

Coal in a sustainable future

MAJOR TASK AND ASSESSMENT INFORMATION

The task

This topic focuses on Australia's major source of energy, coal, how it is formed, why it is useful and problems associated with its use.

You will have studied the greenhouse effect in Year 7 or 8, and in this topic you will be examining the association between the greenhouse effect and coal powered electricity generation. You will also be examining alternative renewable and non-renewable sources of energy and how the coal industry is preparing for a zero emissions future along with rehabilitation work already being carried out.

Your assessment task is to identify the merits and concerns in the use in NSW of two of the following for large scale electricity generation, then argue for one, as a member in a debating team:

- the continued use of coal
- the development of zero emissions coal technology
- a renewable (eg solar, wind, geothermal, tidal etc) OR a non-renewable (nuclear) energy source.

In the task, you have an opportunity to demonstrate how well you can:

- describe and explain the scientific bases of existing coal fuelled electricity generation, emerging low emission coal-based technologies, and a renewable or nuclear energy technology
- describe and explain the potential benefits and drawbacks in the use of existing coal fuelled electricity generation, emerging low emission coal-based technologies, and a renewable or nuclear energy technology
- describe and explain the properties and reliability of a range of important fuels and energy sources.
- use flow charts, word and symbol equations and symbols, including numerical quantities and units to communicate scientific information.
- distinguish between and use scientific, economic and legal arguments to justify your stated points of view.
- identify the costs (economically and environmentally) of developing and using a particular energy source including the costs of establishing and maintaining infrastructure
- demonstrate an understanding of the greenhouse effect and the effects of forms of pollution on it
- give valid reasons why research and development money should be provided to the technology you are arguing for and not that of your opponents.

The task is in two parts:

Part 1: Individually, you must complete the summary table to demonstrate your understanding of the science of the large scale energy generation methods and arguments proposed for and against their use. You will have 40 minutes to complete this task. You may use your notebook and information collected throughout the topic.

Refer to COAL_Assess taskPart1

Part 2: In teams of 4, prepare and deliver arguments to debate one of the following statements.

The Debate Topics:

“Existing coal power stations should be phased out and replaced by new clean coal technologies.”

“Coal generated electricity should be phased out and replaced by alternative forms of renewable energy, such as tidal power, wind energy, solar energy, hydro-electricity, geothermal energy or biomass energy.”

“Existing coal generated electricity should be phased out and replaced by nuclear energy.”

“The NSW government should concentrate on the development of zero emissions coal technology rather than on nuclear energy for the generating of electricity in the future.”

Teachers note: The task could be easily modified to require students to produce a written discussion, an exposition or an oral report rather than have them engage in a debate.

Outcomes and essential content being assessed:

- 5.2: A student describes the processes that are applied to test and validate models, theories and laws.
4/5.2b) distinguish between scientific argument and economic or legal argument
4/5.2c) apply scientific processes to test the validity of ideas and theories
- 5.5: A student analyses how current research might affect people's lives.
4/5.5 b) evaluate the potential impact of some issues raised in the mass media that require some scientific understanding
- 5.7: A student relates properties of elements, compounds and mixtures to scientific models, theories and laws.
5.7.3c) construct word equations from observations and written descriptions of a range of chemical reactions
5.7.3e) qualitatively describe reactants and products in the following chemical reactions:
i) combustion
- 5.10: A student assesses human impacts on the interaction of biotic and abiotic features of the environment.
5.10c) describe some impacts of human activities on ecosystems.
5.10b) describe the importance of cycles of materials in ecosystems
- 5.11: A student analyses the impact of human resource use on the biosphere to evaluate methods of conserving, protecting and maintaining Earth's resources.
5.11.1a) discuss the importance of energy as a resource
5.11.2c) discuss strategies used to balance human activities and needs in ecosystems with conserving, protecting and maintaining the quality and sustainability of the environment.
5.11.1b) identify properties that make some natural resources economically important and describe their uses.
5.11.2b) identify excessive use of fossil fuels as a contributing factor to a greenhouse effect
- 5.18: A student selects and uses appropriate forms of communication to present information to an audience.
4/5.18e) use ... flow charts to show relationships and present information clearly and/or succinctly
4/5.18d) use symbols to express relationships, including mathematical ones, and appropriate units for physical quantities
4/5.18a) select, and use appropriately, types of texts for different purposes and contexts including a discussion, explanation, exposition, report for oral or written presentation
- 5.19: A student uses critical thinking skills in evaluating information and drawing conclusions.
4/5.19a) justify inferences in light of gathered information
4/5.19b) identify data which supports or discounts an hypothesis, a question being investigated or a proposed solution to a problem

Marking guidelines: (also available in a single page version < link to file: COAL_Assessrubric)

Range	A student in this range:
<p>16 - 20 High</p>	<ul style="list-style-type: none"> • Clearly and succinctly explains the scientific bases of existing coal fuelled electricity generation, emerging low emission coal-based technologies, and a renewable or nuclear energy technology. • Clearly and succinctly describes the properties of coal and one other energy source that make them economically important in the large scale generation of electricity. • Relates properties of coal to scientific models by using word and symbols equations to explain the possible effects of coal combustion on the atmosphere (should relate to greenhouse effect and global warming). • Uses appropriate physical quantities and units on a flow chart to clearly and succinctly explain how carbon, carbon dioxide and oxygen are cycled in nature and explains at least two impacts on the environment of existing coal fuelled electricity generation. • Evaluates the potential impacts on the environment of alternative energy sources for the large scale generation of electricity. • Discusses strategies used to balance large scale generation of electricity with conserving, protecting and maintaining the quality and sustainability of the environment. • Identifies accurate data from reliable sources which supports or discounts arguments about the use and development of large scale electricity generation technologies and their effects on the environment. • Distinguishes between scientific argument and economic or legal argument.
<p>8 - 15 Satisfactory</p>	<ul style="list-style-type: none"> • Provides a reasonable explanation of the scientific bases of existing coal fuelled electricity generation, emerging low emission coal-based technologies, and a renewable or nuclear energy technology. • Describes some properties of coal and one other energy source that make them economically important in the large scale generation of electricity. • Relates properties of coal to scientific models by using word equations to explain a possible effect of coal combustion on the atmosphere (might relate to greenhouse effect or global warming). • Uses a flow chart to explain generally how carbon, carbon dioxide and oxygen are cycled in nature and explains at least one impact on the environment of existing coal fuelled electricity generation. • Describes some potential impacts on the environment of alternative energy sources for the large scale generation of electricity. • Describes a strategy used to balance large scale generation of electricity with conserving, protecting and maintaining the quality and sustainability of the environment. • Identifies data which supports or discounts arguments about the use and development of large scale electricity generation technologies and their effects on the environment. • Identifies arguments as being scientific, economic or legal.

<p>1-7 Progressing</p>	<ul style="list-style-type: none">• Provides an incomplete or disjointed explanation of the scientific bases of existing coal fuelled electricity generation, emerging low emission coal-based technologies, and a renewable or nuclear energy technology.• Describes a property of coal and one other energy source that makes them economically important in the large scale generation of electricity.• Explains a possible effect of coal combustion on the atmosphere (might relate to greenhouse effect or global warming).• Explains generally how carbon, carbon dioxide and oxygen are cycled in nature and explains generally the impact on the environment of existing coal fuelled electricity generation.• Describes a potential impact on the environment of alternative energy sources for the large scale generation of electricity.• Identifies a strategy used to balance large scale generation of electricity with conserving, protecting and maintaining the quality and sustainability of the environment.
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