 Energy challenge

Stage 5 Physical World

Outcomes

Values and attitudes

SC5-2VA shows a willingness to engage in finding solutions to science-related personal, social and global issues, including shaping sustainable futures.

SC5-3VA demonstrates confidence in making reasoned, evidence-based decisions about current and future use of science and technology, including ethical considerations.

Working scientifically

SC5-6WS undertakes first-hand investigations to collect valid and reliable data and information, individually and collaboratively

e. reporting data and information, evidence and findings, with accuracy and honesty

SC5-7WS processes, analyses and evaluates data from first-hand investigations and secondary sources to develop evidence-based arguments and conclusions

* WS7.1 Students process data and information by:

c. accessing data and information by using a range of appropriate digital technologies

* WS7.2 Students analyse data and information by:

g. critically analysing the validity of information from secondary sources (ACSIS172, ACSIS206)

SC5-8WS applies scientific understanding and critical thinking skills to suggest possible solutions to identified problems

* WS8 Students solve problems by:

a. describing strategies to develop a range of possible solutions to an identified problem

b. assessing strategies that have been identified as possible solutions to an identified problem

c. applying the processes of Working Scientifically in developing creative solutions to problems

f. applying critical thinking in considering suggested proposals, solutions and conclusions, including a consideration of risk

SC5-9WS presents science ideas and evidence for a particular purpose and to a specific audience, using appropriate scientific language, conventions and representations

a. selecting and using in presentations, for different purposes and contexts, appropriate text types including discussions, explanations, expositions, procedures, recounts or reports

d. proposing ideas that demonstrate coherence and logical progression

e. presenting scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations for specific audiences (ACSIS174, ACSIS208)

Knowledge and understanding

SC5-10PW applies models, theories and laws to explain situations involving energy, force and motion

* PW3 Scientific understanding of current electricity has resulted in technological developments designed to improve the efficiency in generation and use of electricity.

Students:

d. outline recent examples where scientific or technological developments have involved specialist teams from different branches of science, engineering and technology, eg low-emissions electricity generation and reduction in atmospheric pollution

* PW4 Energy conservation in a system can be explained by describing energy transfers and transformations. (ACSSU190)

Students:

c. discuss, using examples, how the values and needs of contemporary society can influence the focus of scientific research in the area of increasing efficiency of the use of electricity by individuals and society (ACSHE228, ACSHE230)

d. discuss viewpoints and choices that need to be considered in making decisions about the use of non-renewable energy resources

Learning across the curriculum

Cross-curriculum priorities

Aboriginal and Torres Strait Islander histories and cultures

Asia and Australia's engagement with Asia

Sustainability

General capabilities

Critical and creative thinking

Ethical understanding

Information and communication technology capability

Intercultural understanding

Literacy

Numeracy

Personal and social capability

Other areas of learning

Civics and citizenship

Difference and diversity

Work and enterprise

Teacher notes

This assessment task allows the opportunity for students to work collaboratively as well as individually. Student work in groups to design and model a system to deliver electricity to remote communities. Students also work individually to create a sustained piece of text answering an important question in energy usage and availability.

Included is a brief stimulus material which teachers can use as an introduction to the assessment task or in class.

Introduction

Most people in Australia can access mains electricity through ‘the grid’ – a system that links electricity-generating power stations with our homes through the poles and wires network. A simplified diagram of the ‘grid’ is shown below:



However, there are some remote communities that cannot access electricity supply in this way. They have two alternatives:

1. Have no access to electricity; or
2. Use an alternative power supply

Many Aboriginal communities in Australia do not have access to electricity from the grid due to their remote locations. This may include communities located in the outback, in rural area and on islands such as in Torres Strait.

Not being able to access electricity can have a significant impact upon those who live in such a community. It can affect the way that people cook, keep warm, communicate and even their health.

Task

There are 3 parts to this task. Parts 1 and 2 are to be done in a team of up to 3 people and presented to the class. Part 3 is to be done individually and submitted to your teacher.

You will be given some time during class for research and collaboration, but you will also need to work with your team outside of class. This can be done in person or online.

You are to design a system that allows remote communities that do not have grid electricity to be able to access around-the-clock electricity (i.e. electricity that can be accessed any time of the day or night).

Part 1

Research and choose a location that does not have access to the electricity grid. Mark it on a map and determine the environmental and geographical features of this particular location that may be able to be utilised for accessing alternative electrical energy sources.

Part 2

Design a small scale system that could be used by the community to be able to access electricity 24 hours a day without accessing the grid. Your system must be able to be used any time of the day and night and must cost as little as possible to run. Start-up costs for the system are not included and be able to meet the minimum energy requirements for a small community.

You must present your system to the class.

Parts 1 and 2 deliverable items

Presentation to include:

* Map and images of the area that has been identified.
* Discussion about the features that are in the local environment/geography of the identified area.
* Model (model can be working or not) or design plans for the system you will employ to supply electricity to the town.

Along with your model, you must discuss the following:

* Where the system is to be situated (in a central location, individual homes, etc.)?
* How much energy is able to be produced each day by the system?
* What will that amount of energy be able to be used for?
* What are the on-going costs of using this system?
* What makes the particular system that you have chosen the best option for the identified location?
* What are the advantages and disadvantages of the system?
* Justify why you chose this system for this particular location.

Part 3: Impact of accessing electricity

You are to write ONE page on the following:

‘Electricity is no longer a luxury in our society, but a necessity. What are some impacts of not having access to electricity on a daily basis for a community and the people who live there?’

Your page should include:

* Standard margins
* Arial font
* Size 12 font
* No diagrams

Your style of writing can be in any appropriate format, for example a song or poem, persuasive text, letter or interview. You can discuss different formats with your teacher.

Scaffold

Student checklist

Part 1

Use Google to search ‘towns without access to electricity’ (it doesn’t have to be in Australia)

Choose ONE town that you find.

Locate this town and mark it on a map

Describe the town – where is it located, what is the weather like, is it close to the ocean or hot springs?

Part 2:

Information Gathering

Define renewable energy.

Do an internet search and make a list of 4 or 5 types of sources of renewable energy.

For each type of renewable energy,

describe how it works

energy production or output

list the benefits and the negative effects of the energy type

describe how the energy can be stored.

Choose the best ONE of the types of renewable energy to use in the town you have chosen

Preparing your presentation

Collect pictures of your town and the type of energy system you have chosen

Make a power point presentation of about 7-8 slides.

Slide 1: title slide with a picture

Slide 2: introduction to the town

Slide 3: describe the renewable energy you have chosen and how it works

Slide 4: describe the benefits and negative effects of the energy

Slide 5: how much energy can be made and how will it be used up?

Slide 6: why did you choose this system?

Slide 7: any other important information

Part 3

Information Gathering

Make a list of all the things that you do on a typical day that use electricity

How would you do these things without electricity? What would you have to do instead?

What would be different if no-one in your community had access to electricity?

How long will it take for life to be very different? One week? Month? Year? Decade?

Marking guideline/rubric

Part 1

|  |  |
| --- | --- |
| Criteria | Mark range |
| * Location identified and marked upon a map. * Relevant geographical and environmental features useful for accessing alternative energy sources are discussed including:   + Geological nature   + Annual wind/rainfall   + Temperature   + Average sunlight   + Elevation   + other | 8-10 |
| * Location identified and marked upon a map. * Relevant geographical and environmental features useful for accessing alternative energy sources are described including:   + Geological nature   + Annual wind/rainfall   + Temperature   + Average sunlight   + Elevation   + other | 5-7 |
| * Location identified and marked upon a map. * Some relevant geographical and environmental features useful for accessing alternative energy sources are identified including:   + Geological nature   + Annual wind/rainfall   + Temperature   + Average sunlight   + Elevation   + other | 2-4 |
| * Location is identified. * One or two relevant geographical and environmental features useful for accessing alternative energy sources are identified including:   + Geological nature   + Annual wind/rainfall   + Temperature   + Average sunlight   + Elevation   + other | 0-1 |

Part 2

|  |  |
| --- | --- |
| Criteria | Mark range |
| * All criteria listed in part 2 deliverables are thoroughly discussed. * Planned system is more than adequate for community needs and is relevant to geographic location * Model/design plans are well-detailed * Presentation is delivered confidently; all team members participate and engage the audience. * Presentation runs for 5-10 minutes. | 18-20 |
| * All criteria listed in part 2 deliverables are discussed. * Planned system is adequate for community needs and is relevant to geographic location * Model/design plans are detailed * Presentation is delivered confidently; all team members participate and engage the audience. * Presentation runs for 5-10 minutes. | 14-17 |
| * All criteria listed in part 2 deliverables are discussed. * Planned system is adequate for community needs and is relevant to geographic location * Model/design plans are presented * Presentation is delivered confidently; all team members participate and engage the audience. * Presentation runs for 5-10 minutes. | 10-13 |
| * Most criteria listed in part 2 deliverables are addressed. * Planned system is adequate for community needs and/or is relevant to geographic location * Model/design plans are presented * Presentation is delivered confidently; all team members participate and engage the audience. * Presentation runs for 5-10 minutes. | 5-9 |
| * Some criteria listed in part 2 deliverables are addressed. * Planned system is adequate for community needs and/or is relevant to geographic location * Model/design plans are presented * Presentation is delivered with all team members’ participation. | 0-4 |

Part 3

|  |  |
| --- | --- |
| Criteria | Mark range |
| * A wide range of needs met by electricity for communities and individuals is thoroughly discussed * Several impacts of not having access to electricity are discussed for both communities and individuals * Format is acceptable | 8-10 |
| * Some of the needs met by electricity for communities and individuals is described * Some impacts of not having access to electricity are discussed for both communities and individuals * Format is acceptable | 5-7 |
| * A few of the needs met by electricity for communities and/or individuals are identified;   OR   * A few of the impacts of not having access to electricity are identified for both communities and/or individuals * Format is acceptable | 2-4 |
| * One or two of the needs met by electricity for communities and/or individuals are identified;   OR   * One or two of the impacts of not having access to electricity are identified for both communities and/or individuals * Format is acceptable | 0-1 |