Super U’s Sidekick: Thorium

When it comes to nuclear energy, uranium typically takes center stage as the primary fuel of commercial nuclear reactors. However, another actinide element, thorium, is just as important.

Thorium was discovered in 1828 by Jons Jakob Berzelius. Its name derives from Thor, the Scandinavian god of weather and thunder. The most abundant isotope of thorium (Th-232) has a half-life of approximately 14 billion years, and so it is less radioactive than natural uranium. Thorium, like uranium, is naturally occurring and can be found in minerals such as monazite, thorianite, and thorite among others. In fact, thorium is more abundant than uranium in the earth’s crust. It is used in the manufacture of lenses for instruments and cameras as well as coatings for tungsten welding rods. However, its most prominent application is in nuclear energy.

In the context of the nuclear fuel cycle, uranium is used to fuel most commercial nuclear reactors. However, in an advanced type of nuclear reactor, called a fast breeder reactor (FBR), thorium can be used as fuel to maintain the chain reaction that produces energy. This unique reactor design can convert fertile Th-232 (not capable of undergoing fission) into fissile U-233 through a series of reactions and radioactive decays. The ability to use thorium as nuclear fuel in these types of nuclear reactors is revolutionary. It allows countries that do not have significant resources of uranium, but do have abundant resources of thorium, to employ nuclear power for electricity generation. This is the case for India, which has substantial deposits of the thorium-containing mineral monazite. Using a thorium nuclear fuel cycle to power fast breeder reactors is a crucial facet of India’s proposed [three-stage nuclear power program](http://www.barc.gov.in/reactor/tfc_3sinpp.html).

While thorium-fueled fast breeder reactors may seem like technology of the far future, companies like Elysium design and develop a specific type of fast breeder reactor called a [molten salt reactor](https://www.world-nuclear.org/information-library/current-and-future-generation/molten-salt-reactors.aspx). Molten salt reactors are one of the most heavily researched fast breeder reactor designs, and a thorium nuclear fuel cycle has been developed for this type of reactor. By combining this technology with a modular design, [Elysium](http://www.elysiumindustries.com/) produces small scale, portable nuclear reactors that can be rapidly assembled and disassembled.

With higher natural abundance than uranium and ability to fuel fast breeder nuclear reactors, thorium has the potential to be a crucial component of modern day commercial nuclear fuel cycles.

References:

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