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Thorium; Fuel for Thought?

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In the early 1930's, a series of events cemented the use of an energy fuel for almost 8 decades. That fuel is Uranium 235 (U-235), the fuel commonly used in nuclear power generation. Here's the catch though: uranium has a sister fuel that may be better for the environment, society, and your wallet: thorium.

The 1930's saw the rise of fascism in Europe, and with that, a rise in the precautionary and defense measures put forth by the United States. Any research done in thorium reactions were quickly pushed aside for more uranium research, as uranium was much easier to manufacture bombs with. The Manhattan Project essentially removed thorium reactions from everyone's interests. After the war, the Atomic Energy Acts of 1946 and 1954 were passed, and laws governing the research of uranium were applied to more "domestic" problems, such as energy generation. This history led to the current conventional Pressurized Water Reactor (PWR), such as the Fort Calhoun Station near Omaha.

Uranium itself is a relatively scarce resource compared to thorium, which is about as common as lead. In addition, according to 1984 Nobel Prize Winner Physicist Carlo Rubbio, roughly .7% of the uranium mined is U-235. The rest must be processed before being used as nuclear fuel. U-235 is a fissile element, which basically means that if one were to pack a lot of U-235 molecules together, the molecules would spontaneously begin the fission process. If this process is not regulated, uncontrollable nuclear reactions could result, spewing radiation into the surroundings. This factor is why PWC and other traditional reactors use control rods, which slow down and control the reaction.

When mined from the ground, thorium is almost 100% usable as a fuel in a reactor. Unlike U-235, thorium (Th-232) is a fertile element, which means that to use thorium as fuel in a nuclear reactor, a source of neutrons to bombard it with is needed. That source just so happens to be one of our biggest problems in the nuclear industry. But it's one that can easily be solved.

Spent nuclear fuel rods have been stockpiled all across the country because there is nowhere to dispose of them once the fuel is "spent" in the reactor. These fuel rods are placed in cooling pools and then eventually placed in concrete casks where they will remain essentially forever as the they will continue to emit radiation for thousands of years. The irony of this situation is that a very large amount of fuel remains in those "spent fuel rods." However, in America, policies are in place that do not allow companies to come in and reprocess the materials into usable fuels. So the big question is, what do we do with all of this excess uranium lying around?

The answer is thorium. Remember how thorium needed a source of neutrons to maintain the nuclear reaction? Yes, the answer is that we can indeed use the stockpiled fuel rods to maintain thorium reactors, and the waste that then comes out of the thorium reactors is “tenths of a percent of the amount that is traditionally produced by common nuclear reactors,” says Rubbia. In addition, the radioactivity of the waste products are anywhere from 100 to 10,000 times less than that of traditional reactors. What this all boils down to is less waste and less radioactivity, which, in the long run means less money for more power.

Currently, interest in thorium has started to gain ground. According to the *Stanford Energy Journal*, a publication printed by Stanford University, India has become the world’s leader in thorium reactors as they attempt to keep meeting electrical demands while reducing the country’s emissions. China has also recently announced plan to begin the implementation of Molten Salt Water Reactors (MSR) fueled by thorium.

Thorium reactors should be used in America to help meet the “energy crunch” because thorium is abundant and cheap, which means the cost of obtaining it is exceptionally low. The other way that thorium can save taxpayers money is due to decommissioning fees. When the nuclear reactors were built in the early 1960’s and late 70’s, a huge chunk of their expense was to provide a financial backing for the time when the plant would be retired. When a nuclear plant is retired, much of the equipment must be cemented off and buried for thousands of years until the radiation can wear off. In a thorium reactor, there are exponentially less components and equipment that will need to be quarantined.

In addition to being cheaper, thorium reactors are generally safer and easier to scale down than traditional reactors. This is due again to the fact that thorium is fertile whereas uranium is fissile. Thorium reactors can be built so that they are the size of a large home and run passively. A large vessel of water is suspended above the reactor core and is kept from contacting the reactor. If a meltdown or high temperature event should occur, “salt plugs” sealing the water off from the reactor melt and the water crashes down, stopping the neutrons from bombarding the thorium and ending the nuclear process. All contaminated materials, fuel, and other components would be contained. This method dramatically increases safety and better avoids a nuclear disaster.

Essentially, thorium could replace our aging nuclear energy plants while feeding off of their waste and reducing the total amount of waste in process. Implementing thorium reactors in the United States would mean a greater chance for energy independence and a happier, fatter wallet for its citizens.