A titan of titanium – with a big HAMR

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Companies that combine hard rock assets with technology have a unique appeal. It gives you the tangible and familiar steps of a mining company – drill, initial resource, PFS, and PEA progress that you can measure and monitor with reasonable transparency. But if it also has an innovative technology component, it also can offer the potential of a greater upside if the technology side of the business ends up being a game-changer. Granted you have to have the funding and the human resources to keep both aspects of the business moving forward in a way that is beneficial to shareholders, which can be a challenge depending on your size. But if you keep making positive progress on both fronts without sacrificing one aspect of the business or the other, then a shareholder can be handsomely rewarded. It's also good diversification if one of your business units lays an egg so to speak.

Today's company could also almost fit the bill for the Dean's List critical minerals series except that its mineral assets are in the U.S. Arguably, that's better for investors given the size of the market and the scale for potential government support. So let's dive into IperionX Limited (NASDAQ: IPX | ASX: IPX), a U.S. critical minerals company that is also pursuing a patented powder metallurgy process technology that allows for the production of titanium powders. The company aims to be a leading developer of sustainable critical mineral supply chains in the United States through a multi-pronged strategy comprising a variety of technology, integration, and sustainability focused initiatives.

Starting with the mining side of the business, IperionX holds a 100% interest in the Titan Project located in Tennessee, a very large titanium resource in North America which is also rich in rare earth minerals. The Titan Project is one of the largest titanium, zirconium and rare earth minerals deposits in the U.S., forming part of a large-scale critical mineralization trend in an area known as the Mississippi embayment. The Titan Project's unconsolidated, near-surface mineral sand hosted material allows the potential for simple, low-impact, low-cost and sustainable mineral extraction, unlike many hard rock mineral deposits.

IperionX released the result of a scoping study on the Project in late June which included an after tax NPV_8 of US$692 million, potential for significant cashflow generation including an average annual EBITDA of US$117 million, and a 1.9 year payback period. Another highlight that I believe will help elevate the profile of this project is the development of a sequential mining method to allow for a low cost, reduced area footprint and environmentally sustainable mining process. Lastly, the location (aside from simply being in the U.S.) is near existing infrastructure including low-cost power and gas, with high-capacity transmission lines near the Project, abundant transportation infrastructure including the Norfolk Southern mainline running through Camden, the major I-40 highway just 10 miles south of Camden and a major barge-loading point 15 miles from the Titan Project connecting to all major U.S. customers and export ports. I believe once the U.S. gets the ball rolling on domestic supply of various commodities, that sustainability and carbon footprint will be the differentiator between a good project and a great project.

On the technology side, IperionX holds an exclusive option to acquire the HAMR technology and other associated technologies. The patented metal technologies, centered around Hydrogen

Assisted Metallothermic Reduction (HAMR), were invented by world-renowned metallurgist, Dr. Zak Fang, Professor of Metallurgical Engineering at the University of Utah. The HAMR process allows for the production of titanium powders. This process can take almost any form of titanium or scrap titanium alloy feedstock and produce titanium powders at very low energy intensity, enabling the potential for low cost, low carbon emission production in a sustainable closed loop. I won't get into the details of the technology because it's way over my head and I'm not sure I'd explain it properly, but what's important is that its low cost, has reduced energy consumption, and has 100% titanium recycling potential.

IperionX is already producing titanium powder with its partner BlackSand at a pilot facility operating in Salt Lake City, Utah, built with funding from the U.S. Department of Energy's ARPA-E. Development of a larger Titanium Demonstration Facility (TDF) is currently underway with a targeted production capacity of 125tpa. The TDF will serve a dual purpose of demonstrating scale while allowing for the commencement of powder production for commercial sales.

Next on the list of milestones for the company is to continue work to get the Titan Project construction ready, begin discussions with potential titanium metal strategic customers and scale-up titanium metal powder production capacity (the TDF noted above). Any or all of these could provide catalysts for IperionX's shareholders over the next few months.

A legitimate contender to the Chinese dominance in the rare earths space

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Energy Fuels Inc. (NYSE American: UUUU | TSX: EFR) has taken another step toward diversifying into a fully integrated U.S. rare earth supplier. On Wednesday the company announced the execution of a non-binding memorandum of understanding (MOU) with Hyperion Metals Limited (ASX: HYM) for the supply of natural monazite sands from Hyperion's Titan Project in Tennessee. The parties also agreed to evaluate a potential teaming, joint venture, equity investment or other arrangement under which Hyperion would collaborate with Energy Fuels, and potentially other parties (perhaps Neo Performance?), in advancing Energy Fuels' current initiative to establish a fully integrated, "mine to market" U.S. rare earths supply chain.

This builds on previous steps taken by Energy Fuels to expand upon its existing uranium and vanadium mining and supply business. In December, 2020 the company announced a similar monazite supply agreement with The Chemours Company (NYSE: CC) to acquire a minimum of 2,500 tons per year from the Offerman Mineral Sand Plant in Georgia. Then on March 1, 2021 Energy Fuels announced an initiative with Neo Performance Materials Inc. (TSX: NEO) whereby Energy Fuels will process natural monazite sands into a rare earth carbonate beginning in March/April 2021 and ship a portion of that production to Neo's rare earth separations facility in Sillamäe, Estonia.

The reason for Energy Fuels' current success is a shift in focus roughly a year ago to enter into the rare earths business. Many if not most rare earths ores contain low-levels of radioactive

materials, including uranium and thorium, necessitating extensive radioactive materials licensing requirements. Energy Fuels 100% owned White Mesa Mill has existing infrastructure (licensed, constructed and in operation) with a 40 year history of "responsibly managing low-level radioactive materials". Energy Fuels is in a unique, industry-leading position with this asset to process monazite ores into rare earth carbonate. Even more importantly, processing North American sourced material in North America. Followers of this website are well aware of the significance of this and I encourage you to read this article by Jack Lifton for more insight.

Even more exciting is the fact that Energy Fuels is well capitalized, debt free and hungry to expand. It's a stated goal of President and CEO, Mark S. Chalmers to have Energy Fuels become a critical mineral hub (uranium, rare earths and vanadium) for the raw materials that make many clean energy and advanced technologies possible. Having completed the first step of successfully processing monazite sands into a mixed rare earth carbonate, the company is looking to create, refine, and grow a sustainable rare earth supply chain capable of supplying growing demand for clean technologies in the U.S. and Europe. Energy Fuels is evaluating the future development of its own rare earth separation and other value-added U.S. rare earth production capabilities at the White Mesa Mill. Perhaps moving down the value chain as far as end-use minerals and alloys.

Affirmation of this strategy came today with the announcement that the U.S. Department of Energy (DOE) Office of Fossil Energy and National Energy Technology Laboratory has exercised their option to award Energy Fuels, working with a team from Penn State University, an additional $1.75 million to complete a feasibility study on the production of rare earth products from natural coal-based resources, as well as from other materials such as the natural monazite ore the Company is currently

processing at its White Mesa Mill in Utah. These kinds of collaborative public-private partnerships will be a key to restoring U.S. global leadership in the clean energy sector and re-establishing critical defense-related supply chains putting Energy Fuels in the driver’s seat to lead the charge.

Obviously, this all isn’t going to happen overnight but Energy Fuels has come a long way in its first year of focusing on the critical materials business. Now we have to wait and see if this can be done profitably and at scale which could make Energy Fuels a legitimate contender to the Chinese dominance of the space.