2 Example essay

■ **Read the following essay on the topic of nuclear energy. In pairs or groups, discuss the following points:**

(a) What is the writer's position on this issue?

(b) How does the writer make his or her position clear?

EVALUATE THE RISKS OF USING NUCLEAR ENERGY AS AN ALTERNATIVE TO FOSSIL FUELS

Introduction

The search for sources of energy began when humans first started to burn wood or other forms of biomass to generate heat for cooking and smelting. This was followed by using hydropower from rivers and harnessing wind energy with windmills. Later the exploitation of chemical energy began with the burning of coal, oil and natural gas. Then, in the middle of the twentieth century, nuclear energy appeared for the first time, with the hope that it would allow the efficient production of cheap, clean energy (Bodansky, 2004).

Nuclear energy has, however, become the subject of considerable debate, with its proponents claiming that it is beneficial for the environment, since its production does not create carbon dioxide (CO_2) which can lead to global warming. However, its opponents argue that it can damage the environment by creating radioactive waste. It is also linked to diseases in humans, and there is the additional fear that it may be abused by terrorists in future. These critics further argue that other energy sources, such as solar power, could constitute safer alternatives to fossil fuels without posing an environmental threat.

This essay attempts to assess the risks of using nuclear power, in comparison with other sources of energy. The main arguments for employing nuclear energy are first considered, followed by an examination of the safety issues around this source of power, including the safety and security concerns connected with nuclear waste.

1 Reasons for Using Nuclear Energy

1.1 An Alternative Source of Energy

The rationale behind using nuclear energy stems from the need to find alternative energy sources to fossil fuels (i.e. oil, gas and coal), which are finite. This is a

growing concern, due to the increase in the global population, which is accompanied by an increase in energy demand. Mathew (2006) indicates that the annual energy consumption rate per capita in developed countries is between 4,000 and 9,000 kg of oil, while the rate in less developed countries is around 500 kg. As a result, the demand for total primary energy, which will accompany the population growth, is projected to increase from 12.1 Mtoe (million tons of oil equivalent) to 16.1 Mtoe in 2030. If this increase occurs the total global stock of oil and gas would only be adequate for 250 years, thus requiring the urgent development of other energy sources, which would not deplete the stock of natural resources available for future generations.

1.2 Limitations of Other Energy Sources

Wind energy and solar power are frequently presented as alternative energy sources to fossil fuels. Both are freely available in many parts of the world and their use involves no CO_2 emissions. Sterrett (1994) claims that sufficient wind energy exists to displace approximately eight billion barrels of oil. However, wind energy is unreliable, as wind turbines do not function if the wind speed is too high or low. Similarly, solar power is only effective during the day, and is uneconomic in cool and cloudy climates. Neither of these sources currently offers an efficient and reliable alternative to energy created from fossil fuels.

1.3 Reducing Carbon Dioxide Emissions

An important reason for using nuclear energy is to reduce the emissions of CO_2, which are produced by burning fossil fuels. Bodansky (2004) points out that this type of fuel is the main source of the increase in atmospheric carbon dioxide. The amount of CO_2 produced by each source differs due to the differences in their hydrogen content. For example, natural gas contains one carbon atom and four hydrogen atoms, which combine with oxygen to produce CO_2. The proportion of CO_2 is lower than with the other sources, because the emission depends on the mass of carbon inside the chemical compounds. Although natural gas is thus cleaner than the alternatives, burning all three fuels contributes to the greenhouse effect which is causing the earth to heat up.

Nuclear energy, however, emits no carbon dioxide, sulphur dioxide (SO_2) or nitrous oxide (NOx). It is estimated that in 2003, in the USA, nuclear energy prevented the release of 680 million tons of CO_2, 3.4 millions tons of SO_2 and 1.3 million tons of NOx. If released from coal burning plants, these gases would have caused the deaths of 40,000 people annually (Olah *et al.*, 2006: 127). According to Richard (2008: 273) the use of nuclear energy in France between 1980 and 1987 reduced CO_2 emissions by 34 per cent.

1.4 Cost Efficiency

Nuclear energy could potentially generate more electricity than other current sources. As Murray (2000: 73) explains, a typical reactor, which consumes 4 kg/day of uranium U235, generates 3,000 MW of energy a day, while other sources such as natural gas, coal or oil require many times the equivalent of that amount of uranium to generate the same energy. Therefore nuclear energy is relatively cost efficient as it uses a cheap raw material.

In recent years the price of oil and natural gas has risen sharply, and this trend seems likely to continue in future. Lillington (2004) suggests that the cost of purchasing fuel for nuclear energy is likely to remain low compared to other energy sources, so it seems likely that this cost advantage will become a significant factor in the comparison between nuclear and other energy sources.

2 Health and Safety Concerns

2.1 The Impact of Radiation on the Human Body

Especially since the Chernobyl accident in 1986 there has been persistent concern about the dangers to human health from nuclear power and nuclear waste. However, it must be understood that nuclear energy is not the only source of radiation, and that there are natural sources in the environment which may be more significant. According to Bodansky (2004: 74) there is far more exposure to radiation from natural sources such as radon and cosmic rays than from all human sources, for example X-rays and nuclear medicine.

Some researchers argue that radon is one of the main causes of cancer diseases among uranium miners. However, radon may be found in all types of soil which contain uranium and radium. Bodansky (2004) points out that the concentration of radon in the soil depends on the type of soil. Hence people's exposure to radon depends on their surroundings, so that people living in houses made from limestone or wood are exposed to less radon than those living in houses built with granite. So it seems that it is not only uranium miners who are exposed to radiation, but also people in certain geological districts.

According to US law the maximum permissible exposure for those living close to nuclear plants is 1/200 rem. However, according to Hoyle (1979) this amount is just 1/20th of the radiation that can be experienced from natural background radiation. It has been estimated that nuclear energy is responsible for just 20 deaths per year worldwide, although these figures are disputed by anti-nuclear campaigners who claim that the true figure is as high as 600 deaths. Hoyle (ibid.) claims that the

average American's life-span is reduced by 1.2 hours as a result of nuclear accidents, and contrasts that with the risk from smoking, which is a loss of eight years if one packet a day is smoked. Consequently, it can be seen that the risk to human health from the use of nuclear power is extremely low.

With regard to medical treatment, which is the next largest source of exposure to radiation, X-rays will expose a patient to radiation amounts from 0.4 to 1 rad (radiation absorbed dose). A broken wrist, for instance, is likely to require 4 X-rays with a total exposure of up to 4 rads. The unit of measurement for radiation exposure is the rem, and one rem is equal to the damage caused by 1 rad of X-rays; the maximum amount allowed for workers in nuclear plants is 5 rem per year: the same as the quantity received in the course of a routine medical check-up.

2.2 The Impact of Radioactive Waste on the Environment

Nuclear energy is not alone in producing dangerous waste. Lillington (2004) estimates that nuclear energy, in the course of producing 1,000 megawatts (MWe) of electricity produces annually about 30 tons of highly radioactive waste and about 800 tons of intermediate and low-level waste. In contrast, a coal-burning plant producing the same quantity of electricity would generate about 320,000 tons of coal ash, of which nearly 400 tons would be hazardous waste such as mercury and vanadium, and at least 44,000 tons of sulphur dioxide. So it can be seen that nuclear energy only produces a fraction of the dangerous wastes emitted from coal-fired power stations, and in addition does not produce greenhouse gases.

2.3 Risks of Terrorism

There has been widespread concern that terrorists might steal plutonium to produce nuclear weapons. In general nuclear facilities are tightly controlled, and in practice, it would be very difficult for terrorists to use such stolen material effectively. There are alternative materials such as toxic gas which could produce equally lethal terrorist weapons. However, these concerns could be solved by keeping U233 mixed with U238, which would prevent terrorist groups extracting the plutonium and fabricating a bomb.

Conclusion

The risks of nuclear energy in terms of both human health and the environment have been the subject of widespread debate and controversy. This essay has attempted to examine these risks both in terms of human health and environmental damage. It appears that many of these concerns are exaggerated, and that nuclear

energy can be seen as a safe, reliable and cost-effective alternative to using fossil fuels.

While all energy sources have drawbacks, nuclear should be viewed as a useful and relatively safe component in a mix of sources which can include renewables such as hydro and wind energy and non-renewables such as natural gas. The steady depletion of reserves of oil and the subsequent rise in prices is liable to emphasise this position. Clearly more could be done to make nuclear plants safer and more efficient in future, but until their value is recognised and more work is done on their design and construction their full potential is unlikely to be realised.

References

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Sterrett, T. (1994) *The Energy Dilemma*. London: Multivox.

3 Revision

■ **Look back at the text and find examples of the following features:**

(a) Background information

(b) A purpose statement

(c) An outline

(d) A definition

(e) A generalisation

(f) The use of brackets to give extra detail

(g) A passive structure

(h) A phrase showing cause and effect

(i) A synonym for 'energy'

(j) An example of tentative or cautious language

(k) An example to support the writer's argument

(l) A counterargument

(m) A citation

(n) A synopsis