

YEARS 7-10

Discovering Solar PV Technology

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OVERVIEW

This inquiry learning resource guides students to investigate photovoltaic technology and its amazing applications and potential for the 21st Century and beyond. This resource addresses the ancient word origins of many scientific words, and then takes a closer look at the chemistry, physical properties and physics that are the basis of this technology.

NZ CURRICULUM LINKS

LEARNING AREAS:	ACHIEVEMENT OBJECTIVES:	LEVELS:	YEARS:
Science: Nature of Science: Communicating in Science: Participating and Contributing	Use a wider range of science vocabulary, symbols, and conventions. Develop an understanding of socio-scientific issues by gathering relevant scientific information to draw evidence based conclusions and to take action where appropriate.	5-6	7-10
Science: Material World: The Structure of Matter: Chemistry and Society	Describe the structure of the atoms of different elements. Link the properties of different groups of substances to the way they are used in society or occur in nature.	5-6	7-10
Science: Physical World: Using Physics: Physics Concepts	Explore a technological application of physics. Identify and describe the patterns associated with physical phenomena found in simple everyday situations involving electricity and light.	5-6	7-10

TEACHER INFORMATION:

This resource is to be used in conjunction with the Renewable Electricity from Solar PV Cells **FACTSHEET**. Students should use the factsheet and attached links in their inquiry to answer the focus questions on the student worksheet.

Four mini-inquiries require the students to carry out some targeted background research around the general topic of photovoltaic technology. Each inquiry has 3 or 4 “supporting” questions to be considered before addressing the central question. This helps students break down a complex or multifaceted question into smaller more specific chunks.

1. The first inquiry guides students to consider the origins of the word photovoltaic and could be seen within the Nature of Science strand of the New Zealand Curriculum, as it prompts the student to consider the usefulness of specific words with a precise meaning while appreciating the historical context.

Any text highlighted in orange represents a link to further material. If you have printed this resource, please return to schoolgen.co.nz/for-teachers/resources to access the linked material.

2. The second inquiry guides students to recognise the extremely varied uses of electricity generated from sunlight from a pocket calculator to the International Space Station. Students are also asked to consider beneficial ways in which they could apply/use solar generated electricity in their own lives.
3. The third inquiry topic guides students to consider how the properties of materials used in PV panels relates to chemical structure, and how this relates to how they can be used.
4. The final inquiry has students think about the physical aspects of generating their own electrical energy at home – how much solar radiation is received by their roof, how much north-facing area they might have, and how much electrical energy this could generate?

Learning intentions

Students are learning to:

- Conduct their own science-focused inquiry into key technology for utilising the sun's energy to generate electricity.
- Consider what Solar PV technology is and how it is used

Success criteria

Students can:

- Explain Solar PV technology uses.
- Recognise varied uses of electricity generated by solar.
- Understand how PV panels relates to chemical structure.
- Compare electrical energy use in their home to a home utilising renewable energy.

Resources needed

Renewable Electricity from Solar Photovoltaic Cells - [Link](#)

Student Worksheet - [Link](#)

Teacher Answers

Any text highlighted in **orange** represents a link to further material. If you have printed this resource, please return to schoolgen.co.nz/for-teachers/resources to access the linked material.



Student Worksheet

[Link](#)

Discovering Solar PV Technology and its Uses

Inquiry 1

Discuss the meaning and origin of the scientific word “photovoltaic”?

Answer the supporting questions 1A, 1B and 1C below.

Use the **Renewable electricity from solar PV cells FACTSHEET** to help you research information on these questions.

Brainstorm your ideas here:





Student Worksheet

Supporting questions 1A

What are the 2 "mini" words in photovoltaic? What do they mean? What is their historical origin? What are some other words that use the root: photo?

Supporting question 1B

Explain the difference between a photovoltaic panel and the solar panel that heats water? (It might help to think about energy transformations)

Supporting question 1C

Why do you think scientists often use unfamiliar sounding words from Ancient Greece or other historical sources?





Student Worksheet

Inquiry 2

What are some beneficial or innovative uses for photovoltaic panels?

Answer the supporting questions 2A, 2B, 2C and 2D below.

Use the **Renewable electricity from solar PV cells FACTSHEET** and the links below to help you research information on these questions.

Brainstorm your ideas here:

- Solar Plane: [Link](#)
- Solar Boat: [Link](#)
- Waka-waka Solar Light: [Link](#)





Student Worksheet

Supporting question 2A

State at least 5 places you might find photovoltaic technology used:

Supporting questions 2B

In 2012 a boat circumnavigated the world using only solar energy. In 2016 a solar powered plane flew around the world. What are they trying to prove about photovoltaic technology? In your own words, describe these two vehicles and the journey they took.

Supporting questions 2C

What other electrical devices, apart from photovoltaic cells, are required to use the solar energy to achieve the bold aims of these adventures?





Student Worksheet

Supporting question 2D

Apply solar energy in your own life: How could you personally benefit from photovoltaic technology?
(Be practical and/or creative!)





Student Worksheet

Inquiry 3

Identify key materials used to create and protect photovoltaic cells.

Answer the supporting questions 3A, 3B, 3C and 3D below.

Use the **Renewable electricity from solar PV cells FACTSHEET** and the links below to help you research information on these questions.

Brainstorm your ideas here:

- Periodic Table of the Elements: [Link](#)
- How photovoltaic cells form solar panels and solar arrays: [Link](#)
- Make your own solar PV panels: [Link](#)





Student Worksheet

Supporting questions 3A

Which common chemical element is used to make a typical photovoltaic cell?
Write its chemical symbol, atomic number and mass number, and draw its atomic structure.
How many electrons are in the valence (outer) shell?
What kind of chemical bonds does it make with other atoms of the same kind?

Supporting question 3B

What chemical reactions can be used to extract the desired element from the other atoms in sand?

Supporting question 3C

What chemical element is typically used to conduct electricity from the top (front contact) of the photovoltaic cell to the circuit?





Student Worksheet

Supporting questions 3D

You can buy photovoltaic cells by themselves and make your own panels but you need to find a way to protect the very brittle photovoltaic cells. To be useful they must be protected by more durable materials.

What do they need to be protected from?

How long do they need to last for?





Student Worksheet

Inquiry 4

How much electricity can photovoltaic panels generate on my roof?

Answer the supporting questions 4A - E below.

Use the **Renewable electricity from solar PV cells FACTSHEET** to help you research information on these questions.

Brainstorm your ideas here:

A large rectangular area enclosed by a dotted line, intended for students to brainstorm their ideas.





Student Worksheet

Supporting question 4A

Outline the energy transformations involved in a photovoltaic cell generating electricity. Illustrate each step with a diagram or picture.

Supporting questions 4B

How much solar energy shines on the area where you live?
How much does this vary between summer and winter? (You might like to show this with a graph).

Supporting questions 4C

A single photovoltaic panel, depending on brand/model, can generate a voltage of about 30 volts and a current of about 9 amperes in perfect sunny conditions.
How much power is each panel generating?
If there are 8 panels connected together (series), how much power is the whole system generating?
Show your working and remember to state the unit of power.





Student Worksheet

Supporting question 4D

If each PV panel is 1.6 m high by 1.0 m wide, and your roof is north-facing with dimensions of 7.5 m by 5 m, how many of these panels could you fit on the roof?
(Sketch out the roof area first.)

Supporting question 4E

What type of photovoltaic system would you select for your house if you had the option?