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| --- | --- | --- | --- | --- |
| STSE Category | Risks | Ranking | Benefits | Ranking |
| Science/Technology | **Proliferation of Nuclear Weapons**  With the proliferation of civil nuclear energy has come the proliferation of nuclear weapons and the capabilities for nations to generate weapons grade uranium. The World Information Service on Energy claims that “ The borderline between civil and military use of nuclear energy evidently exists more in theory than in practice”  (World Information Service on Energy, 1999) and that most civil nuclear energy reactors can be utilized by rogue nation states to generate nuclear weapons. This appears to be an issue however most nations pursue civil nuclear energy project but do not pursue a nuclear weapons arm. This is largely due to the nuclear non-proliferation act which prevents most nations from being able to stockpile nuclear weapons and proliferation of nuclear weapons has been shown to make nations less want to use them. No nation after the bombing of Japan has used a nuclear weapon as an attack on a nation due to the fear that a nuclear strike would result in nuclear retaliation. | **Proliferation of Nuclear Weapons**  4 | **Radioactive Isotopic Production**  Many modern medical procedures require radioactive isotopes. According to the International Atomic Energy Agency “Growing tumour cells are sensitive to irradiation  damages, and that is why therapies often employ radioactive isotopes” (International Atomic Energy Agency, 2016). The proliferation of nuclear reactors has resulted in the proliferation of radioactive isotopes which can be used for medicinal purposes. Cancer is the largest cause of death in the world if the proliferation of medical isotopes can result in a widespread treatment for cancer then it could be one of the greatest medical milestone in history. | **Radioactive Isotopic Production**  2 |
| Society  Cultural  Legal  Economic  Ethics |  |  | **Cultural support for native American.** |  |
| Environment | **Issues with Radioactive Waste disposal.**  Modern nuclear fission reactors result in a significant amount of energy however have a disturbing by-product of hazardous waste. The current solution is to bury the radioactive waste underground in repositories to prevent leakage and future human contact. However the International Atomic Energy Agency says that “waste repositories represent possible sources of radiation exposure to humans” (International Atomic Energy Agency, 1996). The issue is that with the proliferation of nuclear power generation there is an increased amount of repositories which are taking up an increasing amount of area that is running out. These repositories also face the risk of unintentional human contact, if humans were to accidentally drill and reach one of these repositories this could lead to leakage and a devastation of the surrounding environment and potentially human population. The issue of radioactive waste disposal is important because if nuclear power generation is to become more wide spread, another solution must be found as there is only a finite amount of space on the planet and these repositories risk contaminating the outside. However the International Atomic Energy Agency claims that the risk for contamination to the environment is low and that any such risks would occur centuries in the future (International Atomic Energy Agency, 1996).  **Emissions caused by reactor meltdown**  Nuclear reactors emit very little dangerous emissions or greenhouse gases during standard use. However in the event of a reactor meltdown many dangerous gases can enter the atmosphere and cause devastating effects. When the Fukushima reactor was hit by an earthquake it caused a meltdown. According to a report by the Fukushima Disaster organization when Fukushima melted down it emitted many heavy isotopes such as Strontium-90 and Caesium-137, these emissions turned into radioactive clouds and when they fell to the earth contaminated the marine environment and soil (Rosen, 2012). The emissions were very dangerous however the likelihood of such nuclear meltdowns are decreasing as technology improves and is a very rare occurrence. | **Issues with Radioactive Waste disposal.**  2  **Emissions caused by reactor meltdown**  3 | **Nuclear Power Greenhouse gas emissions**  Nuclear fission generation has been shown to output less greenhouse gas emissions compared to other major energy sources. According to a report by Intrinsik, prepared for Ontario power generation that compiles data, shows that nuclear power generates approximately 0.15g CO2e/kWh compared to other sources such as Natural gas which outputs 525g CO2e/kWh. That is a 3500x increase in carbon emissions. One of the biggest benefits of nuclear power is its lack of greenhouse gas emissions compared to other sources of energy. This is extremely important as greenhouse gas emissions are an incredible factor in global climate change which unless stopped will cause devastation to the environment including mass migration of people and animals and the transition of once fertile lands into inhospitable wastelands. By converting sources of energy such as coal and natural gas to nuclear power would reduce these greenhouse gas emissions and thus lessen the impact of climate change. | **Nuclear Power Greenhouse gas emissions**  1 |

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