

Reflecting on 'How can solar energy power the night?'

Tapping into many sources of power in nature can often mean needing to tolerate changes in intensity. Whether it's the cycles of day and night, seasons of breezes and gales, or even the rise and fall of tides and waves, renewable resources can be inconsistent. Fortunately there are ways to save extra energy to tap into during those quiet times.

Video summary

(Approximate running time: 3 ½ minutes)

- Solar energy production can't occur at night, or in certain areas of the globe.
 - Electrochemical cells have been around for 200 years.
 - The basis of an electrochemical cell is a difference in reactivity between conducting materials, such as metals of different elements.
 - An electrochemical cell operates using metal electrodes and an electrolyte solution/s that donates and accepts electrons.
 - Energy transformed through electricity generation can also be used to separate hydrogen from oxygen.
 - Hydrogen gas can be transported to be used elsewhere, or at another time.
 - Hydrogen gas is used in hydrogen fuel cells to produce electrical currents.
 - Potential gravity energy storage can be a useful way to set energy aside for later electrical production.
- Battery: A power source made of one or more electrochemical cells.
 - Electrode: A material (usually a metal) that accepts or donates electrons in a reaction, generating an electrical current.
 - Electrolyte: A material that helps generate an electrical current when in a solution.
 - Potential energy: A measure of the relative amount of energy in an object based on its position near other objects (like a weight held above a planet's surface).

Research tasks: Want to know more?

Use the following facts to inspire your students to research more about batteries

- Powerful battery cell technology is commonly based around the metal lithium. Ask students to research facts on lithium, and explain why this is such a popular metal of choice for batteries that power our laptops, phones, and even our cars.
- In 2017, a power storage facility featuring 'big batteries' was opened near the Hornsdale Wind Farm near Jamestown in South Australia. Neoen oversaw the installation of the Tesla technology, and upgrades meant it was soon capable of storing 150 MW of electricity – a record at the time. It didn't take long for the record to be beaten though, with a power storage facility in California getting boosted to 250 MW in 2020, enough to provide a few hours of power all on its own. Ask students to investigate the future of big batteries, noting the capacity and how many megawatt hours of power new projects expect might provide.

Literacy links

- Electrochemical cell: A device that uses chemical reactions to generate an electrical current.

TEACHER NOTES

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- A downside to batteries is the amount of time they take to charge. Just think of all those hours waiting for a flat phone battery to reach 100%! While it's getting faster, electric cars aren't as quick to refuel as fossil fuel engines. Hydrogen could be a way have the best of both worlds – a quick top-up of a fuel cell, without the carbon emissions. Ask students to look into the pros and cons of hydrogen power, and to discuss where they think it might fit in a clean energy future.

Curriculum links

Australian Curriculum Science, year 8

- Energy appears in different forms, including movement (kinetic energy), heat and potential energy, and energy transformations and transfers cause change within systems (ACSSU155)
- Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations (ACSHE135)
- Cross curricular priorities: Sustainability
- General capabilities: Numeracy, Literacy, Ethical understanding

NSW Curriculum Science, stages 3 and 4

- Discusses how scientific understanding and technological developments have contributed to finding solutions to problems involving energy transfers and transformations (SC4-11PW)
- Appreciates the importance of science in their lives and the role of scientific inquiry in increasing understanding of the world around them (SC4-1VA)
- Cross curricular priorities: Sustainability
- General capabilities: Numeracy, Literacy

Victorian Curriculum Science, Levels 7 and 8

- Energy appears in different forms including movement (kinetic energy), heat, light, chemical energy and potential energy; devices can change energy from one form to another (VCSSU104)
- Science and technology contribute to finding solutions to a range of contemporary issues these solutions may impact on other areas of society and involve ethical considerations (VCSSU090)
- Cross curricular priorities: Sustainability
- General capabilities: Numeracy, Literacy

Worksheet Answers:

Question 1

B) Roughly 430 quintillion joules; enough to power our energy needs for a year

Question 2

C) The longer the powerline, the more energy is wasted on pushing a current to where it's needed

Question 3

B) Voltaic pile

Question 4

A) Electrodes

Question 5

B) Lithium and zinc

Question 6

A) Hydrogen and oxygen

Question 7

D) Excess electricity can be used to pump water uphill then released to drive a turbine