NZQA Approved

Internal Assessment Resource

Physics Level 3

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| This resource supports assessment against:Achievement Standard 91527Use physics knowledge to develop an informed response to a socio-scientific issue  |
| Resource title: Renewable energy technology in new buildings – should it be compulsory? |
| 3 credits |
| This resource:* Clarifies the requirements of the Standard
* Supports good assessment practice
* Should be subjected to the school’s usual assessment quality assurance process
* Should be modified to make the context relevant to students in their school environment and ensure that submitted evidence is authentic
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| Date version published by Ministry of Education | May 2013To support internal assessment from 2013 |
| Quality assurance status | These materials have been quality assured by NZQA. NZQA Approved number A-A-05-2013-91527-01-6251 |
| Authenticity of evidence | Teachers must manage authenticity for any assessment from a public source, because students may have access to the assessment schedule or student exemplar material.Using this assessment resource without modification may mean that students’ work is not authentic. The teacher may need to change figures, measurements or data sources or set a different context or topic to be investigated or a different text to read or perform. |

Internal Assessment Resource

Achievement Standard Physics 91527: Use physics knowledge to develop an informed response to a socio-scientific issue

Resource reference: Physics 3.7B

Resource title: Renewable energy technology in new buildings – should it be compulsory?

Credits: 3

Teacher guidelines

The following guidelines are supplied to enable teachers to carry out valid and consistent assessment using this internal assessment resource.

Teachers need to be very familiar with the outcome being assessed by Achievement Standard Physics 91527. The achievement criteria and the explanatory notes contain information, definitions and requirements that are crucial when interpreting the Standard and assessing students against it.

Context

This assessment activity requires students to use their physics knowledge to develop an informed response to a socio-scientific issue related to renewable energy technology.

They are required to develop a presentation that:

* gives an informed personal response to the issue of whether renewable energy technology in new buildings should be compulsory
* includes recommendations of actions that could be taken as a result of their informed position.

Conditions

Select a timeframe that suits you and your students. Consider the format of the assessment and ensure they have enough time to complete the assessment task.

The presentation could be, for example, a group presentation, a documentary, a poster presentation, or a PowerPoint presentation – accompanied by hand-out material where appropriate. A written report should not be considered the default format.

Group research is to be encouraged. If wished, the standard could be assessed entirely via group work. If this is done, the teacher must put in place a means of ensuring that all students are full contributors to the end product. This could be, for example, the requirement that each student keeps a log or diary in which they maintain a brief running record of actions, who did what, thinking, problems, decisions, progress, etc.

Resource requirements

* You may provide some of the resource material for students to select relevant information from. For example: paper copies of articles, web links (see Resource A), videos, books from the National Library of New Zealand, and/or guest speakers.
* Internet access for research.
* Computer access for creating presentations (and, possibly, maintaining digital diaries).
* Data projector for presentations.

Additional information

To produce an informed response, students should be processing knowledge from a range of sources, selecting relevant ideas and integrating them to produce their presentation. For a comprehensive response, the presentation should also provide evidence of evaluation of the different sources. Referencing is not a requirement of the standard, although some form of referencing will assist you with managing authenticity.

Internal Assessment Resource

Achievement Standard Physics 91527: Use physics knowledge to develop an informed response to a socio-scientific issue

Resource reference: Physics 3.7B

Resource title: Renewable energy technology in new buildings – should it be compulsory?

Credits: 3

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| Achievement | Achievement with Merit | Achievement with Excellence |
| Use physics knowledge to develop an informed response to a socio-scientific issue. | Use physics knowledge to develop an informed and reasoned response to a socio-scientific issue. | Use physics knowledge to develop an informed and comprehensive response to a socio-scientific issue. |

Student instructions

Introduction

In January 2011, scientists published peer-reviewed findings that suggested global energy demands could be reduced by 73% using energy efficient technologies in buildings, industries and transport.

Your local council is investigating the feasibility of requiring renewable energy technologies such as solar panels and wind turbines to be compulsory for new buildings. You are the consultant hired to prepare a presentation on this socio-scientific issue for their consideration.

Task

This assessment activity requires you to use your physics knowledge to develop an informed response to a socio-scientific issue related to renewable energy technology.

You are required to develop a presentation that:

* gives an informed personal response to the issue of whether renewable energy technology in new buildings should be compulsory
* includes recommendations of actions that could be taken as a result of your informed position.

Research

Research the physics of renewable energy technologies for buildings. This may include photo-voltaic solar panels and wind turbines, identifying the short and long-term benefits and drawbacks to individuals and society. The benefits and drawbacks may be related to an economic, ethical or environmental issue. Develop an informed personal response to your chosen issue of whether renewable energy technology in new buildings should be compulsory, based on physics knowledge. Develop suggestions for actions that could be taken.

You will be assessed on the overall comprehensiveness of your presentation, whether it explains the relevant physics ideas, and your analysis and discussion of the issue(s).

You may work in groups to carry out the research, develop and present your findings. You will have approximately <insert timeframe> weeks of both in-class and out-of-class time, to complete the necessary research and presentation.

Your teacher may provide you with resource material and/or suggest relevant information sites or possible new directions for your research.

Teacher note: Select a timeframe that suits you and your students ensuring they have enough time to complete the assessment. Specify milestone points to monitor progress and a due date. You may also choose to specify a maximum length for the presentation.

Keep a research logbook to record your notes, references, article outlines or plans, drafts of paragraphs, comments on the validity, bias or purpose of resources, and so on. This information will help you to prepare and refine your presentation.

Teacher note: If the school has appropriate resources students could collect primary data to aid their presentation. For example, testing photo-voltaic cells output at different angles to the sun could be measured to support placement recommendations.

Topics you need to cover in your presentation

* provide physics knowledge that includes:
* physics concepts and processes that relate to the renewable energy technology for buildings. This may include ideas such as energy storage/links to the national grid, conversion between AC and DC, voltage and frequency considerations etc.
* a comparison of the renewable technologies in buildings with the technologies currently used to provide electricity
* physics related to social implications – this may include possible short and long-term benefits and drawbacks to individuals, society and the environment
* use the physics knowledge you have gathered to state your personal position and recommend action(s) about compulsory renewable energy technology in new buildings
* justify your position and action(s) by providing supporting evidence to explain why you chose your position and action(s)
* analyse and prioritise the physics knowledge used to justify your position and recommended action(s). This may include:
* comparing the significance of implications of the issue on individuals and society
* considering the likely effectiveness of the identified action(s)
* commenting on sources and information, considering ideas such as validity (date, peer reviewed, scientific acceptance) and bias (attitudes, values, beliefs), and weighing up how science ideas are used by different groups.

Resource A: Useful web pages

Energy efficiency

<http://www.newscientist.com/article/dn20037-efficiency-could-cut-world-energy-use-over-70-per-cent.html>

Solar power

<http://physicsworld.com/cws/article/news/2010/aug/09/squeezing-more-out-of-solar-power>

<http://www.stuff.co.nz/the-press/business/your-property/6358261/Biggest-solar-energy-community-planned>

<http://www.teara.govt.nz/en/wind-and-solar-power/3>

<http://science.howstuffworks.com/environmental/energy/solar-cell.htm>

<http://www.eeca.govt.nz/efficient-and-renewable-energy/renewable-energy/solar-energy-in-nz>

<http://www.sciencelearn.org.nz/Science-Stories/Harnessing-the-Sun/Photovoltaic-roofs>

<http://www.sciencelearn.org.nz/Science-Stories/Harnessing-the-Sun/Photovoltaics>

Future solar technology

<http://physicsworld.com/cws/article/news/2011/apr/21/solar-power-without-solar-cells>

<http://news.discovery.com/tech/paint-your-house-get-solar-power-111223.html>

Renewable energy generation

<http://www.eeca.govt.nz/efficient-and-renewable-energy>

<http://www.eeca.govt.nz/distributed-generation>

Wind turbines

<http://www.energywise.govt.nz/your-home/generating-your-own-energy/wind>

<http://www.righthouse.co.nz/>

Assessment schedule: Physics 91527 Renewable energy technology in new buildings – should it be compulsory?

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| Evidence/Judgements for Achievement  | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The student has selected and processed information to produce a presentation that uses physics knowledge to develop an informed response to the issue.The presentation includes:* an explanation of relevant physics concepts and processes in response to a socio-scientific issue, for example:
	+ *a description of at least one type of wind turbine including AC generation*
	+ *a description of at least one type of photo-voltaic cell including an explanation of the photo-electric effect.*

Diagrams should be included where relevant.* a position on whether the local council should make renewable energy technology in new buildings compulsory, for example:
	+ *benefits in terms of using renewable energy technology compared to existing methods. This must relate to the physics concepts involved in electricity generation*
	+ *benefits in terms of what pollution is produced from the construction of the systems and the running processes and how the pollution is produced from the physics processes*
	+ *difficulties in terms of energy being stored, describing the physics involved in the energy storage process.*

*The examples above are indicative of the evidence that is required.* | The student has selected and processed information from a range of sources to produce a presentation that uses physics knowledge to develop an informed and reasoned response to the issue.The presentation includes:* an explanation of relevant physics concepts and processes in response to a socio-scientific issue, for example:
	+ *a description of at least one type of wind turbine including AC generation*
	+ *a description of at least one type of photo-voltaic cell including an explanation of the photo-electric effect.*
* an explanation of how and why the physics concepts and processes are relevant in response to a socio-scientific issue, for example:
	+ *an explanation of how features of the structure of a wind turbine maximise energy generation and how they might impact on individuals and/or society*
	+ *an explanation of how electricity is produced by photo-voltaic cells and any associated waste products/pollution*
	+ *the use of cell arrays*
	+ *the problems in relation to individuals and society in terms of setting up the system with the best orientation for maximum efficiency and electrical energy storage.*

Diagrams should be included where relevant.* a position on whether the local council should make renewable energy technology in new buildings compulsory, for example:
	+ *benefits in terms of using renewable energy technology compared to existing methods. This must relate to the physics concepts involved in electricity generation*
	+ *benefits in terms of what pollution is produced from the construction of the systems and the running processes and how the pollution is produced from the physics processes*
	+ *difficulties in terms of energy being stored, describing the physics involved in the energy storage process.*
* the student's personal response and recommended action(s), which are justified in relation to relevant physics knowledge.

*The examples above are indicative of the evidence that is required.* | The student has selected and processed information from a range of sources to produce a presentation that uses physics knowledge to develop an informed and comprehensive response to the issue.The presentation includes:* an explanation of relevant physics concepts and processes in response to a socio-scientific issue, for example:
	+ *a description of at least one type of wind turbine including AC generation*
	+ *a description of at least one type of photo-voltaic cell including an explanation of the photo-electric effect.*
* an explanation of how and why the physics concepts and processes are relevant in response to a socio-scientific issue, for example:
	+ *an explanation of how features of the structure of a wind turbine maximise energy generation and how they might impact on individuals and/or society*
	+ *an explanation of how electricity is produced by photo-voltaic cells and any associated waste products/pollution*
	+ *the use of cell arrays*
	+ *the problems in relation to individuals and society in terms of setting up the system with the best orientation for maximum efficiency and electrical energy storage.*
* linking of key physics concepts and processes in response to a socio-scientific issue, for example:
	+ detailed analysis of how the variable availability of renewable energy technology affects the design and use of the technology

Diagrams should be included where relevant.* a position on whether the local council should make renewable energy technology in new buildings compulsory, for example:
	+ *benefits in terms of using renewable energy technology compared to existing methods. This must relate to the physics concepts involved in electricity generation*
	+ *benefits in terms of what pollution is produced from the construction of the systems and the running processes and how the pollution is produced from the physics processes*
	+ *difficulties in terms of energy being stored, describing the physics involved in the energy storage process.*
* the student's personal response and recommended action(s), which are justified in relation to relevant physics knowledge.
* an analysis and prioritisation of the physics knowledge related to the issue to justify the response, for example:
	+ comparison of the significance of implications of the issue on individuals and society
	+ consideration of the likely effectiveness of identified actions
	+ commentary on sources and information; and consideration of ideas such as validity and bias, and how science ideas are used by different groups.

*The examples above are indicative of the evidence that is required.* |

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