

Year 6 – Science, Mathematics and Technologies

Teacher Guide: What is wind energy?

Wind energy conversion is the process of converting the kinetic energy of wind into electrical energy. Wind turbines are a clean and renewable energy source.

Wind power works similarly to hydropower. Wind spins the blades of a turbine, which in turn spin a magnet inside a coil of a generator.

Tower

Towers are made of tubular steel. They are installed in three sections and can reach up to 140 metres high and potentially higher. Generally, the higher the height of the turbine hub, the faster the wind speed will be.

Nacelle

The nacelle is made from steel and fibreglass and houses the generator, gearbox and ancillary equipment. It sits on top of the tower. A cone shaped hub that supports the turbine blades is attached to the nacelle. The entire nacelle swivels to face the blades into the wind.

Blades

The turbine blades are made from composite materials such as fibreglass, carbon fibre and even balsa wood, allowing them to flex in strong winds. The curved cross-section creates a pressure differential that makes them rotate. Most modern turbines have three aerodynamic blades.

Anemometer

This instrument measures the speed and direction of the wind so that the automatic control unit can adjust the position and angle of the blades. Each turbine has a lower and upper limit of wind speed between which it can operate.

Points of interest

- A collection of wind turbines is known as a wind farm.

- Years of work go into planning a new wind farm. The first step in planning a wind farm is locating a site that receives reasonably regular and strong winds
- Additionally, sourcing available land with the potential for a good connection to the power network and where the effects on the local community and environment will be minimal.
- The total wind infrastructure (turbines foundations, cables, roads and substations) use only a small proportion of the wind farm site, leaving the rest available for other use, such as farming.

Australian Curriculum

Learning Area Science	Content Descriptions
AC9S6U03	Investigate the transfer and transformation of energy in electrical circuits, including the role circuit components, insulators and conductors.
AC9S6I01	Pose investigable questions to identify patterns and test relationships and make reasoned predictions.
AC9S6H02	Investigate how scientific knowledge is used by individuals and communities to identify problems, consider responses and make decisions
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 the problem.
Technologies: <i>Design and Technologies</i>	
AC9TDE6K01	Explain how people in design and technologies occupations consider competing factors including sustainability in the design of products, services and environments.

Technologies: *Design and Technologies cont.*

AC9TDE6P03	Select and use suitable materials, components, tools, equipment and techniques to safely make designed solutions.
AC9TDE6P04	Negotiate design criteria including sustainability to evaluate design ideas, processes and solutions
AC9TDE6P05	Develop project plans that include considerations of resources to individually and collaboratively make designed solutions.
Cross-curriculum Priorities	Sustainability
General Capabilities	Literacy, Numeracy, Critical and Creative Thinking

Learning goals

Know:

- Energy can be transformed from one form to another
- Tasmania is exploring varied forms of renewable energy

Understand:

- Wind energy is a form of renewable energy
- There are processes whereby energy is transferred
- Detailed project plans are required to develop and build wind farms

Do:

- Reflect on the story of building Mussleroe Wind Farm

Achievement standard

By the end of Year 6, students:

Science

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

Mathematics

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

Technologies: *Design and Technology*

... explain how people design products, services and environments to meet the needs of communities, including sustainability. They select and justify design ideas and solutions against design criteria. Explain how the features of technologies impact on design decisions and they create designed solutions.

Teaching and learning resources

Hydro Tasmania website: Wind power.

<https://www.hydro.com.au/clean-energy/our-power-stations/wind-power>

King Island renewable energy integration project website

<http://www.kingislandrenewableenergy.com.au/>

[Musselroe Wind Farm – The Full Story](#)

(Hydro Tasmania, October 2013, 21:30)

<https://www.youtube.com/watch?v=ZxeQeJ4jW-4&index=2&list=PL7A385BA4EFEA54EE&t=0s>

Materials	Number
Smart board or projector	1
Internet connection	1
Activity Sheet 1 Design a wind turbine (see resource for materials)	1 each
Activity Sheet 2 Create a project plan (see resource for materials)	1 each
Activity Sheet 3 Debate the advantages and disadvantages of wind energy	1 each
REF The Beaufort Scale	1 each
REF Wind turbine performance compared to the Beaufort scale	1 each
REF Wind turbine labelled	1 each

Adjustments / strategies to include all students

	Enabling	Extending
Content	Spend time introducing students to the language of wind farms e.g. turbines, blades, ...	Have students research and compare and contrast the stories of development of other wind farms constructed by Hydro Tasmania. Invite them to make a list of similar differences.
Process	Guide students through one to one where necessary such as by explaining how a turbine works using the turbine poster reference as a prop.	Invite students to create a list of ten questions they have about wind energy and email these to a scientist at Hydro Tasmania.

	Enabling	Extending
Product	Provide students with a copy of the topographical map of Tasmania and have them label existing wind farms in Tasmania and suggest new wind farm locations.	Provide students with a copy of wind farm locations in Tasmania and have them research other potential sites and develop a proposal to present to Hydro Tasmania for a new wind farm.

Assessment

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

Evidence of Student Learning

- explain what is meant by renewable energy
- identify advantages and disadvantages of wind farm power
- describe attributes of a project plan

Group Reflection

Refer to *Elaborate and Review* in each Lesson Plan

Feedback

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