Situation With Nuclear Power In Australia

Australia is a large country being the 6th largest country on the planet, it currently holds 24.6 million people and needs electricity for every single one of them. According to the Australian Government “Australia produces about 2.4 per cent of total world energy and is a major supplier of energy to world markets, exporting more than three-quarters of its energy output, worth nearly A$80 billion.” (https://www.ga.govn.au/scientific-topics/energy/basics) This large amounts of energy however can be acquired in unsustainable methods by using non-renewable resources such as coal and gas. Australia is a large consumer of energy being 20th in the world. However, coal accounts for about 75 percent of Australia’s electricity generation. Only to be followed by gas which accounts for 16 percent, then hydro at 5 percent and wind around 2 percent of Australia's total electricity. Australia’s large allows for large amounts of space dedicated for energy facilities and production.

Nuclear fission is the technique that nuclear power plants use to create electricity. Nuclear fission in simple terms is the process of splitting an atom’s nucleus into 2 pieces in turn release extremely large amounts of energy which then can be captured and turned into electricity. The process of nuclear fission occurs in a chain reaction meaning once it starts it won't stop until exhausted creating large and extreme amounts of energy. Nuclear fission was discovered in 1939 and from here until the late 1970’s was heavily researched for the purposes of electricity and other uses such as the atomic bomb. After the increase of attention after Americas show in ww2 many countries got involved. The UK opened the first commercial nuclear power plant in 1956 and by 2013, there were 437 reactors in 31 countries.

Australia is the largest exporter of coal, according to ABC “Australia mines about 57 tonnes of CO2 potential per person each year, about 10 times the global average, and exports 7 percent of the world's fossil fuel CO2 potential.” This is extremely bad but this is the only way Australia can keep its currency strong through trade of raw materials and products.

Nuclear energy however is a CO2 free method of creating viable and reliable. It reduces CO2 emissions so dramatically that since 1976, 64 gigatons of greenhouse gases have been avoided being pumped into the atmosphere thanks to the implementation of nuclear power. When adjusting these numbers for the future and rising power consumption, another 80-240 gigatons of CO2 will be avoided from being pumped into our atmosphere and our lungs.

Nuclear power is such a strong and environment-friendly source of power that it is the highest source of electricity that contributes to US energy demands. If implemented into Australia could do the same or even better within our environment.

“In 2018, Pennsylvania’s nuclear power plants prevented more than 57 million metric tons of carbon emissions which is the equivalent of taking 12 million cars off the road. The saved social cost of carbon is more than $2.6 billion annually, according to the federal government’s evaluation.” (NEI, pg 1, https://www.nei.org/advantages/ climate)

Australia would benefit so much from nuclear power, already there is no carbon emissions, much better compared to coal, but Australia holds 1/3 of the world's Uranium reserves. This is a

large economic opportunity for Australia, with this much Uranium reactors could keep on running for no problem for hundreds of years. Major uranium deposits are located in South Australia, the Northern Territory and Western Australia. The largest of which is the Olympic Dam Mine, which is in fact the largest deposit of uranium in the world. In 2013, Olympic Dam is the second largest uranium-producing mine in the world. During this year the mine produced 4,100 tonnes in the financial year ending June 2013. Australia also yields 20% of the world's thorium, being another material that is proposed for used within nuclear reactors. Australia as a continent is covered in rocks and deposits of uranium and thorium. However, thorium is much more abundant within the Earth’s crust is the form of rocks and small amounts within soil. This can create a large opportunity within the Australian country not only for the actual materials but also for employment and a new mining rush. Western Australia has a rising unemployment because of the fact that it was born as a mining state and with the declining need for mining in that area it leaves people vulnerable. But with a new mining project for nuclear materials instead of coal it could open up more opportunities and revenue income for the Australian Government and people. This would also open up a new mining rush within Australia maybe even creating another migration rush to areas with Uranium mines.

With Australia's population density being mainly on the coasts because of the harsh and desert climate, Nuclear reactors can be comfortably constructed about 200km- 500km away from the shoreline, with only about 0-10 people living per square kilometer in those areas. Reactors do not have a limit to how close they can or cannot be to urban areas, however most issues while pacing reactors is the thought of meltdowns and the dangers involved. Luckily about 90% of the nuclear power plant incidents or issues arise after the impacts of natural disasters, such as earthquakes, tsunamis, cyclones etc… Australia sits on its own tectonic plate reducing the impacts of earthquakes to nothing and only receive slight shakes on the border of our country. Cyclones and tornadoes are also unheard of within all areas except QLD. So Australia is made for the creation and implementation of Nuclear power plants. So with nuclear power plants being able to be built in a large amount of space in Australia, they can also be built close to urban areas because of the safety and reassurance that nothing bad will happen from natural disasters. These plants are also in need of water, lots of water, which would create an option for Australia to turn on its revolutionary desalination plants creating easy access to power and keep running plants.

When people talk about nuclear waste the most common aspect spoken about is the fuel that has been used up from being in a reactor. Nuclear fuel is a solid, solid both before and after use. The main structure is arranged in fuel assemblies: sets of sealed metal tubes that hold ceramic uranium pellets. The byproducts of nuclear processes also stay within the fuel tubes. Nuclear fuels cells are classified as a high-level radiation waste. Nuclear fuel is used to generate and produce electricity within power plants for about 5 years of work. Once the fuel is deprived of enough power to sustain the facility it is very safely and carefully removed and stored until a permanent disposal site is available. With Australia's large and quite open space a large disposal site within the middle of Australia could be established as reliable area, accessible by all 5 mainland states and 2 territories. This would be a viable option as that deposits would only would have to be done every 10 years (preparation for disposal) after being placed within, and not much waste is created.

There is also low-level waste, this includes items such as gloves, tools or machine parts that have been exposed to radioactive materials and surprisingly makes up most of the volume of waste produced by plants. But low-level waste has its benefits because it can be stored at

plants until the items can also be disposed of safely like normal trash.

A large-scale nuclear country like the US, has only created an amount of waste that would cover a football field with a depth of less than C9 meters, since the 1950’s by the commercial nuclear industry. Coal factories create this much waste in an hour. This may be done by transportation through trucks or even planes if a full-scale program was to start. However nuclear power plants also produce low-level radioactive waste, which would also need to be disposed of in various locations. With low levels of radiation, it could be stored closer to the actual sites rather than kilometers away in Australia's outback.

However fuel doesn’t always have to be deposited into special landfills, it can actually still be used for energy. Used fuel has only exhausted parts of its potential energy in the uranium pellets after use. An example of nuclear recycling occurs in France, they reprocess and recycle the old fuel, extracting the elements which are still capable of generating electricity to be used in new fuel. Only the is the final waste contained once more and put for permanent waste.

Nuclear waste disposal is actually quite safe because of the process involved until it is actually able to be deposited away. Once the fuel has been removed from the reactor, used fuel is initially cooled down in storage pools. These pools are made out of concrete and reinforced steel, which shields the workers from any radioactivity. This cooling process takes about 2-5 years after being taken out of the reactor. After this process used fuel is transferred and stored in dry cask. Casks are large steel-reinforced concrete containers, these casks are designed for long term storage until a site is available for a permanent site. These storage areas are also so safe that it can be touched without any harm. This would take so long with Australia’s large baran terrain.

As kurzgesagt said on one of his videos, “If we can choose between lots of dangerous stuff being put into a deep hole and lots and lots and lots of dangerous stuff being pumped into the atmosphere, the former seems more logical.”

The nuclear rush stopped around the 1970’s and from that point on, interest within the topic has dropped dramatically. Once an idea of unlimited and free power for all turned into a lost topic. However if Australia joins the nuclear program we can indeed spark up a new future by ourselves we have the power and resources to do so. New technologies are being discovered every day and all these discoveries can make a large impact on the world we live in today. The nuclear power we harness now is only a mere fraction of nuclear energy presents. But first we must work and refine the techniques we use now. With Australia involved scientists and engineers can work together to create better and more efficient models of what we have already created a standpoint of where Australia is at in power and setting an example for the rest of the globe.

New technology may solve the problem of nuclear waste creating an even cleaner way of life and power. Most of the nuclear reactors used these days are outdated and starting to get old, thanks to the rush dying out. There are many advanced models out there that have not yet been implemented heavily, such as the thorium reactor. With Australia holding 20% of the world's Thorium it wouldn’t be a bad idea to experiment and work on new ideas to make bigger and better reactors. A property of Thorium is that it is extremely hard to turn into nuclear weapons, in turn it won’t hinder with Australia's agreement to cease all nuclear weapons and stop construction and development of them. Thorium reactors are also less wasteful than normal

uranium reactors by a marginal scale, this is evident in how thorium waste will be toxic for few hundreds of years whereas uranium would be a few thousand. Another benefit of thorium over other sources of power, is that 1 ton of thorium is estimated to provide the same amount of energy as 200 tons of uranium or 3.5 million tons of coal. Although current indications suggest that thorium nuclear reactors won't be in widespread use for a while because of the technical challenges it is an extremely viable and research worthy idea. Australia has overcome so many challenges thought to be impossible, what's stopping us now?

Nuclear fusion… can we bottle a star? The stars are a supply of limitless power, this is achieved through thermonuclear processes like fusion. In order to achieve nuclear fusion the ingredients must be super hot, millions of degrees hot. Atoms become so hot that they are stripped of their electrons, making an area of plasma where both nuclear and electrons fly freely. However all the nuclei are positively charged, so they repel from each other, but in order to make this process succeed they must be traveling very, very fast meaning millions of degrees hot to fuse together. Suns act out this process so easily because their mass creates an extremely dense core leaving no option but for the nuclei to fuse becoming heavier nuclei and in turn let out massive amounts of energy. This type of energy could be the turning point for our everyday lives and Australia has the money and means to invest in such a project.

New technologies have interested Australia for generations, finding and improving on things that make our lives thrive. To date scientists have invented 2 ways of achieving nuclear fusion. The first type is in a donut type shape where it uses magnetic fields to squeeze plasma where reactions are hoped to take place. There is one currently on Earth, the I.T.E.R. reactor in France. It uses superconducting electromagnets cooled with liquid helium, to the point of a few degrees of absolute zero. Meaning that it hosts some of the biggest temperature gradients in the known universe. The second type of fusion reactor is called "inertial confinement." This type of reactor uses super powered lasers to pulse and heat up the surface of fuel in the shape of a pellet, imploding it, creating a substance that is dense enough to fuse. In fact, one of the most powerful lasers in the world Is used for fusion experiments at the National Ignition Facility in the U.S. However these experiments, are in fact experiments, they are still developing around the world. Although both techniques can achieve fusion, the amount of energy put into it, is far more than what is actually produced. But if Australia would join with the research and mission to create such a revolutionary power source, it will be so efficient that a single glass of seawater, could be used to produce as much energy as burning a barrel of oil, with no waste at all.

To top it all off nuclear fusion is much safer than most other types of power plants. A fusion reactor although nuclear is very different than fission, a fission plant is made up of chain reactions and if it were to meltdown a catastrophe would occur. If confinement would fail during a fusion test, the plasma would simply expand and cool, stopping the reaction all together.

People may state that nuclear energy has killed more people than normal means of getting electricity such as coal. While it's true that nuclear disasters have come close and happened in the past such as Chernobyl, Ukraine (former Soviet Union), April 26, 1986, Middletown, Pennsylvania, USA, March 28, 1978 and more recently Fukushima, Japan, March 2011, technology has evolved to ensure no meltdowns happen again. By putting station in Australia we can skip all the natural disaster threats as Australia sits on its own tectonic plate therefore eliminating large earthquakes and tsunamis completely from main land. It also is in a spot where only northern Australia receives tropical cyclones. A study by nasa in 2013 led to discovery that nuclear energy has prevented 1.8 million deaths, from 1978-2009. Even by including the death

tolls of Chernobyl and Fukushima, nuclear energy ranks last in death per energy unit produced. One major life saver is that as seen before nuclear waste is stored and recycled where as contemporary fossil fuels toxins are pumped into the air. So, just by reducing the amount of fossil fuels burned, countless cases of cancer or lung disease and accidents in coal mines have been avoided. Nuclear energy would save more lives then it will ever destroy.

Overall nuclear power would no doubt sustain Australia and generate enough electricity for it to be beneficial. Australia has the land, the time, the money, the raw materials and should rethink the ban on nuclear power and rethink the way it helps and how most problems of natural disasters are obsolete to Australian plants. The waste is easily manageable with the amount of space Australia can use even if it means building containment areas to block from winds in the outback. With fission being a reliable and strong source of power and Australia's quantity of the material creates the perfect equation for long term lasting power and economic strengths. No carbon emissions create the perfect environment for Austrlian people as they are already under stress from the immense coal mining within the country and the hole in the ozone impacting on Australia dramatically. New technologies is the main principle of creating these factories, the idea of creating bigger better and more sustainable power plants such as the thorium reactor and achieving a stable and powerful fusion plant, Australia could become quickly an extremely string nation through electricity alone. With Australia needing 25 power plants to sustain one third of its power consumption it will impact dramatically in reducing the amount of carbon emissions being pumped into the Australian people’s lungs. Although plants take roughly 20-30 years to construct, it would be worth it, especially with the rising power consumption from all over Australia. It would power the Australian life without leaving a trace, and combined with other sustainable power techniques it can only help to slow down the effects of a man-made catastrophic disaster. We left the natural world and created our own, so why not make it the best?