Nuclear Power: Is it Safe?

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An article briefly describing how Nuclear Power is generated, and pro's and cons of the technology

A few weeks ago, I had the opportunity to attend one of St. Scholastica's Alworth Center for Peace and Justice Lecture Series on Sustainable Living. The particular talk I attended was: "The Truth About Nuclear Energy" presented by Gwyneth Cravens. As an engineering student and someone interested in sustainability, I had high hopes for this talk but was actually quite disappointed with the outdated content and wanted to do some research of my own. Hopefully, this article will provide some more current information about how nuclear works and some of the pros and cons of using this technology.

When people hear the word “nuclear”, they commonly associate it with weapons, or the Chernobyl disaster. This is perhaps the biggest hill that this technology has to climb. Nuclear technology is not all doom and

gloom. In this article, I am going to give a brief description on how the technology works and offer some pros and cons of nuclear power.

Nuclear plants produce electricity by heating water into steam, this steam will then turn turbines to produce electricity. The process of creating electricity is similar to that of plants that burn coal, oil and natural gas, which also produce electricity by boiling water into steam. The big difference being that nuclear plants do not actually burn any fuel. Instead, they use uranium fuel, to produce heat to boil water through a process called fission.

So fission is actually a physical process, that involves the splitting of atoms of uranium inside a nuclear reactor. The uranium fuel is comprised of small, hard ceramic pellets which are then packaged into long, vertical tubes. Bundles of these tubes are inserted into the reactor and surrounded by water.

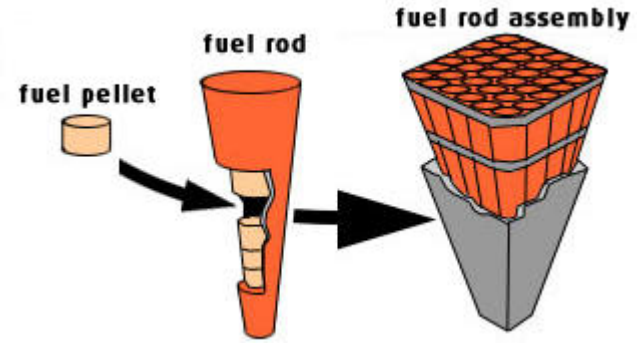

Image showing how a nuclear fuel rod is composed

Before I get into the reaction, it's necessary to understand the structure of an atom, as atoms are where the energy is coming from in a fission reaction. Atoms consist of electrons that surround a nucleus, which is made up of protons and neutrons. Nuclear reactors work when a nucleus breaks up. When a nucleus breaks up, it releases neutrons. These neutrons will hit other atoms (Uranium), which causes them to split and release their own neutrons, along with heat. This is fission, and more and more atoms will break up until the reaction becomes self-sustaining. Think of having a bucket full of firecrackers and you light one and throw it in. This single firecracker might set two others off and these two could set ten off. Eventually, all of the firecrackers go off. So in the reactor, we have the fuel bundles separated by water. The heat from the fission turns the water to steam, which will spin a turbine. In a nutshell, this is how the electricity is generated.

One of the big arguments against nuclear power is that it generates toxic waste. It can take tens of thousands of years for it to be safe for humans to be near it. This sounds scary because it is but we should also look at the reality of the situation. Toxic byproducts from fossil fuels are pumped into the air we breathe every day, affecting everyone and everything. With nuclear energy, we can keep these toxic byproducts away from people, our water supply, and from affecting the environment for the short term. Nuclear waste can be safely stored and monitored, but I cannot say the same about to the toxic waste of fossil fuels. Another thing to keep

in mind is that nuclear waste is recyclable and we can use it in other reactors. As we improve and innovate this technology we can figure out safer and smarter ways of reusing and storing waste.

There are dangers to using nuclear energy, Chernobyl and Fukushima are poster children for this concern. The World Health Organization estimates that 4,000 people could eventually die due to radiation exposure from Chernobyl. It should be taken into consideration that as of mid 2005 fewer than 50 deaths have been directly attributed to radiation from the incident. The environmental impact of nuclear disasters is also significant, and this is why future nuclear installation locations should be strictly regulated . Although these tragedies are not as common as one might think. There have been a total of 7 major nuclear disasters since the technology first came to light in 1954. However, it can be argued that this form of energy actually saves lives. A 2013 NASA study found that nuclear energy has saved 1.8 million lives from 1976-2009 by decreasing the amount of toxic byproducts in our atmosphere.

The biggest con of nuclear power is that it is really expensive and it takes awhile to offset the initial costs. Some countries are making those big up front investments, for example right now, France is investing heavily in nuclear power and 76.3% of their total electrical consumption is satisfied by nuclear reactors. On the flip side, right now China is expected to add the equivalent of all of America's coal power over the next 10 years. This is equal to a new 600 MW power plant every ten days. It is no secret that China has devastated their natural environment, and their people have felt the effects of polluted air and water. With this in mind it makes sense for China to use nuclear power to develop better living conditions for their people.

A recent innovation in nuclear power plants is Thorium-based nuclear power plants. What's cool about these is that 1-ton of Thorium produces energy equivalent to 200 tons of Uranium and 3,500,000 tons of coal. Most likely in the future China will look at nuclear power as it is very efficient and it will provide much more energy in a much smaller area than coal is capable of providing.

The bottom line is that nuclear energy is not the end all be all. Its instead another tool we can use to combat the challenges of climate change. We need to be smart about how and where we apply it. We've got a lot of work to do, and a lot of opportunity in front of us, the next ten years will be very interesting to see how we as a species work to switch away from fossil fuels to alternative energy forms.

Tags

Urban and Environmental Sustainability Studies
Sustainability

Contact us

sustain@d.umn.edu

(218) 726-8198

TTY/TDD:
(800) 627-3529

1208 Kirby Drive
Kirby Plaza 245
Duluth, MN 55812