

Going solar at the local school



Activity description

Students will inquire into the issue of a local school installing photovoltaic panels to generate solar energy.

Curriculum level 6

NCEA Level 1

Geography

Teaching rationale

Genesis Energy supports schools which generate solar energy using photovoltaic panels. So far more than 90 New Zealand schools monitor their solar energy generation and usage through School-gen.

Students will use geographic understanding to investigate generating and using solar energy at their own school or a neighbouring local school.

Curriculum and NCEA Links

NCEA Level 1

Achievement standard 91012

Geography 1.6 Describe aspects of a contemporary New Zealand geographic issue

Version 3

Credits 3

Level 6 Geography

Achievement objective

Understand that natural and cultural environments have particular characteristics and how environments are shaped by processes that create spatial patterns.

Understand how people interact with natural and cultural environments and that this interaction has consequences.

NCEA Level 1 Geography

1.6 Describe aspects of a contemporary New Zealand geographic issue (91012)

Student learning outcomes

By the end of this study, students will:

1 Describe solar energy as a contemporary geographic issue.

2 Fully describe viewpoints about solar energy, incorporating beliefs, values and/or perspectives.

3 Evaluate establishment of solar energy generation at a local school, describing strengths and weaknesses in detail.

4 Make a recommendation and fully support it with detailed reasons.

Running the activity

1 Visit www.nzqa.govt.nz/geography for up-to-date understanding of Achievement Standard 91012, using the Achievement standard, Conditions of assessment, Clarifications, Moderator newsletters, and Exemplars of student work.

2 Choose a school for students to investigate and propose solar energy for. This could be their own school, if it doesn't already generate solar energy, or it could be another local school, for example the contributing primary or intermediate school.

3 Create a class inquiry table about electricity production and solar energy.

What I know	What I think I know	What I'd like to find out

4 Introduce New Zealand's electricity generation. Students take notes to compare renewable and non-renewable electricity production, North and South Island production, electricity transfers to the north and the south – Students will use this information in Tasks 1 and 3

- Power system live data www.transpower.co.nz/power-system-live-data
- Generation mix www.transpower.co.nz/system-operator/security-supply/generation-mix

5 Introduce electricity charges through this video – Students will use this information in Tasks 1 and 3

- What makes up my power bill? www.ea.govt.nz/consumers/my-electricity-bill/

6 Find out about electricity costs – Students will use this in Tasks 1 and 3

- Average electricity costs per kWh www.canstarblue.co.nz/energy/average-electricity-costs-per-kwh/

7 Find out or estimate how much electricity the chosen school uses. A power bill will have this information if available – Students will use this information when calculating costs of electricity used and installing a solar generation system. If accurate electricity use information is not available, students could use an estimate, or skip the sections about costs.

8 Use an electricity cost comparison tool to calculate the cost of electricity paid by the chosen school. It may help to have access to a power bill if possible. Students will use this information in Tasks 1 and 3

- Consumer powerswitch www.powerswitch.org.nz/

9 Brainstorm ways the school could reduce its energy use. Add other ideas from the technologies and action sheets on this page – Students will use this information in Tasks 3

- EECA Education energy efficiency www.eecabusiness.govt.nz/sectors/education/

10 Brainstorm reasons for a school to consider using solar energy – Students will use this information in Tasks 1 and 3

11 Show students this EECA introductory video – Students will use this information in Tasks 1 and 3

- Solar electricity systems:
youtu.be/jN5xaxeNbD8

12 Allow students to read and take notes about the pros and cons of solar energy generation – Students will use this information in Tasks 1 and 3

- Genesis How does solar power work?
www.genesisenergy.co.nz/energy-insights/insights/how-solar-power-works
- EECA Solar energy
www.eeca.govt.nz/energy-use-in-new-zealand/renewable-energy-resources/solar/
- EECA Solar electricity systems
www.energywise.govt.nz/at-home/generating-energy/solar-electricity-systems/
- EECA Businesses and solar energy
www.eecabusiness.govt.nz/technologies/renewable-energy/solar-electricity/
- EECA Saving energy in schools: renewable energy
www.eecabusiness.govt.nz/assets/Resources-Business/schools-action-sheet-6-renewable-energy.pdf
- Consumer are solar panels right for your home?
www.consumer.org.nz/articles/grid-tied-pv-systems
- Why more schools in NZ should be switching to solar energy now
www.solargroup.co.nz/why-more-schools-should-be-switching-to-solar-energy-now/

13 Use the School-gen website to learn about solar energy generation in schools – Students will use this information in Tasks 1 and 3

- www.schoolgen.co.nz/solar-schools/

14 Find out about solar energy generation systems at other schools

- Remuera Intermediate School
www.buildmagazine.org.nz/assets/PDF/Build126-90-Research-SolarPotentialOfSchools.pdf
- Panama Road School www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=11936758
- Sylvia Park School www.scoop.co.nz/stories/BU1509/S00900/nzs-most-affordable-solar-power-option-for-schools-launch.htm

15 Together with your students, investigate natural and cultural features of the chosen school as they relate to solar energy generation. This could be combined with NCEA Level 1 geographic research achievement standard 91011. Possible data to collect: Natural features – sunshine hours, topography, shading by natural features; Cultural features – roof size, aspect, shading by cultural features. Students will use this information in Task 1 and possibly Task 3. You can find some information about sunshine hours for various locations around NZ from these websites:

- NIWA Climate summaries www.niwa.co.nz/education-and-training/schools/resources/climate/summary
- Stats NZ Sunshine hours http://archive.stats.govt.nz/browse_for_stats/environment/environmental-reporting-series/environmental-indicators/Home/Atmosphere-and-climate/sunshine-hours.aspx

- PV Watts calculator
<https://pvwatts.nrel.gov>
- EECA energywise is enhancing their solar calculator
www.energywise.govt.nz
- Auckland rooftop solar energy assessment <http://solarpower.cer.auckland.ac.nz/>

16 Find out the estimated cost of installing a solar system at the chosen school

- <https://mysolarquotes.co.nz/about-solar-power/residential/how-much-does-a-solar-power-system-cost/>

17 Ask at least two suitable staff members from the chosen school to share their positive and negative viewpoints on the issue of solar power. Arrange for students to interview each staff member and/or video them explaining their viewpoints on the issue. Students will use this information in Task 2.

18 Arrange for students to read the newspaper articles and watch the videos below, and search for more recent articles which include viewpoints of people who are for and against solar energy. Students will use this information in Task 2

- Dr Kiti Suomalainen, of the University of Auckland's Business School (for solar energy) www.nzherald.co.nz/university-of-auckland/news/article.cfm?c_id=1503679&objectid=12067046
- Stephen Malone, solar energy homeowner from Timaru (disappointed with his solar system, slightly against), and Christian Hoerning, EECA technical advisor (cautiously for)
- www.stuff.co.nz/business/money/100484649/solar-power-not-yet-financially-worthwhile-for-many-people-eeca
- Ed and Juliette Cooke and Dora Aw-Yong, Members of the Genesis Local

Energy Project in South Wairarapa (for solar energy) www.genesisenergy.co.nz/about/community/local-energy-project

- Patrick Smellie, business journalist
www.stuff.co.nz/business/opinion-analysis/84005660/Patrick-Smellie-Why-solar-power-does-not-stack-up-in-New-Zealand?rm=m

19 Introduce students to the geographic language of viewpoints, beliefs, values and perspectives.

20 Introduce students to geographic concepts as related to energy production – sustainability, perspectives, change, interaction, patterns, environments, processes.

21 Introduce your students to Achievement Standard 91012 v3 – ensure they understand the keywords, geographic concepts, and criteria for Achievement, Merit and Excellence from Explanatory Note 2.

22 Use the student worksheet below to step students through the internal assessment task.

23 Conditions of assessment: Students should have at least three weeks of in-class and at-home time, including preteaching, researching and presenting their findings. Authenticity should be monitored using school procedures.

24 Students should have access to devices for research and to present their answers. The task allows students to use a presentation application of their choice to present their answers. However teachers may choose to limit students' choice of presentation applications to make marking more manageable.



25 Collect and mark using the assessment schedule and exemplars of student work from www.nzqa.govt.nz/geography. To ensure authenticity, no exemplars of student work have been made available online, however schools should keep student exemplars at Achievement/Merit/Excellences as benchmarks and for moderation purposes.

Extending your students

- Present your research to the school Principal, Board of Trustees or Student Council.
- Start a petition to install photovoltaic panels to generate solar energy at the school.
- Research solar energy for your home and/or community groups you are involved with.
- Research other sustainable actions you can take at your school and plan to do one.
- Plan one sustainable action you can do with your family.

Supporting resources

- Solar Schools background and data from the School-gen website: www.schoolgen.co.nz/solar-schools/
- Solar energy for all your energy needs poster, found in the posters section of www.schoolgen.co.nz/teach-and-learn/resource/
- Discovering solar PV technology and its uses resource and background information student worksheet found in the Level 5-6 section of www.schoolgen.co.nz/teach-and-learn/resource/
- Electricity in New Zealand provides a good background for teachers www.ea.govt.nz/dmsdocument/20410-electricity-in-new-zealand

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Achievement standard information

NCEA Level 1
 Achievement standard 91012
 Geography 1.6 Describe aspects of a contemporary New Zealand geographic issue
 Version 3
 Credits 3

Achievement criteria

Achievement	Achievement with Merit	Achievement with Excellence
Describe aspects of a contemporary New Zealand geographic issue.	Describe, in depth, aspects of a contemporary New Zealand geographic issue.	Comprehensively describe aspects of a contemporary New Zealand geographic issue.

Introduction

Through School-gen, Genesis helps schools monitor solar energy generation and usage. Solar energy generation using photovoltaic panels is a sustainable way to power a school, reducing the carbon footprint, and reducing costs so money can be used on other important educational initiatives. So far 93 schools monitor their solar energy generation through School-gen, and that number is growing.

In this activity you will apply geographic thinking to investigate installing photovoltaic panels to generate solar energy at a school in your local area that does not yet produce solar energy, for example your own school, the local primary or intermediate school.

This is an individual task. You will be assessed on how well you:

- ▲ Describe the nature of the contemporary geographic issue of solar energy in your local school;
- Describe viewpoints about solar energy;
- Evaluate courses of action describing in detail the strengths and weaknesses; and
- ▲ Fully support your recommended course of action with reasons.

Make sure you use specific information such as quotes and facts throughout your answer. Use geographic terminology and geographic concepts such as environments, perspectives, processes, patterns, interaction, change, sustainability. Maori terms such as aroha, kaitiakitanga, and taonga may also be useful.

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Conditions and due date

Complete the following with your teacher

When is this assessment due?

Where should it be completed?

Authenticity

- This is my own work completed this year.
- I have acknowledged all sources.
- I understand that there are penalties for plagiarism and collusion.

Signed:

Date:

Before you start: Decide on how you will present your work

Choose a presentation application to present your answers to Tasks 1-4. Make sure the application you choose allows you to fully describe your geographic thinking – you need to include paragraphs, and you might also choose to use visuals such as maps, photos or tables.

Task 1: The geographic nature of the contemporary issue of solar energy for the local school

Describe the geographic nature of the issue of solar energy for a local school, in paragraph form or as annotations on a map.

Include the following information in your description:

- The name of the school.
- The location of the school.
- An overview of why this school should consider changing to generating solar energy at this time.
- Natural features of the environment that make this school suitable for generating solar energy.
- Cultural features of the environment that make this school suitable for generating solar energy.
- The effects on people of changing to generating solar energy – positive, negative, short-term, long-term.
- The effects on the environment of changing to generating solar energy – positive, negative, short-term, long-term.

Task 2: Viewpoints about solar energy

Fully describe two different viewpoints about solar energy.
Choose two people/groups who hold different viewpoints about solar energy.

Write a paragraph for each one, which includes:

- The name of the person/group.
- Their viewpoint described in your own words.
- Specific information, such as quotes, facts, numbers that show support for the person's viewpoint.
- Detailed reasons why they hold their viewpoint.
- Beliefs, values and/or perspectives of the person/group that have influenced their viewpoint.
- Geographic terminology.
- Geographic concepts such as environments, perspectives, interaction, change, sustainability.
- Evidence of showing insight – showing perception and linking causes with effects.

Task 3: Evaluate the options for the local school

These are three options of courses of action for the local school when considering solar energy:

1. Join School-gen and go ahead with installing solar panels.
2. Do not install solar panels, instead continue buying all electricity.
3. Start reducing energy consumption now and investigate solar energy further in a few years.

Describe in detail strength(s) and weakness(es) for each option. Write a paragraph for each strength/weakness, which includes:

- The strength or weakness described in your own words.
- Detailed reasons why it is a strength or weakness.
- The relative importance of the strengths and weaknesses.
- Specific information, such as facts, numbers, names, quotes, prices to support the strengths and weaknesses.

Task 4: Make a recommendation

Recommend which option you think is best for the local school.
Write a paragraph support your choice, which includes:

- Detailed reasons why you chose this option – you could further develop the ideas you wrote in your strengths paragraph.
- Detailed reasons why this option is better than the others – weigh up the strength(s) and weakness(es) of this option against the other options.
- Specific information such as facts, numbers, quotes to support your recommendation.

Helpful resources

What is solar energy?	How can solar energy help schools?
<ul style="list-style-type: none"> • Solar electricity systems introduction: youtu.be/jN5xaxeNbD8 • Solar energy for all your energy needs poster, found in the posters section of www.schoolgen.co.nz/teach-and-learn/resource/ • Discovering solar PV technology and its uses student worksheet, found in the Level 5-6 section of www.schoolgen.co.nz/teach-and-learn/resource/ • How does solar power work? www.genesisenergy.co.nz/energy-insights/insights/how-solar-power-works • Solar energy introduction www.eeca.govt.nz/energy-use-in-new-zealand/renewable-energy-resources/solar/ • Solar electricity systems www.energywise.govt.nz/at-home/generating-energy/solar-electricity-systems/ 	<ul style="list-style-type: none"> • Solar Schools background and school solar data on the School-gen website www.schoolgen.co.nz/solar-schools/ • Going solar with Genesis www.genesisenergy.co.nz/solar • EECA Saving energy in schools: renewable energy www.eecabusiness.govt.nz/assets/Resources-Business/schools-action-sheet-6-renewable-energy.pdf • Solar energy for businesses www.eecabusiness.govt.nz/technologies/renewable-energy/solar-electricity/ • Energy use in schools/education sector www.eecabusiness.govt.nz/sectors/education/ • Why more schools in NZ should be switching to solar energy now https://solargroup.co.nz/why-more-schools-should-be-switching-to-solar-energy-now/
How much energy will solar produce?	
<ul style="list-style-type: none"> • EECA Solar calculator (focussed on residential) www.energywise.govt.nz/tools/solar-calculator/ • PVWatts calculator (focussed on residential) https://pvwatts.nrel.gov • Auckland solar assessment http://solarpower.cer.auckland.ac.nz/ 	
How many sunshine hours do places in NZ get?	What do people think about solar energy?
<ul style="list-style-type: none"> • Selected locations 1971-2010 www.niwa.co.nz/education-and-training/schools/resources/climate/summary • Selected locations 1972-2016 http://archive.stats.govt.nz/browse_for_stats/environment/environmental-reporting-series/environmental-indicators/Home/Atmosphere-and-climate/sunshine-hours.aspx • PVWatts calculator has solar data for many locations https://pvwatts.nrel.gov 	<ul style="list-style-type: none"> • Dr Kiti Suomalainen, of the University of Auckland's Business School www.nzherald.co.nz/university-of-auckland/news/article.cfm?c_id=1503679&objectid=12067046 • Stephen Malone, solar energy homeowner from Timaru, and Christian Hoerning, EECA technical advisor, www.stuff.co.nz/business/money/100484649/solar-power-not-yet-financially-worthwhile-for-many-people-eeca • Ed and Juliette Cooke and Dora Aw-Yong, Members of the Genesis Local Energy Project in South Wairarapa www.genesisenergy.co.nz/about/community/local-energy-project • Patrick Smellie, business journalist www.stuff.co.nz/business/opinion-analysis/84005660/Patrick-Smellie-Why-solar-power-does-not-stack-up-in-New-Zealand?rm=m
How much does energy cost?	
<ul style="list-style-type: none"> • Estimated cost of installing a solar system https://mysolarquotes.co.nz/about-solar-power/residential/how-much-does-a-solar-power-system-cost/ • Average electricity costs per kWh www.canstarblue.co.nz/energy/average-electricity-costs-per-kwh/ 	

Assessment

Tick	Achievement	Tick	Achievement with Merit	Tick	Achievement with Excellence
	Achievement Criteria Describe aspects of a contemporary New Zealand geographic issue.		Describe, in depth, aspects of a contemporary New Zealand geographic issue.		Comprehensively describe aspects of a contemporary New Zealand geographic issue.
	Task 1: The geographic nature of the contemporary issue of solar energy for the local school Student describes the nature of the contemporary geographic issue. This could include describing the significance of the location, natural and cultural features, effects on people and the environment.		As for Achievement		As for Achievement
	Task 2: Viewpoints about solar energy Student describes the different viewpoints and/or opinions individuals (or groups) hold in relation to the issue. Student describes two differing viewpoints, giving reasons.		Student describes, in detail the different viewpoints and/or opinions individuals (or groups) hold in relation to the issue, using specific information.		Student fully describes the different viewpoints and/or opinion individuals (or groups) hold in relation to the issue, using specific information and geography terminology and concepts, and showing insight and incorporating stakeholder beliefs, values and/or perspectives.
	Task 3: Evaluate the options for the local school Student describes the strength(s) and weakness(es) of possible courses of action. Student describes one strength and one weakness for each course of action. Student recommends a course of action with a reason.		Student describes in detail the strength(s) and weakness(es) of each course of action.		As for Merit
	Task 4: Make a recommendation Student recommends a course of action		Student supports a recommended course of action with detailed reasons.		Student fully supports a recommended course of action with detailed reasons, demonstrating why the chosen course of action is better than the other courses of action.

Final grades will be decided using professional judgement based on a holistic examination of the evidence provided against the criteria in the Achievement Standard.

Final grade	Achievement	Achievement with Merit	Achievement with Excellence
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