homes).

After water, having done its job of turning the turbine, flows out of the hydropower station through the tailrace and re-joins the river system downstream. The same water used to generate electricity may then be used for drinking water, irrigation, recreation or directed through another hydropower station.

Australian Curriculum

Learning Area Science	Content Descriptions
AC9S6U03	Investigate the transfer and transformation of energy in electrical circuits, including the role of circuit components, insulators and conductors.
AC9S6I01	Pose investigable questions to identify patterns and test relationships and male reasoned predictions.
AC9S6H02	Investigate how scientific knowledge is used by individuals and communities to identify problems, consider responses and make decisions.

Australian Curriculum cont.

Mathematics	
AC9M6M01	Convert between common metric units of length, mass and capacity; choose and use decimal representations of metric measurements relevant to the context of a problem.
Cross – curriculum Priorities	Sustainability
General Capabilities	Literacy, Numeracy, Critical and Creative Thinking

Learning goals

Know:

- Energy can be transformed from one form to another
- There are four forms of energy used to produce hydropower; potential, kinetic, mechanical and electrical
- Hydropower is generated by the force of water spinning a turbine inside a generator

Understand:

- Hydropower is a form of renewable energy
- Energy can be transformed.
- We cannot see electricity but we can feel it
- The height of water affects pressure.

Do:

- Experiment with potential and kinetic energy
- Experiment with water head and pressure
- Build a water wheel

Achievement standard

By the end of Year 6, students:

Science

…identify the role of circuit components in the transfer and transformation of energy.

Maths

… convert between common units of length, mass and capacity.

Adjustment Strategies to include all students

	Enabling	Extending
Content:	Spend time introducing students to the language of electricity.	Have students investigate another hydropower scheme such as the Snowy Mountains scheme.
Process:	Guide students one to one where necessary such as by explaining language used on the poster.	Invite students to create a list of ten questions they have about hydropower and research them.
Product:	Provide students with a copy of the hydropower station cross section poster and let them design their own poster with labels using the original as a reference.	Provide students with a copy of the hydropower station cross section poster and have them write a script and/or create a role play of how the water is transformed from the dam into hydropower.

Assessment

Refer to *Options for assessment and extension* in each Lesson Plan

Evidence of Student Learning

Students are able to:

- Analyse requirements for the transfer of electricity
- Describe how energy transforms from one form to another when generating electricity
- Identify variables
- Make connections between capacity and volume

Group Reflection

Refer to *Elaborate and Review* in each Lesson Plan

Teaching and learning resources

Hydro Tasmania website www.hydro.com.au

Hydro Tasmania *Power of Nature* publication https://www.hydro.com.au/docs/default-source/clean-energy/our-power-stations/power-of-nature.pdf?sfvrsn=15c22528_2

Teaching and learning resources cont.

YouTube video *How Hydroelectricity Works*
by Robert Woodman (2008)
https://www.youtube.com/watch?v=rnPEtwQtmGQ

YouTube video *How Hydroelectricity Works?*
By Rocket Science (2015)
https://www.youtube.com/watch?v=ABv631t1OKI

Materials	Number
Smart board or projector	1
Internet connection	1
Glossary	1 each
Name the parts of a generator turbine activity.	1 each
Hydropower cross section activity	1 each
Does a marble have energy activity sheet ****see source for list of materials required**	1 each
Water head and pressures activity sheet ****see source for list of materials required**	1 each
Build a waterwheel activity sheet ****see source for list of materials required**	1 each

Feedback

If you would like more information or to provide feedback please contact our Education Coordinator at education@hydro.com.au