

## **Advantages of Thorium Fuel Cycle**

**By Charles S. “Rusty” Holden, Manager of Thorenco LLC**

Thorium is element 90 on the Periodic Table of Elements close to element 92, uranium. Thorium is more common than uranium. There could potentially be more energy available from thorium than from both uranium and fossil fuel combined. Below the earth's crust the heat of thorium and uranium decay provides the internal heat needed to sustain the tectonic plate movement. Thorium could become a superior fuel because it does not produce plutonium or other 'bad actors' (longed-lived actinides) as toxic waste.

Use of thorium as a common nuclear fuel is still several years in the future, but significant work has been done in developing the Thorium Fuel Cycle. Several full scale prototypes, including the HTGR (high-temperature gas-cooled reactor) and MSRE (molten salt converter reactor experiment). (Source: radiochemistry.org)

The Thorium Fuel Cycle can be applied to burn waste plutonium that is a separation of undesirable waste isotopes of the nuclear fuel cycle of utility power plant reactors and to burn military plutonium covered under treaty and presidential order for destruction. The “bad actors” can be made to fission away also. (Source: International Atomic Energy Agency Tecdocs 1349 and 1450.)

The Thorium Fuel Cycle will be greatly needed.

World-wide, the uranium fuel used in the 441 nuclear reactors produces plutonium and long-lived toxic radioactive elements, the 'Bad Actors.' Spent fuel from these reactors must be managed more efficiently. This increasing waste-pile jeopardizes the efficient production of electricity. Plutonium has a half life of 24,000 years or so. Plutonium containing materials require extremely long term storage and security. Thorium can fission plutonium safely so that world stocks of plutonium can decline.

After plutonium and the other troublesome elements from spent nuclear fuel are burned, transmuted or fissioned away, the significant risks to humanity posed by the continued existence of these materials vanish. Spent fuel would no longer have the potential to be abused after the dangerous heavy metals are converted to lighter elements having no explosion potential and much shorter radioactive decay periods.

Easily mineable uranium is being extracted at a fast pace. Many mines are already depleted. Prices have escalated particularly for future delivery. There is no strategic repository of Uranium Oxide, or Yellow Cake. Current extraction capacity is about 100 million tons per year with near term demand expected to reach 180 million tons with many new reactors, particularly in China and India coming on line.

The breeder reactor fuel cycle could have been used to convert large quantities of depleted uranium into burnable fuel. This major reactor technology has been politically and technologically decapitated because it optimizes an isotopic conversion to plutonium to produce burnable (fissionable) fuel.

The thorium converter (reactor) can be designed to burn plutonium, without making more plutonium. While burning up the most dangerous components of spent fuel, the converter will produce energy that is used for electricity, fuel extraction, desalinization of water, and medical isotopes.

Thorium fuel has equivalent energy density to uranium with a much longer operating life.

## THORENCO, LLC

In April 2005, Charles S. “Rusty” Holden, formed Thorenco LLC and is its manager. Thorenco was formed to commercialize the provisional patents protecting methods to advancing the use of the thorium fuel cycle he filed with the US Patent Office. As developer and co-inventor of the technology Holden located progressive nuclear activists in the Hanford area and Carl Holder responded. Carl has provided the important introduction to community leaders and science professionals who have been graciously donating, time and expertise to advance the art and science associated with the innovations.

Thorium applications need advocacy, study and attention from all levels of our society. The innovation seeks a “home”, an economic base, a political advocacy network, scientific peer review, and naturally, Thorenco, seeks to attract adequate long term capital.

If successfully developed, certified and deployed, this technology advancement has the potential to make Hanford the center of the industrial development of the fuel cycle and for the manufacturing of Thorium powered devices for the world market. The innovative, cleaner burning reactor fuel will be developed so as to be self regulating: as the temperature of the fuel increases the rate of fission in the fuel declines.

The converter is planned to be small and portable and to produce 50 Megawatts or so of thermal energy. This miniature heat well system is designed for:

- Remote, Cleaner, Safer Electricity Generation
- Industrial Process Heat Applications
  - Ideal for process heat for coal to syn-diesel fuel conversion
  - Ideal for in field extraction of hydrocarbons from Oil Shale and Tar Sand by nuclear steam
  - Ideal to supply process heat in the refinery or chemical plant to conserve hydrocarbon consumption
- Desalinization of Ocean Water
- Water Purification
- Spent Nuclear Fuel Treatment (Plutonium and Minor Actinide Disposition)
- Medical Isotope production
  - Operates in the ideal epithermal spectrum, .2 to 10kev
  - Produces Thorium Chain Products that are Alpha Emitters.

Through Thorenco LLC, the Tri-Cities could become an international center working towards cleaner energy independence, plutonium disposition, spent fuel remediation. Thorenco also provides an improved Medical Isotope solution. Here is a great opportunity!