Power generation

Turbines

Engineering
Lesson Plan

Stage 4 - Overview

In this lesson your students will be able to explore the power of water and the generation of hydro-electricity as they take a closer look at how turbines work within the Snowy Scheme. Watch our video and learn more about energy transfer and transformation.

Students will have the opportunity to analyse hydro-power as a renewable energy.

Learning area	Content descriptions
Science ACSSU116	**Science understanding** Earth and space sciences Some of Earth's resources are renewable, including water that cycles through the environment, but others are non-renewable
ACSSU155	Physical sciences Energy appears in different forms, including movement (kinetic energy), heat and potential energy, and energy transformations and transfers cause change within systems
ACSHE223	**Science as a human endeavour** Nature and development of science Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures
ACSHE121	Use and influence of science People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity
Design and Technology ACTDEK031	**Knowledge and understanding** Analyse how motion, force and energy are used to manipulate and control electromechanical systems when designing simple, engineered solutions

The subject of sustainability is a foundation for all learning areas and key concepts - sustainability - cross-curriculum priority (ACARA)

Resources

Fact sheet - Turbines
Activity sheet - Name the parts of a turbine
Video - Power generation turbine runner
Hands-on - Create a turbine
Website - Snowy Hydro

Lesson ideas and activities

Introduction

Turbines are essential to generating hydro-power - power from water. Water released from the reservoir flows through the penstocks to the turbine, spinning it, allowing the generator to produce electricity. There are two main types of hydro turbines: impulse and reaction. The type of hydro-power turbine selected for a project is based on the height of standing water, referred to as 'head' and the flow, or volume, of water at the site. Other deciding factors include how deep the turbine must be set, efficiency and cost. Most of the turbines in the Snowy Scheme are Francis reaction turbines.

Lesson

Provide your students with the 'Turbine' fact sheet (either online or printed) and take your students through the information as described below.

- If students are not familiar with where the Snowy Scheme is, visit our interactive map on the website **click here**
- Begin with looking at the turbine diagram
- Go through the various parts and examine how they work together, for example water turns the turbine, which then turns the main shaft, which turns the generator
- The information on the other side of the fact sheet is foundation knowledge to go over before viewing the video, noting that there are nine power stations with 33 turbines in the Snowy Scheme
- To meet the power output factors, the Snowy Scheme consists mostly of Francis reaction turbines, however, there is a Kaplan turbine at Jounama Power Station
- Have the students located Jounama Power Station and using the information on the front of the sheet, analyse why the Kaplin turbine was the preferred choice
- **Activity** - ask your students to listen to the video for answers to the following questions;
    - What are the components of the model?

      A - dam, penstocks, generator, turbine,transmission assets, substation, load centre
    - There are two valves, simulating the _____ and _____

      A - main inlet valve and the governor system (controls how much water goes through the turbine)
    - What does the substation do? Based on what?

      A - transforms power either into high voltage or low voltage, based on what the consumer needs

- Describe what happens when water is run through a Frances reaction turbine

  A - it is where both the pressure and kinetic energy of water is converted into electrical energy

- What are the efficiency rates of the Pelton and Francis turbines?

  A - 90-95%

- **Click here** to watch one of our graduate students explain renewable power generation
- Activity - 'Name the parts of a turbine' (*download and print, one per student*)
- Activity - hands-on - create a turbine. Follow the instructions on the sheet. You can substitute the paper plates for plastic if you wish for prolonged use *(this activity can be approached individually or collaboratively)*
- **Hint** - To trial the finished products created by your students, make sure you have access to running water, buckets . A hose is a helpful addition, but not mandatory
- Reflect on the power of water within the Snowy Scheme and the generation of renewable power

Extension ideas

Science

- Challenge the students to build a working model using other materials. Work in groups or pairs to provide opportunities for collaborative and innovative thinking. Use our 'capture ideas' work sheet - **click here**
- Head to the Snowy 2.0 pop-up book and have your students participate in this interactive resource and learn how the turbines play an instrumental role in our Snowy 2.0 pumped-hydro project from water to wire - **click here**
- Extend this activity further by participating in the Snowy 2.0 Knowledge Quest as it challenges your students to use their comprehension, research and navigational skills, while providing an opportunity for critical thinking, building on the idea of renewable generation of hydro-power - **click here**