Science as a Human Endeavour:

The effect that the Adani coal mine will have on the Great Barrier Reef

Linked in Subject Outline: Give examples of human activities that lead to climate or environmental change."

Connected to Biology Subject Outline.

1. Introduction

The acceptance and use of scientific knowledge can be influenced by a range of factors, and in the case of Adani's mega coal mine, the politicians who support the venture are choosing not to accept the science by choosing potential benefits to the economy over the concerns for the environment. Although it is evident through scientific research that the Adani coal mine would likely result in the destruction of the of the Great Barrier Reef, the Queensland State Government and the Federal Government are refusing to accept the growing body of evidence due to the potential for jobs and money. In addition, the scientific knowledge of the impact that the coal mine would have on the reef informs public debate between environmental campaigners and politicians, as they both try to develop solutions through evaluating the economic and environmental impacts of the mine.

Relevant topic and SHE key concept identified.

2. Related biological science

The Great Barrier Reef is the earth's largest coral reef (Great Barrier Reef, 2017), stretching over 2,300 kilometres along the coast of Queensland (Tourism and Events Queensland, n.d.). The reef is home to an array of marine species, contributing to its naming as "one of the richest and most complex natural systems on Earth" (Great Barrier Reef Marine Park Authority, 2017). Whilst the Australian Government has policies to protect the World Heritage Site (Great Barrier Reef Marine Park Authority, 2017), the reef is falling victim to a larger force: climate change. Rising sea temperatures as the result of an increase in carbon emissions has caused coral bleaching to occur, affecting approximately two-thirds, of the Great Barrier Reef (ABC, 2017). The bleaching occurs when the water becomes too warm, causing "the expulsion of essential microscopic algae which live in symbiosis with the coral" (Institut de Recherche pour le Développement, 2017). The result of this is other types of algae covering the coral, which changes the species of fish that live on the reef and therefore disrupts the food chain (Reef Teach, 2017).

Relevant and deep Biology and background concepts.

3. Science as a Human Endeavour Relevance

a. Influence

The decision made by the Federal and Queensland Governments to support the Adani coal mine is motivated by money. The major motivating factor to support the mine among politicians is the promised creation of an estimated "10,000 direct and indirect jobs". This is predicted to reduce Queensland's unemployment rate which is currently at 6.4% (Slezak, 2017). In addition, the mine is estimated to be "valued at $21.7 billion", which would increase state and federal budgets for years into the future and allow for the completion of related projects such as a "rail link and connected port" (Crowe, 2017).

Depth of understanding of how this shows a link to *influence*.

Many Politicians are therefore not accepting the scientific evidence from various organisations such as UNESCO and The Australian Conservation Foundation (ACF) that building the Adani mine would cause damage to the Great Barrier Reef. Instead they are being heavily influenced by the prospect of "billions of dollars' worth of income and thousands of jobs domestically", as stated by the Federal Environment Minister Josh Frydenberg (SBS, 2017). In addition, the Governments' decisions are biased against the environmental considerations they are ethically obligated to act upon and rather than accept the scientific data that overwhelming suggests the mine should not go ahead. When asked about the negative environmental impact that the mine would have, Minister Frydenberg stated that

Australia's coal is "cleaner than other sources", and that if they weren't to go ahead with the mine, "somebody else will sell that coal into India and the impact on the environment could be worse in terms of emissions" (SBS, 2017). This statement suggests that the Federal Government condones the use of coal despite the evidence against its use and was also seen as "disturbing" to ACF campaigner Basha Stasak, who told the media that "our governments seem to refuse to acknowledge the reality of the situation" (SBS, 2017), showing that politicians are not accepting the scientific knowledge that the Adani mine would cause more harm than good.

Public debate between environmental campaigners and politicians has been influenced by the scientific knowledge that the Adani coal mine would have an environmental impact on the Great Barrier Reef. The major reason why many communities, a number of environmental organisations, and the Australian Greens party do not support Adani is that it is set to mine "2.3 billion tonnes of coal", which equates to the generation of "7.7 billion tonnes of carbon dioxide when burned" globally over 60 years (Coghlan, 2016). Scientific knowledge shows that this release of carbon dioxide will, over a period of time, contribute to the acceleration of global warming and cause ocean temperatures to rise (Slezak, 2017). This will result in the Pacific Ocean becoming warmer by 0.7°C, from this mined coal alone, (ABC, 2017). High profile opponents of the Adani project, such as a former chief scientist of the Australian Institute of Marine Science, Charlie Veron, and climate scientist from the Climate Council, Professor Will Steffen, believe that the mine would "sign the reef's death warrant", as it would "fuel the primary threat to the reef's survival: climate change" (SBS, 2017). This argument is belittled by some Politicians who debate that the Adani coal mine would have a positive economic impact on the Australian economy and that this is more important than the potential for damage to the environment. However, if the economy is the main aim, then it has been suggested that the mine will contribute to even greater economic loss, as it is said by the Climate Council that the death of the Great Barrier Reef would result in a loss of tourists (Barlow, 2017) to the region, which would mean a significant loss of money, conservatively estimated to be A$6.4 biilion per year (Deloitte Access Economics, Perry 2017).

Critical exploration showing connection shown between society and science using *application and limitation.*

Therefore society will need to determine, the importance of the Great Barrier Reef. Whether to follow the State and Federal Governemnts lead and accept the Adani mine development and the potential for economic growth or if the needs of the local and global community in securing the existence of the reef is of greater benefit to us all by continuing to promote this World Hertigae Site for others to enjoy through tourism and as a natural conseuquence of this decision protect the environment by reducing carbon dioxide emisisons preventing the acceleration of climate change if the mine was stopped. The ultimate decision will be influenced by many factors, but essentially it is a debate between what is more important: jobs and exports through mining or the environment and its assocated economic benefits.

Explanation of the link between the SHE key concepts and the science/solution shows depth of understanding.

Impact (Application and Limitation)

The decision to enable the Adani mine ot go ahead has huge consequences, to both the ecomomy of Australia, our standing in the world in relation to the environment and our reputation for how we look after our natural resources. If the mine is allowed to proceed, there are risks and the potential for unforeseen circumstances to the surrounding environment, but also concern for what is likely to occur with increased burning of coal and the impact this will have on climate change. A victory for those opposing the mine, will see the Great Barrier Reef protected, so that it is available for future generations to enjoy and for natural ecosystems to survive. It might also act as a catalyst to increase public support for environmental protection and lead to the prevention of the approval of other mining and development projects in areas that are sensitive to environamental damage, which could have far greater benefits to society, than just the protection of the Great Barrier Reef.

Critical consideration of the potential impact of the decisions that could be made.

4. Conclusion

If the Adani coal mine goes ahead, it could have catastrophic implications for the Great Barrier Reef. An increased amount of coal being burned as a result of the mine will contribute to global warming, and contribute to an increase in ocean temperatures, which will cause coral bleaching and therefore have negative effects on the reef. Whilst a positive aspect of the mine is the creation of "10,000 direct and indirect jobs" and $21.7 billion for the economy, the death of the Great Barrier Reef as a result would cause the loss of "more than 1 million visitors to the region annually – a figure equivalent to at least $1 billion in tourism spending and 10,000 jobs" (SBS, 2017). This would actually result in a large loss of money and no increase in the amount of jobs in Queensland, as well as the loss of the Great Barrier Reef.

Critical exploration of, and justified conclusion based on the depth of understanding of the SHE key concepts.

In reality, no one can say for sure what the effect of the Adani mine will be. Will it lead to an explosion of jobs? Or have these numbers been overinflated to make the project look attractive. Wiill the projected profits benefit Australian society or will they feed the pockets of multinationals who don't contribute to the Australian economy, it is hard to know. If we stop the Adani mine, will the hungry developing countries seek alternative sources of coal and thereby cause an increase in the effects of climate change despite the efforts of those opposed to the mine and as a result cause the destruction of the Great Barrier Reef despite the policies put in place to protect it. "The consequence of the mine going ahead are almost incalculable" (Holmes, 2017), and the damage it does may be in its promotion and normalisation that the use of coal is somehow still good for society.

Therefore, in my opinion, the State Queensland Government and the Federal Government should not build the Adani coal mine.

5. Bibliography

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Bibliography and effective and appropriate in text referencing provides evidence for KA4- appropriate conventions.

Meets all requirements of a science as a human endeavour report as specified in the subject outline

Overall grade - A

Stage 2 Biology Performance Standards

Performance Standards	Investigation, Analysis and Evaluation	Knowledge and Application
A	Designs a logical, coherent, and detailed biological investigation. Obtains records, and represents data, using appropriate conventions and formats accurately and highly effectively. Systematically analyses data and evidence to formulate logical conclusions with detailed justification. Critically and logically evaluates procedures and their effects on data.	Demonstrates deep and broad knowledge and understanding of a range of biological concepts. Develops and applies biological concepts highly effectively in new and familiar contexts. Critically explores and understands in depth the interaction between science and society. Communicates knowledge and understanding of biology coherently, with highly effective use of appropriate terms, conventions, and representations.
B	Designs a well-considered and clear biological investigation. Obtains, records, and represents data, using appropriate conventions and formats mostly accurately and effectively. Logically analyses data and evidence to formulate suitable conclusions with reasonable justification. Logically evaluates procedures and their effects on data.	Demonstrates some depth and breadth of knowledge and understanding of a range of biological concepts. Develops and applies biological concepts mostly effectively in new and familiar contexts. Logically explores and understands in some depth the interaction between science and society. Communicates knowledge and understanding of biology mostly coherently, with effective use of appropriate terms, conventions, and representations.
C	Designs a considered and generally clear biological investigation. Obtains, records, and represents data, using generally appropriate conventions and formats with some errors but generally accurately and effectively. Undertakes some analysis and interpretation of data and evidence to formulate generally appropriate conclusions with some justification. Evaluates some procedures and some of their effects on data.	Demonstrates knowledge and understanding of a general range of biological concepts. Develops and applies biological concepts generally effectively in new or familiar contexts. Explores and understands aspects of the interaction between science and society. Communicates knowledge and understanding of biology generally effectively, using some appropriate terms, conventions, and representations.
D	Prepares the outline of a biological investigation. Obtains, records, and represents data, using conventions and formats inconsistently, with occasional accuracy and effectiveness. Describes data and undertakes some basic interpretation to formulate a basic conclusion. Attempts to evaluate procedures or suggest an effect on data.	Demonstrates some basic knowledge and partial understanding of biological concepts. Develops and applies some biological concepts in familiar contexts. Partially explores and recognises aspects of the interaction between science and society. Communicates basic biological information, using some appropriate terms, conventions, and/or representations.
E	Identifies a simple procedure for a biological investigation. Attempts to record and represent some data, with limited accuracy or effectiveness. Attempts to describe results and/or interpret data to formulate a basic conclusion. Acknowledges that procedures affect data.	Demonstrates limited recognition and awareness of biological concepts. Attempts to develop and apply biological concepts in familiar contexts. Attempts to explore and identify an aspect of the interaction between science and society. Attempts to communicate information about biology.