

EXECUTIVE SUMMARY | THORIUM ENERGY ECONOMY AND HEAVY RARE EARTHS

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Heavy rare earths and Thorium are found together in nature¹. The most common and abundant source of heavy rare earths, Monazite, is currently diverted into mine-waste tailings lakes across the U.S., Canada and Brazil because of its companion element Thorium. The U.S. must address Thorium before it can develop a domestic rare earth supply chain for heavy rare earths.

U.S. policy on Thorium is the basis for China's monopoly control of rare earths. According to Mark Smith, CEO of Molycorp, Mt. Pass was closed by the EPA for a tailings spill containing Thorium bearing Monazite. Molycorp's Mt. Pass mine only produces about half of the rare earth elements, the low value lights; they dump their valuable Monazite-containing heavy rare earths into a tailings lake because of the Thorium content. Due to existing regulatory issues related to Thorium, no mining company will refine heavy rare earths from Monazite outside Asia². Unless the U.S. resolves the Thorium regulatory issue, China's monopoly over heavy rare earths will continue indefinitely.

Thorium's NRC classification is disproportional to its risk and thus prevents many industrial uses. Thorium needs to be reclassified as a "special industrial material" - subject to management and control like other, more dangerous, industrial and agricultural products³. As an industrial material, Thorium has the potential to create tens of thousands of new jobs in the U.S. It is also a potential substitute for some rare earth applications. Thorium is not fissile and does not constitute a proliferation risks⁴.

Rare Earth Solution: By reclassifying Thorium as a special industrial material, the total availability of rare earths will increase dramatically. By creating a centralized facility that can accept Monazites, the U.S. would become self-sufficient in the production of heavy rare earths, in large part, from the utilization of current mining waste and the reprocessing of tailings lakes⁵. To assure the highest environmental and safety standards and to maximize access to refining resources, processing must be done at a centralized rare earth refinery. The centralized cooperative refinery would and distribute all profits back to its Member Suppliers and Member Customers, much like an old fashioned agricultural cooperative⁶. This proven cooperative model stabilized our Nation's nascent agricultural industry out of chaos and was a critical factor in the development of our Nation's economy.

U.S. Energy Solution: As a subset of the rare earth cooperative, the U.S. must authorize a new private corporation to accept and store all Thorium byproducts from the rare earth cooperative. This corporation would be given the authority and responsibility to develop uses and markets for Thorium, including energy. For non-energy uses this corporation would act much like an Underwriter Laboratory, developing, certifying and insuring commercial and industrial applications for Thorium.

Thorium energy represents the safest and cleanest alternative for base load energy. The U.S. Government proved the Thorium Molten Salt Reactor (The-MSR) in the late 1960s, with over 20,000 hours of operation. Alvin Weinberg and Edward Teller favored the The-MSR over all other forms of civilian nuclear energy. Because the The-MSR was not compatible with Cold War defense objectives, The-MSR was shelved in favor of Uranium and Plutonium nuclear reactors that met nuclear weapons priorities of that time.

Under U.S. development and control The-MSR has the potential to provide total U.S. energy independence, while protecting all current energy stakeholders. Oil will remain competitive below some price (i.e., \$200 bbl) and coal can be refined into liquid fuels through income transfers & pricing subsidies from a successful The-MSR energy economy. Global annual revenues and positive balance of trade would be in the hundred billion dollar range. Total jobs would exceed 1 million for The-MSR alone.

¹The few exceptions, such as south China's *ionic clays*, are too environmentally destructive and rare for 'Western' mines to consider.

² Australia's Lynas Corp built its RE refinery in Malaysia to avoid the 'western' regulatory issues associated with Thorium.

³Unlike Chlorine gas or Anhydrous that can cause instantaneous death from exposure, Thorium poses no significant health risks. In fact, Thorium poses less health risk than Mercury, Cadmium, Thallium and metals like Vanadium, Chromium, Manganese, Cobalt and Nickel, because Thorium is not water soluble and the body cannot metabolize it. The Potassium in a banana emits more harmful radiation than Thorium.

⁴Thorium cannot be used to make a bomb unless it is converted into Uranium 233 via particle bombardment in a reactor or particle accelerator. U-233 from Thorium cannot be considered a *legitimate* proliferation risk because all 'weapons states' have found U-233 too difficult to successfully weaponize. Thorium is common, easily accessible (very common in beach sand) and easy to purify, yet no state or terrorist group covets it.

⁵A U.S. based Cooperative can spread risk and lower capital cost for U.S. rare earth producers, ensuring depth to the supply chain.

⁶The cooperative would also serve any independent rare earth producers via "Tolling Fees" at set 'utility rates' (e.g., below 15%).