

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 NPV₈ 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.

Spotlight on American Rare Earths as new Bill forces defense contractors to stop buying rare earth enabled products from China

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On January 15, 2022 it was [reported](#) by Reuters that a new bill was introduced in the US Senate that would force defense contractors to stop buying rare earth enabled products from China by 2026 and use the Pentagon's Defense Logistics Agency, DLA, to create a permanent stockpile of rare earth minerals. The U.S has only one producing rare earths mine at Mountain Pass, California, run by MP Materials, and currently has no capability to process rare earth minerals downstream of the mine. If passed, the new bill would help support the U.S goal of developing a more local and secure supply of rare earths, in the USA.

Today's company has not one, not two, but three USA located rare earth projects. Its flagship Arizona rare earths project contains light rare earths. Light rare earths include the valuable magnet metals praseodymium and neodymium, as well as scandium.

American Rare Earths Limited 3 USA rare earths projects – location map



Source: [Company presentation](#)

[American Rare Earths Limited](#) (ASX: ARR | OTCQB: ARRNF) is focused on developing its 100% owned La Paz Scandium and Rare Earths Project in Arizona, USA. The Project was acquired in August 2019 with an existing NI 43-101 Resource. The Project lies about 170km northwest of Phoenix.

The Company [states](#): “La Paz is a large tonnage, bulk deposit comprising high value, light rare earth (LREE) assemblage with the potential to be the largest rare earth project in North America....contains very low penalty elements such as radioactive thorium and uranium.” They further [comment](#): “The results show an increase in grades of certain high-value Rare Earth elements, including magnetic and heavy Rare Earths used in numerous technologies such as Electric Vehicles (EVs), wind turbines, air conditioners/refrigeration, phones, and critical national defense industry tech.”

The La Paz Scandium and Rare Earths Project

La Paz covers over 890 hectares with mining claims on federally controlled land and a prospecting permit over one section of Arizona State Trust land (259 hectares). The claims are unencumbered and 100% controlled by La Paz Rare Earth LLC (100% owned subsidiary of American Rare Earths Limited). The Project benefits from excellent local infrastructure including electricity, water, and gas; and is in a mining friendly jurisdiction.

The JORC 2012 classified Resource Estimate as [announced](#) in August 2021 at La Paz is **170.6 million tons of Total Rare Earth Elements (TREE) at an average grade of 391ppm**. The Indicated Resource Estimate is 35.2 million tonnes. The Resource estimation report demonstrates approximately 66.6 million kilograms TREE, approximately 80.0 million kilograms TREO, plus 4.4 million kilograms of Scandium Oxide (Sc₂O₃).

The Resource displays relatively uniform distribution of total rare earth elements (TRRE) across and along strike, covering a resource area of 2.5km by 1.5km (La Paz Resource only). The entire deposit is exposed at surface, or lightly concealed by alluvial cover.

The Company recently [stated](#) (re La Paz): “What is also exciting are the higher grades intersected in the La Paz resource area of up to four times the depth of the previous maiden resource, with mineralization remaining open at depth and along the strike, indicating the potential for a much larger deposit.”

The Company also [reported](#) a new potential resource in the Southwest area of the La Paz Project where one diamond core hole terminated in mineralization material below 75 metres. New claims are being staked in the area.

La Paz Project highlights and showing the La Paz Resource area and the new discovery Southwest Resource area <4km away



Source: [Company presentation](#)

Other projects

American Rare Earths Limited has also [recently acquired two other USA rare earth projects](#) – The Searchlight Rare Earths Project in Nevada and the Halleck Creek Project in Wyoming. The Company also has exposure to cobalt via its strategic investment in Cobalt Blue Holdings (ASX: COB), which owns the Broken Hill Cobalt Project in Australia.

Catalysts in 2022

- La Paz drilling contractor appointed and to commence work in January 2022.

- Field exploration work continues at Halleck Creek with the Maiden Drill program planned for Q1 2022.
- Results from working with USA research institutions with La Paz's mineral profile incorporated into emerging US advanced rare earth processing technologies.
- Preliminary Economic Assessment (PEA) for La Paz by the end of 2022.

American Rare Earths Managing Director and Chief Executive Officer, Chris Gibbs, [stated](#) in December 2021: "Timing could not be better with the recent Capital raising efforts and obtaining the permits to commence drilling at our key projects. The opportunity to bring Fidelity onto the register means we can accelerate the planned scope of works and unlock value sooner."

American Rare Earths Limited highlights



Source: [Company presentation](#)

Closing remarks

American Rare Earths Limited offers investors exposure to three USA rare earths projects, including the flagship La Paz Scandium and Rare Earths Project in Arizona.

With rare earths demand set to surge this decade as we switch to green energy and transportation, it is worthwhile looking at what companies can be the next suppliers of rare earths, especially in the USA.

American Rare Earths Limited has recently raised [A\\$5.7 million after fees](#) with Fidelity International initially taking an equity interest of approximately 9.9%. The current market cap is [A\\$110 million](#). One to follow in 2022, especially with the

current drilling at La Paz and Q1 2022 drilling at Halleck Creek. Stay tuned.

The Post-COP26 World Looks To Australia For Future Non-Chinese Rare Earths Production

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To achieve U.N. climate change management goals the world needs to shift rapidly to clean energy, and that means we need to build or secure, reliable sources of rare earths. While the USA and Canada have made some progress in this direction, Australia will also be needed to play a key role.

When looking at [a chart of rare earths reserves by country](#), China shows the largest reserves followed by Vietnam, Brazil, Russia, India, and Australia, in that order. The USA is ranked 8th and Canada is outside of the top ten. Given Australia's stellar track record as a reliable supplier of raw materials, it should not be surprising to know that the West is looking towards Australia to step up production of rare earths, especially those needed to support the surging cleantech sectors of electric vehicles, wind energy, and solar energy.

ClearWorld.us says it well, [stating](#):

"Renewable energy development relies upon sufficient quantities of rare earth minerals, specifically neodymium, terbium, indium, dysprosium, and praseodymium. These are used in the production of solar panels and wind turbines. **If the world is to meet the**

greenhouse gas emissions targets sought in the Paris Climate Agreement the availability of these minerals must increase by 12 times by 2050.”

(Emphasis by the author.)

Rare earths are key elements in the cleantech revolution



Australian listed rare earths companies:

Producers

[Lynas Rare Earths Limited](#) (ASX: LYC) (“Lynas”)

Lynas is the second largest neodymium and praseodymium (“NdPr”) producer in the world. Lynas owns the Mt Weld rare earth mine, which is one of the world’s highest grade rare earths’ mines, and the Mt Weld ORE Concentration Plant, both located in Western Australia. Lynas also owns the Lynas Advanced Materials Plant (LAMP), which is an integrated manufacturing facility, separating and processing rare earths’ materials in Malaysia. The Lynas 2025 growth strategy encompasses plans to build the Kalgoorlie Rare Earths Processing Facility (cracking and leaching) in Australia and an LRE/HRE separation and specialty materials facility in the USA. Lynas trades on a market cap of [A\\$7.3 billion](#).

[Iluka Resources Ltd.](#) (ASX: ILU) (“Iluka”)

Iluka is a relatively new (April 2020) producer of rare earths at their Eneabba Project in Western Australia. Iluka intends to ramp to selling 50,000 tpa of a 20% monazite-zircon ore concentrate for further processing offshore. Iluka has an offtake agreement for 50,000 tpa. Iluka [is working on developing a Phase 2](#) of the Eneabba Project which involves investigating

techniques to beneficiate and purify the monazite to an 80% concentrate for sale further down the value chain. Iluka is mostly known for being an Australian heavy mineral sands, zirconium and titanium, producer. Iluka trades on a market cap of [A\\$3.5 billion](#).

Vital Metals Limited (ASX: VML) (“Vital”)

Vital recently began mining ore at its Nechalacho’ Mine in Canada’s Northwest Territories (NWT), with commencement of ore processing at Vital’s, under construction, Saskatoon cracking and leaching facility expected to begin in 2022. The Nechalacho Mine is a high grade, light rare earth (bastnaesite) project with a world-class resource of 94.7Mt at 1.46% REO (measured, indicated and inferred). Nechalacho’s North T Zone, which is being mined by Vital, hosts a high-grade resource of 101,000 tonnes at 9.01% LREO (2.2% NdPr). Vital has a [non-binding MOU](#) with Ucore Rare Metals Inc. for the supply to it of a mixed rare rare earth carbonate, beginning H1 2024. Vital Metals trades on a market cap of [A\\$250 million](#).

Explorer/Developers (in alphabetical order):

Arafura Resources Limited (ASX: ARU) (“Arafura”)

Arafura 100% own the Nolan’s Bore rare earth project 135kms from Alice Springs in the Northern Territory, Australia. Arafura [states](#): “The Project is underpinned by low-risk Mineral Resources that have the potential to supply a significant proportion of the world’s NdPr demand. It is a globally significant and strategic NdPr project which, once developed, will become a major supplier of these critical minerals to the high-performance NdFeB permanent magnet market.”

The deposit contains a JORC 2012-compliant Mineral Resources of 56 million tonnes at an average grade of 2.6% total rare earth

oxides (TREO). 26.4% of the total rare earths contained are NdPr. The Project is [supported by](#) Export Finance Australia (EFA), and the Northern Australia Infrastructure Facility (NAIF), via non-binding letters of support for a proposed senior debt facility of up to A\$200 million and A\$100 million respectively. Arafura is looking to raise further funds to get the project started. Arafura recently [stated](#): “The momentum with offtake discussion has enabled engagement to expand to include the options for strategic investment as part of the Nolan’s project funding.” Market cap is [A\\$379 million](#).

[Australian Rare Earths Limited](#) (ASX: AR3) (“AREL”)

AREL is progressing in the exploration of a significant deposit of valuable ‘clay-hosted’ rare earth elements, located at their Koppamurra Project spread over [~4,000km²](#) of tenements in South Australia and Victoria. Past exploration of the Koppamurra region has shown it contains [mineralization containing the rare earth elements](#) neodymium, praseodymium, dysprosium and terbium. The Koppamurra Project is an ‘ionic clay’ rare earth opportunity with a 2021 JORC [Inferred](#) Mineral Resource of 39.9Mt @ 725ppm TREO. AREL trades on a market cap of [A\\$98 million](#).

[Australian Strategic Materials Ltd.](#) (ASX: ASM) (“ASM”)

ASM owns the Dubbo Rare Earths Project in NSW, Australia. The Dubbo Project is a 100% owned ‘construction ready’ poly-metallic and rare earths project with potential to become a key global supplier of specialty metals and rare earths. ASM’s goal is a “[mine to metal](#)” strategy to extract, refine and manufacture high-purity metals and alloys, supplying directly to global technology manufacturers. Market cap is [A\\$1.92 billion](#).

[Northern Minerals Limited](#) (ASX: NTU)

Northern Minerals own the Browns Range heavy rare earth minerals

project in Western Australia. Northern Minerals has built a pilot plant to test a number of deposits and prospects that contain high-value dysprosium and other Heavy Rare Earths (HREs) such as yttrium, hosted in xenotime mineralization.

The Company [states](#): “Northern Minerals is positioned to become the world’s first significant producer of dysprosium outside of China. Accounting for 60% of the Browns Range Project’s (the Project) revenue, dysprosium is the key value driver of the Project and is at the core of Northern Minerals’ marketing strategy. With a high value, high purity, dysprosium rich product, the Company is set to become a long term and reliable supplier of dysprosium and other critical heavy rare earths to world markets.” Market cap is [A\\$339 million](#).

[Peak Resources Limited](#) (ASX: PEK)

Peak Resources 75% owns the Ngwalla Tanzania rare earth project, which the Company [states](#) is one of the world’s, largest and highest grade, undeveloped rare earth projects. The Ngwalla Project has ore reserves of 18.5 million tonnes at 4.8% REO; 22% of the total mineral resource is NdPr, with an expected 26 year life of mine. The Project is currently at the funding stage having completed a BFS in 2017. The BFS summary details are [here](#). About 90% of the Project’s revenues will be coming from NdPr. Peak Resources [state](#): “Operating cost of US\$ 34.20/kg NdPr* Oxide, demonstrating potential to be the world’s lowest-cost fully integrated rare earth development project.” Market cap is [A\\$135 million](#).

Closing remarks

With rare earths demand set to grow strongly this decade as the world moves towards cleaner energy and technology, investors would be wise to take a second look at the [rare earths sector](#).

Australian critical minerals projects were recently in the news after the Government announced that they would receive an [A\\$2 billion boost](#) (via a loan facility), to support the sector. This bodes well for the Australian rare earths junior miners to join Lynas as producers. Stay tuned as this sector looks set to shine this decade.