Alternative Energy: Nuclear Energy

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Outline

I. Introduction
   A. Nuclear energy can provide abundant steady energy forever.
   B. It's fairly obvious why people do not want nuclear energy; if something goes wrong inside, there can be some very bad consequences, such as nuclear fallout and the belief that everyone would have to leave his/her homes. Many people think a nuclear power plant can explode like a bomb, but that's not possible due to the fact they are built differently from nuclear weapons. However, there have only been a few accidents with nuclear power in many years across many plants. It is actually the safest form of creating energy with the least number of on-the-job accidents across all forms of generating power. It would also be much cheaper for people in the long run as well.
   C. Nuclear energy is our solution to the energy crisis.

II. Body
   A. Background
      1. Nuclear energy is the energy released during nuclear fission or fusion, primarily used to generate electricity.
      2. Originating in the 1950's, nuclear energy like all other technologies has advanced much in the past fifty years. We are now in our third generation of nuclear power plants with fourth-generation technology well on its way expected to be commercially available by 2030.
   B. Pros
      1. Cleanest energy source with next to zero Co2 emissions.
      2. Renewable, will not run out.
      3. Will provide cheap energy for all.
      4. Lowest amount of on-the-job accidents when compared to all other forms of generating electricity combined.
   C. Cons
      1. PEOPLE THINK IT'S A BOMB!
      2. Upfront costs.
      3. Nuclear waste
      4. Terrorist threat
   D. Nuclear energy is the best type of energy with its near zero Co2 emissions, the least number of on the job accidents and the fact that nuclear energy will not as likely run out unlike coal and natural gas. Thorium is the answer to everything wrong with nuclear power. Nuclear energy is the solution to the energy crisis despite what the ill-informed public and some experts say.

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III. Conclusion
   A. Nuclear energy is a great alternative to fossil fuels. It is renewable, it's the cleanest energy source, it will provide cheap energy for all and nuclear power plants have the lowest amount of on the job accidents when compared to all other forms of creating power. The public must be more informed about it for them to accept it. However, we must dispose or recycle the nuclear waste safely.
   B. Nuclear energy can provide abundant steady energy indefinitely.

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In our ever-growing world that is demanding more and more energy to be used each day, we are coming to a point where fossil fuels simply won't cut it anymore. Not only are they very dirty compared to renewable sources of energy such as wind energy and solar energy, but they are also less efficient. With more and more people consuming larger and larger amounts of energy, we must find a new stable and clean type of energy that can replace all the coal-burning-energy-generating plants before the entire world is covered in a thick, dangerous black haze. Fortunately, we have a great solution to the upcoming unavoidable energy crisis called nuclear power, also known as atomic power. Nuclear energy is the energy released during nuclear fission or fusion and is typically used to generate electricity. It has a lot going for it, including the fact that nuclear power plants can be stationed virtually anywhere; nuclear power plants also provide a great amount of energy with virtually no Co2 emissions. If that weren't good enough, they are also the safest plants to work at as far as on-the-job accidents go. Sadly, any good you hear from nuclear energy gets drowned out by the few bad accidents that were out of the many hundreds of nuclear power plants that have functioned fine for decades. There is also the fear of the atomic material getting into the hands of terrorists, which then would cause great harm. We must restore people's faith in nuclear energy. Nuclear energy is our silver bullet to the energy crisis.

Nuclear energy is not really a new thing. In fact, nuclear energy originated during the 1950's. Just like all other technology has evolved and gotten better over the years, so have nuclear power plants. The nuclear power plants are now in what's known as generation three plus, which are enhanced third-generation nuclear power plants. However, the good part is yet to come because what's proposed in these upcoming fourth-generation nuclear power plants

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will make everything that came before them look not nearly as important. Thorium would make things much safer and more efficient than ever before. “In a molten salt reactor, liquid thorium would replace the solid uranium fuel used in today's plants, a change that would make meltdowns all but impossible”(Thompson, 2011). Before thorium, we have always only had uranium, which is weapons grade and more dangerous to use in nuclear reactors than the more efficient, more abundant, non-weapons grade material.

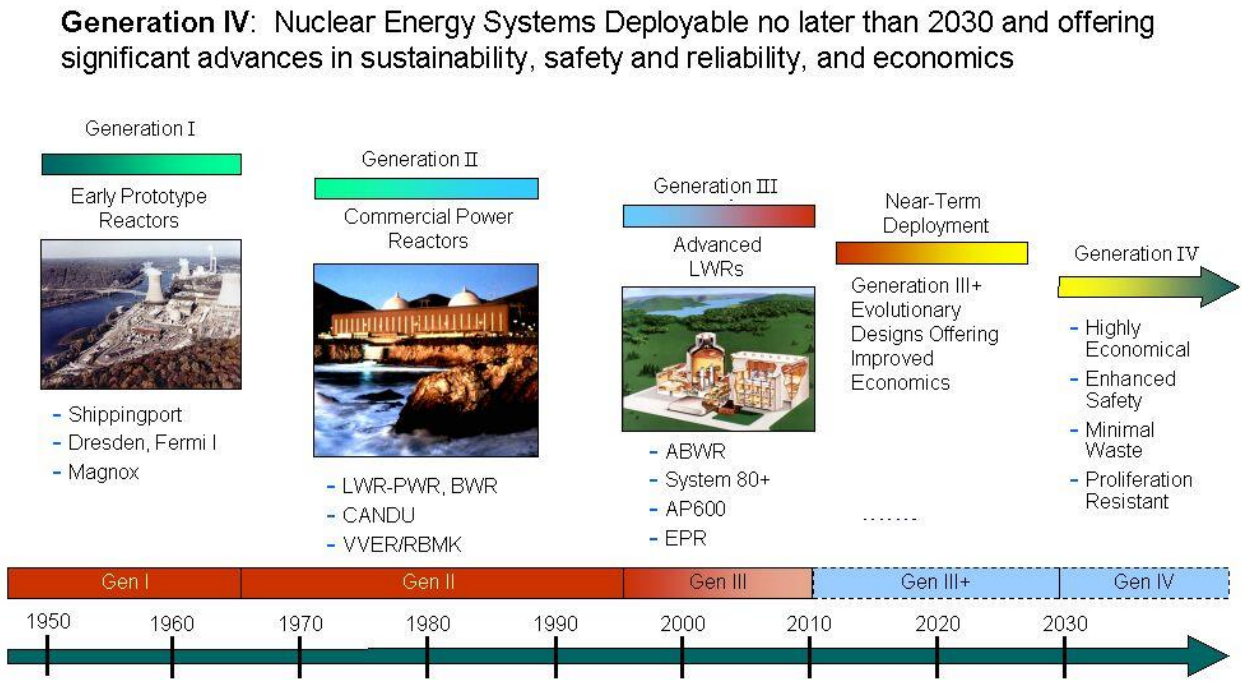

Figure 1: Nuclear Power plant progression from the beginning to the future. (http://www.usnuclearenergy.org/gen%20iv%20reactors.htm)

Nuclear energy is truly a great source of energy. It emits virtually no Co2 emissions when compared to coal and natural gas:

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> A report released by the Oxford Research Group found that nuclear power's carbon emissions are somewhere between renewable resources and fossil fuels. The report estimates that while coal — which is the primary source of electric power in the U.S. — produces 755 grams of carbon per kilowatt hour, the range for nuclear is from 10 to 150 grams per kilowatt hour. Wind power is 11 to 37 grams. In the long run, however, there is no reason why the nuclear fuel cycle (or any renewable energy production for that matter) could not be powered largely by carbon-neutral energy sources, creating the potential for virtually no lifecycle emissions which is exactly what we need (Motavalli, 2007).

Nuclear energy is also the safest type of energy when you take into account all the on-the-job accidents across all forms of generating power. Even though the safety record of older existing reactors are much better than all other power-generating technologies, modern nuclear reactor systems can be made safer than anything that has ever come before them (Guldberg & Eric, 2014). Then there is the fact that uranium reserves will not run out for about 15,000-30,000 years, and thorium would last even longer still because there is about four times more of it than uranium. Thorium also burns a whole lot more efficiently than coal and even uranium by light years. Thorium is four times as abundant as uranium and is much easier to mine, due to its lower radioactivity. The domestic supply could serve the U.S.'s electric needs for centuries. “Thorium is also exponentially more efficient than uranium. In a classic reactor, you're burning up from only about 1-3 percent of the uranium, while in a molten salt reactor, you're burning 99 percent of the thorium. In other words one pound of thorium has as much power as 300

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pounds of uranium or about 3.5 million pounds of coal" (Kutsch, 2011). That is a lot of coal that we can save from entering our atmosphere that may be contributing to global warming (Thompson, 2011). However, before we can start helping the earth by reducing our Co2 emissions, we need to replace existing coal power plants with other sources of power, namely nuclear power. Another positive that everyone should like—well at least everyone who likes to save money will like it—is that nuclear power would provide cheap power for all. Nuclear power would provide low-cost, carbon-free electricity, effectively improving the lives of billions of people (Guldberg & McFarland, 2014). Lastly, nuclear power plants can be built practically anywhere, which makes them great to put just about anywhere that needs a little extra juice.

However, there is great opposition to nuclear power from the general public to experts and even our own U.S government. The general public sees the inflated stories in the news about nuclear-damaged reactors and how they are going to "blow" as if they were bombs. THEY ARE NOT BOMBS! Nuclear reactors and nuclear bombs are made totally differently. Nuclear plants are not identical to nuclear bombs. "The fuel in a nuclear plant does not contain what is required to explode like a bomb, nor can its components form what is known as a 'supercritical' shape in order to explode" ("Subatomic Particles," 2011). There are also anti-atomic energy movies that were released, which didn't help matters either. "The China Syndrome" gave moviegoers visions of Jane Fonda running for her life in the middle of a nuclear meltdown, causing panic and the belief that if there were a nuclear power plant, there would be an explosion, which is just insane and false. Though this film was made back in 1979, its message left an impression that is still part of the public's mind today. The funny thing is that

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this event is not even remotely possible. Some experts are very much against nuclear power, saying it is far too dangerous to continue to peruse, and we should look to other safer, cleaner forms of power.

> The history of nuclear power is full of disasters and near disasters, each with the potential to result in widespread human and environmental destruction. Even when nuclear energy is produced without any problems, the process itself creates large amounts of toxic waste, which is very hard to safely discard. However, the world need not despair about its energy needs, given the vast array of reliable, safe renewable energy options that are available today. The risks of nuclear power and the threat of nuclear weapons worldwide can be eliminated by a continued global focus on the development of safer, healthier forms of energy (Dupea & Morley, 2014).

Lastly, our U.S government doesn't want countries like Iran to have nuclear weapons even though they say they are just trying to make nuclear power, but they also threaten to fire nuclear weapons at Israel, our ally. The Iranian government set up its nuclear program in the early 1950s. Over the many years, Iran has stated that its intended purpose of the program is to produce electric power and only produce electric power. Therefore, the country has the right to carry out its nuclear research without question. However, several countries, mainly Israel, claim there is strong evidence that the main intention of the Iranian government is to produce weapons-grade uranium with the primary goal of producing nuclear weapons, which would be used against the enemies of Iran, including the U.S and Israel.

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> Since high-level Iranian officials have stated it is their goal to destroy Israel, the Israeli government perceives Iran's program as a threat to their survival. Demanding Iran to stop their pursuit of weapons-grade uranium, nations such as the United States have attempted to convince the Iranian government to allow the United Nations to conduct inspections to prove that they are not involved in weapons research (Jones, 2014).

This has been very unsuccessful, and a number of nations have imposed restrictions on Iran for failing to allow inspections to take place. If the inspections were to go through and Iran were not conducting nuclear weapons research, there would be no problems, and they would be able to continue as usual without interference. The rest of the world would be a little bit more at ease if they knew the truth about what's really going on there also. The Israeli government has said that if sanctions are not successful, it will put Iran's nuclear program on ice permanently by military strike if needed (Jones, 2014). One more consideration about using nuclear energy is that we can't forget the start-up costs for one of these nuclear power plants isn't exactly cheap to set up, and then when the plant is up and fully functional, what to do with the nuclear waste? We can't just have it keep stockpiling up; we will run out of room to store it, and then there will be a new problem altogether.

Now enters thorium, the savior of the nuclear world, in a matter of speaking. Thorium in the place of uranium in generation-four-based reactors would solve a lot if not all the outcry against nuclear energy. First, thorium-based reactors can't melt down and are much safer than the current generation reactors being used today, which should help to quiet the ill-informed

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public about nuclear energy. Secondly, countries such as Iran that are suspected as being dangerous and would use nuclear weapons against others can still have and use nuclear power. The only catch is that they cannot have the typical uranium reactors, but they could have the non-weapons-grade and impossible-to-enrich-to-weapons-grade thorium reactors instead. That way if they say they are truly only making nuclear power, this would make them stay true to their word due to the fact that nothing they could do to the thorium would be able to enrich it to the point they could make weapons of mass destruction out of it. Other countries would be happy because Iran or other dangerous countries couldn't fire any warheads at them, and Iran should be happy because they are investing in a clean, reliable energy source that can sustain them for years to come. Some people say nuclear energy is bad for our environment. To such people, I ask where else will you find an energy source that can easily outperform coal and natural gas and at the same time be about ten thousand times cleaner than them as well? The simple fact is that nuclear energy is an answer to our energy crisis. Nuclear energy has the lowest amount of on-site accidents out of all the different forms of generating power. Nuclear energy is one of, if not the most, efficient forms of gathering energy. When fossil fuels here on earth are all depleted, we will have an easy 5000-10,000 years' worth of materials to keep those nuclear reactors going well into the future.

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Energy Source	Mortality Rate (deaths/trillionkWhr)	
Coal – global average	170,000	(50% global electricity)
Coal – China	280,000	(75% China's electricity)
Coal – U.S.	15,000	(44% U.S. electricity)
Oil	36,000	(36% of energy, 8% of electricity)
Natural Gas	4,000	(20% global electricity)
Biofuel/Biomass	24,000	(21% global energy)
Solar (rooftop)	440	(< 1% global electricity)
Wind	150	(~ 1% global electricity)
Hydro – global average	1,400	(15% global electricity)
Nuclear – global average	90	(17% global electricity w/Chern&Fukush)

Figure 2: On the job energy gathering Mortality Rates (for 2012 year). These figures show the overall health risks per trillion KWhr. Notably, the lowest in nuclear in a global average. (http://www.forbes.com/sites/jamesconca/2012/06/10/energys-deathprint-a-price-always-paid)

Nuclear energy is a great solution to the upcoming and unavoidable energy crisis that is coming. Nuclear energy is many times better than fossil fuels. It emits virtually no Co2 emissions and is able to generate even more power than coal and natural gas. It is basically renewable, considering how much uranium and thorium are available. It can be built practically anywhere, meaning power can be supplied practically to any location, no matter how remote. Once the main nuclear plant is set up, it would provide ultra-low-cost energy for everyone, and who doesn't like that? That is not to say nuclear energy is perfect. There are some kinks that

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need to be worked out, such as informing the public about nuclear energy so they don't resist it. We must continue to increase the safety to ensure that nothing can possibly go wrong so that nuclear power plants stay in positive light with the public eye and are accepted. We must ensure nations truly use nuclear research for the generation of power and nothing more. Lastly, we must find a good way to dispose or recycle the nuclear waste so no harm comes to the environment or the people. These shortcomings can be met, and one day we will all be able to live in a Co2-free nuclear world together where the idea of running out of energy would only be a distant memory of the past.

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