INITIATION

# VALUE RANGE

# 0.068 – 0.075


*IXR (lighter line) ASX market vs price relative*

**Monday, 04 December 2023**

| | |
|---|---|
| Intrinsic Price (AUD) | 0.072 |
| Value Range Low (AUD) | 0.068 |
| Value Range High (AUD) | 0.075 |
| Implied MCAP (m) | 302.85 |
| Implied EV (m) | 302.85 |
| XASX | IXR |
| Financial YE | 30-Jun |
| Currency | AUD |

**Business Activity**
Mining E&P

| | |
|---|---|
| **Key Metrics** | |
| Close Price (AUD) | 0.021 |
| MCAP (m) | 88.58 |
| Net Debt (Cash) (m) | -11.13 |
| EV (m) | 77.45 |
| 52 Wk Hi | 0.043 |
| 52 Wk Lo | 0.016 |
| **Key Ratios** | |
| (Net Cash) / Shareholder Equity % | -12.56% |
| FX Rate AUD/USD | 0.67 |


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# Ionic Rare Earths Limited

## REE Mining & Magnet Recycling Circular Economy

**Ionic Rare Earths Ltd (ASX:IXR) is a rare earths mining explorer (Uganda) and REO magnet recycling company (Belfast, UK). We have excluded Belfast recycling from our valuation. IXR appears significantly undervalued on an intrinsic and EV/M+I basis compared to its peers. REEs are used in permanent magnets – key components of clean energy applications. IXR's flagship Makuutu Rare Earths project contributes to de-risking global supply chains and has ionic adsorption clay-hosted geology - similar to that found in Southern China, main global supplier of Heavy Rare Earths. IXR holds a 60% interest in the Makuutu project – MRE 532 Mt @ 640 ppm Total Rare Earth Oxide (TREO) and Indicated Resource of 404 Mt @ 670 ppm TREO. IXR has received £3.72m in UK gov grants for its Belfast magnet recycling plant.**

- Makuutu P5 drilling completed with 128 holes @ 2,501m;
- P5 potential of +532 Mt @ 640 ppm TREO (excl. from NPV);
- Recycled magnet production maiden revs 24E (excl. from NPV);
- IXR to begin reporting on ESG in 2024;
- Cash & CE 4Q23A (30 Sept 2023) A$ 5.7m.

| ACF est. A$ (m) | Revenue | EBITDA | EPS (diluted) | CPS | CPS (diluted) |
|---|---|---|---|---|---|
| 2026E | 101.5 | 53.9 | 0.01 | 0.01 | 0.01 |
| 2030E | 78.8 | 31.9 | 0.01 | 0.01 | 0.01 |

| Multiples | EV/ Revenue | EV/ EBITDA | P/ EPS (diluted) | P/ CPS | P/ CPS (diluted) |
|---|---|---|---|---|---|
| 2026E | 0.8x | 1.44x | 2.63x | 1.64x | 1.65x |
| 2030E | 1.0x | 2.4x | 3.3x | 2.8x | 2.8x |

| Share Price History | No. of Shares in issue | Fully diluted |
|---|---|---|
| NoSh (m) | 4,218.01 | 4,224.71 |
| Implied Intrinsic Price | 0.0718 | 0.0717 |
| Value Range Low | 0.0682 | 0.0681 |
| Value Range High | 0.0754 | 0.0753 |
| XASX | IXR | |
| Financial YE | 30-Jun | |
| Reporting Currency | AUD | |
| NoSh (m) | | 4,218.01 |
| NoSh (m) expected dilution (Exp D) | | 4,218.01 |
| NoSh (m) full dilution (FD) | | 0.00 |

| Key Metrics | A$ | adj. |
|---|---|---|
| MCAP (m) | 88.6 | 88.6 |
| Net Debt (Cash) (m) | (11.1) | (11.1) |
| EV (m) | 77.5 | 77.5 |
| 52 Wk Hi | 0.04 | 0.04 |
| 52 Wk Lo | 0.02 | 0.02 |
| Free Float | 26% | 26% |

| *Key Metrics FCF adj. | 2026E | 2030E |
|---|---|---|
| CPS (AUD) | 0.01 | 0.01 |
| CPS (Exp D) (AUD) | 0.01 | 0.01 |
| CPS (FD) (AUD) | 0.01 | 0.01 |
| P/CPS | 1.64x | 2.78x |
| P/CPS (Exp D) | 1.64x | 2.78x |
| P/CPS (FD) | 1.65x | 2.78x |

# Investment Case

**IXR is a rare earths explorer and permanent magnet recycling business for clean energy technologies, e.g. wind turbines, electric vehicles (EVs). IXR has a low-cost, high value rare earths mining project that is a global supply chain strategic asset** – The Makuutu project provides an advanced stage, low capital cost, high value heavy rare earths development opportunity. Makuutu's geology is a key advantage – Ionic Adsorption Clay (IAC) mineralization.

Makuutu's geology is similar to projects located in Southern China and Myanmar where the lowest cost to extract/most readily available sources of Heavy Rare Earth Oxides (HREO) are mined. ~98% of the global supply of Heavy Rare Earths originates from clay-hosted mines there. The Makuutu project is easily accessible by road, rail and has mobile comms connectivity, reliable high grade power infrastructure and readily available sources of water.

**Scalable economic deposits**: Stage 1 Definitive Feasibility Study (DFS) of the Makuutu project base case indicates an initial life of mine (LOM) of 35 years, delivers EBITDA of US$ 1.6bn, a post-tax-free cash flow of US$ 1.02bn and an IRR of 32.7%. The base case assumes maiden ore reserve of 172.9 Mt @ 848 ppm of TREO, REO potential production of ~1,300 tpa over the first 10 years, with significant upside potential from the recent MRE upgrade.

**Makuutu basket highly sought after**: Makuutu presents one of the best-balanced Rare Earth Oxide (REO) baskets vs. other projects globally. **~71% of the basket is HREO and CREO dominant**, over the initial 35-year LOM. Total CAPEX is estimated at US$120.8m for the LOM production of mixed rare earth carbonate (MREC). We expect first MREC production in 2Q26 putting IXR in a strong position to be a long-term sustainable magnet and heavy REO producer. In addition, Makuutu's basket contains other critical metals (e.g. neodymium, dysprosium, terbium, etc.), used in energy transition technology manufacturing and emissions reduction (EV motors/wind turbine generators).

**Significant valuation upside potential**: Phase 5 drilling at Makuutu was completed in Oct 23 and has indicated potential for an upward revision of the existing mineral resource estimate (MRE) of 532 MT @ 640 ppm TREO and the additional exploration target of 216 – 535 million tonnes grading 400 – 600 ppm TREO. P5 rotary air blast (RAB) drilling advanced on EL00147, EL00247 and RL00007 – 128 holes completed for 2,501 metres. P5 RAB drilling will support growth targets to extend the 37km Makuutu mineralized corridor and facilitate the next Mining License Application (MLA) at RL00007 expected 2H2024.

# Catalysts

Final Investment Decision (FID) 2H24; Makuutu production start 1Q24; Increased MRE; Long run rising critical metals prices; PFS for Belfast demo plant 1Q24. FS for Belfast commercial plant 3Q24; Evidence of growth in permanent magnet recycling and a global circular economy for REEs.

# Operational Strategy - Mining

*DFS Stage 1 completed.*

Ionic Rare Earths is **an REE explorer and recycling company** that completed Stage 1 of its Makuutu REE mining deposits Definitive Feasibility Study (DFS) in March 2023 and received approval for works commencement at the Makuutu mine site by the Ugandan Ministry of Energy and Mineral Development (MEMD) in April 2023.

*P5 drilling completed with additional MRE potential.*

The phase 5 drilling program was completed Oct 2023 with **production scheduled for early 2026E**. The drilling program is expected to increase the existing mineral resource estimate (MRE) at Makuutu to 532 Mt @ 640 ppm TREO. Existing Ore Reserve Estimate of 172.9 Mt @ 848 ppm TREO. These are both expected to grow.

*Makuutu basket contains Dy and Tb, additional HREs used in magnet production.*

*50% of revenue basket NdPr*

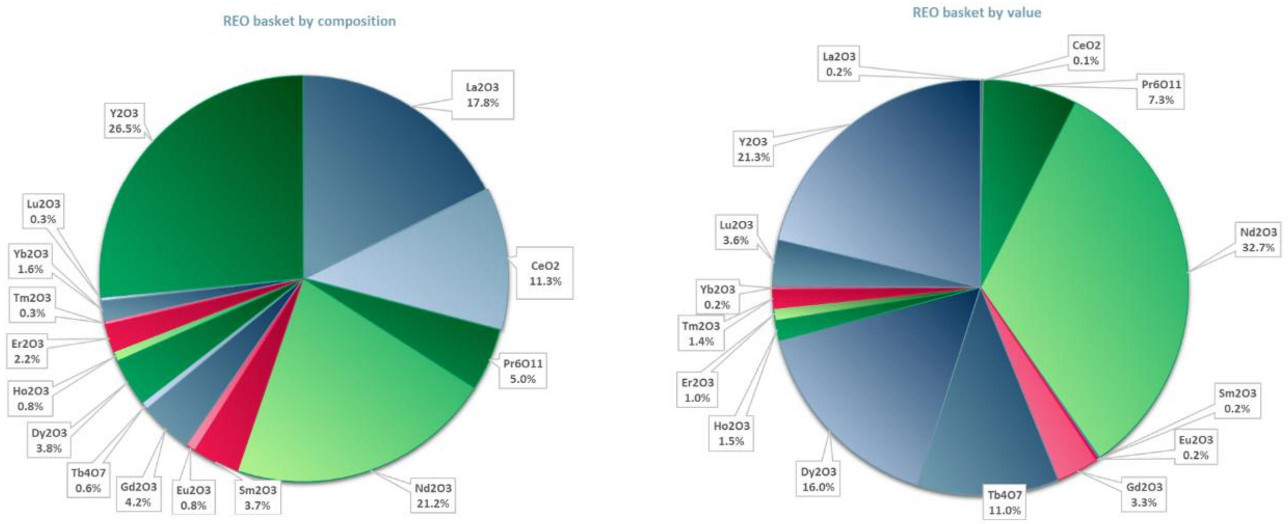
*35% of revenue basket Dy & Tb.*

Makuutu's investment appeal is underpinned by its magnet rare earths (NdPr – Neodymium and Praseodymium) which make up ~50% of the Makuutu revenue basket. More important strategically is Makuutu's Dysprosium (Dy) and Terbium (Tb) proportions of its basked (HREs) of which 98% of global supply comes from China and Myanmar, which have similar IAC deposits to Makuutu.

*15% of revenue basket is HREE including Sm, Gd & Ho.*

15% of Makuutu's revenue basket includes additional heavy rare earths such as Samarium (Sm2O3), Gadolinium (Gd2O3) and Holmium (Ho2O3), which can be used as substitutes for Dy and Tb.

Exhibit 1: **Makuutu basket**




Sources: ACF Equity Research; Company Reports.

# Operational Strategy - Recycling

*Acquisition of Seren Technologies*

**Recycling** - IXR acquired 100% of Seren Technologies Limited (**SerenTech**), a private rare earth separation and magnet recycling tech company, in April 2022. In Sep22 Seren was rebranded to Ionic Technologies International Ltd (**IonicTech**).

*Rare Earth Oxides production at Belfast, UK recycling facility.*

In Sept 2022 IXR received a grant from the UK Government Advanced Propulsion Centre (APC) of £1.72m (~A$2.9m) to **develop a demonstration scale magnet recycling plant in Belfast, UK**. An additional £2m was awarded to IXR in Sep 2023.

*IonicTech technology =opportunity for magnet recycling circular economy..*

The IonicTech asset provides IXR with the opportunity to become a vertically integrated REE company focused on new magnet and heavy rare earth supply chains and magnet recycling. The technology uses ionic liquids to separate and refine REEs.

*18 June 2023 – IonicTech begins REO production at Belfast facility.*

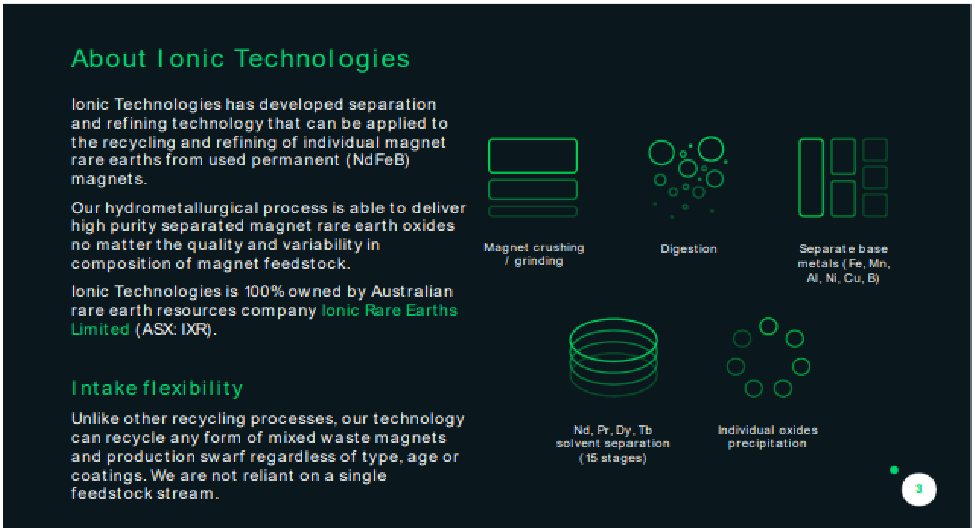
The recycling plant goal is to **secure and recycle REEs from and for renewable energy applications**. The plant is designed to produce **high purity magnet REOs** from recycled magnets and swarf (waste material/debris), for use in high specification magnets in EVs, offshore wind turbines and defence. IXR's technology can be applied to other critical raw materials.

*IXR is engaging with potential partners across the entire REE supply chain, e.g. North America, Europe, India, Japan and UK to promote its unique offerings.*

*Closing the circular economy with Ford Motor.*

In Sep23 **IXR partnered with Ford Motor Company** (NYSE:F) to develop a UK supply chain. IXR extracts and produces recycled magnet REO material. The material is handed over to Less Common Metals Ltd (LCM, UK private) to make metal alloys for a magnet manufacturer that makes Ford's specification magnets. The magnets feed Ford's EV motors testing and evaluation facility (Halewood, UK). IXR later reclaims Ford's old EV drives, extracts/recycles the magnets, creating a **circular economy**.

Exhibit 2: Magnet recycling potential of IXR liquid technologies




Sources: ACF Equity Research; Company Reports.

# Operational Strategy - ESG / Sustainability

*Heavy ESG focus = ahead of the curve in the mining sector.*

*By 2027, the EU will require all SMEs to begin reporting on ESG – albeit using less intensive standards compared to large listed companies. .*

Environmental, Social, and Governance (ESG) criteria have become increasingly essential for investors, stakeholders, and the general public. As a result, many mining companies are leveraging technical data to showcase their ESG performance, drive sustainable practices, and enhance corporate responsibility.

IXR is focused on participating in a global circular economy in magnet and heavy rare earths. In our view, this will require a strong ESG framework (with metrics) for overall reporting and particularly for operations. Now that the P5 drilling program is completed at Makuutu, IXR is preparing an ESG policy based upon mining, production and recycling sciences that adheres to global sustainability frameworks.

*IXR to begin preparing ESG framework in 2024.*

In 1H24, IXR will begin reporting on its ESG framework in order to demonstrate its high standards and assurance processes – 'caring for the environment, people and prosperity of the planet'. These policies and their public metrics will serve to reduce risk and so the discount rate on future cash flows. IXR will report on metrics collected via a third party Currently, IXR promotes its significant involvement in community projects.

Exhibit 3: **IXR community projects in Uganda over FYE 30 June 2022**

*IXR is focused on securing a "prosperous, safe and healthy future for the Makuutu project and its communities."*

| Project type | Description |
|---|---|
| Renovation | Natural Resource Office Block in the Bugweri district. |
| Renovation | Buwaaya police post. |
| Servicing | 11 community boreholes across the Makuutu project area due to poor drinking water quality. |
| Donation | 86 tree seedlings to Mayuge district to commemorate water and environment week. |
| Donation | Balls to the Makuutu football team to support youth sports. |
| Donation | Covid-19 PPE to Buwaisa Health Centre 3 in Mayuge, Makuutu Health Centre 3 in Bugweri, Buwunga Health Centre 3 in Bugiri. |

Sources: ACF Equity Research Graphics; Company Reports.

IXR's Makuutu DFS includes an **Environmental and Social Impact Assessment (ESIA)** which was approved by Uganda's National Environmental Management Authority (NEMA) in Oct 22, which facilitated the approval of the MLA license.

*To improve its rating IXR is in the process of completing an updated submission to Digbee based on activity over the past 12 months.*

IXR joined the United Nations Global Compact in Oct 2022 and will incorporate the UN SDGs into its science-based reports. IXR has been awarded a "BB" ESG score for the Makuutu Rare Earth project by Digbee ESG™ (an independent assessment platforms for ESG disclosure - London, UK).

We expect IXR to benefit from and support the **European Union Critical Raw Materials Act**, which is designed to increase the domestic supply of REEs – at least **40%** of EU annual consumption must be **processed and refined** in the EU by 2023 and **25%** of EU annual consumption must come from **recycling**.

# Geology

*Makuutu deposit stretches 37km.*

*Well serviced via existing infrastructure, highways, roads, rail, power and cell communications.*

The **Makuutu Rare Earths Project** is a**n ionic adsorption clay mineralized system** located in the Eastern region of Uganda - exploration of REEs began in this region in early 2012. The deposit stretches 37 km in length and has demonstrated potential for long-life, low-cost source of heavy REEs and magnets. It is well serviced by existing high-quality infrastructure, which includes highways, roads, rail, power and cell communications.

Makuutu is developed by Rwenzori Rare Metals Limited (RRM), a private company in Uganda that owns 100% of the project. (IXR owns 60% of RRM.)

*REE processing done via PLS.*

The shallow Makuutu deposit covers less than three metres with a clay and saprolite zone (chemically weathered rock) with thickness ranging from five to 30 metres. This suggests low-cost bulk mining methods with low strip ratio (volume or weight of waste material / volume or weight of ore). The processing of REEs is done via a simple acidified salt desorption heap leaching, breaking the chemical ionic bond which extracts the REEs (in a chemical form) from the ore into a pregnant leach solution (PLS).

*Stage 1 plant capacity = 5 million tonnes per annum (Mtpa) Run of Mine (ROM) throughput.*

In Stage 1 of production, PLS will be used to produce a value-added mixed rare earth carbonate (MREC) product – including Scandium; which will attract a higher payability and achieve a high basket price due to dominant high value magnet and heavy REEs, which make up ~71% of the basket.

*LOM 35 years.*

IXR's Mining License Application (MLA), currently in progress, has the potential of generating a high margin product and provides a potential operating life-of-mine (LOM) of 35 years.

Exhibit 4: **Makuutu Rare Earth project location & infrastructure**


Sources: ACF Equity Research; Company Reports.

*810MW at full capacity can power the equivalent of 1.87m UK homes*

*The nearest grid connector is 10-15km (upgrade costs included in Capex) and 132 kV transmission lines run within a few km (<10) of the proposed location site.*

Part of IXR's competitive advantage is that its Makuutu REE project is in proximity to existing infrastructure. The site is ~10km from Highway 109 which connects to Kampala, to Kenya and the Port of Mombasa(~1,000 km to Mombasa). There is also a rail line within 10km north of Makuutu. There are four hydroelectric power plants located within 65km of the area, with total installed generating capacity of ~810MW, providing an abundant supply of cheap power to the project.

*Total annual average rainfall in Uganda is 1,197mm with 2 seasons: March-May, Sept.-Dec.(World Bank). [~1,000mm will trap ~15,000 litres/year.]*

*IXR proposed flow sheet includes a significant water treatment processing capacity through nano filtration (cost included in Capex).*

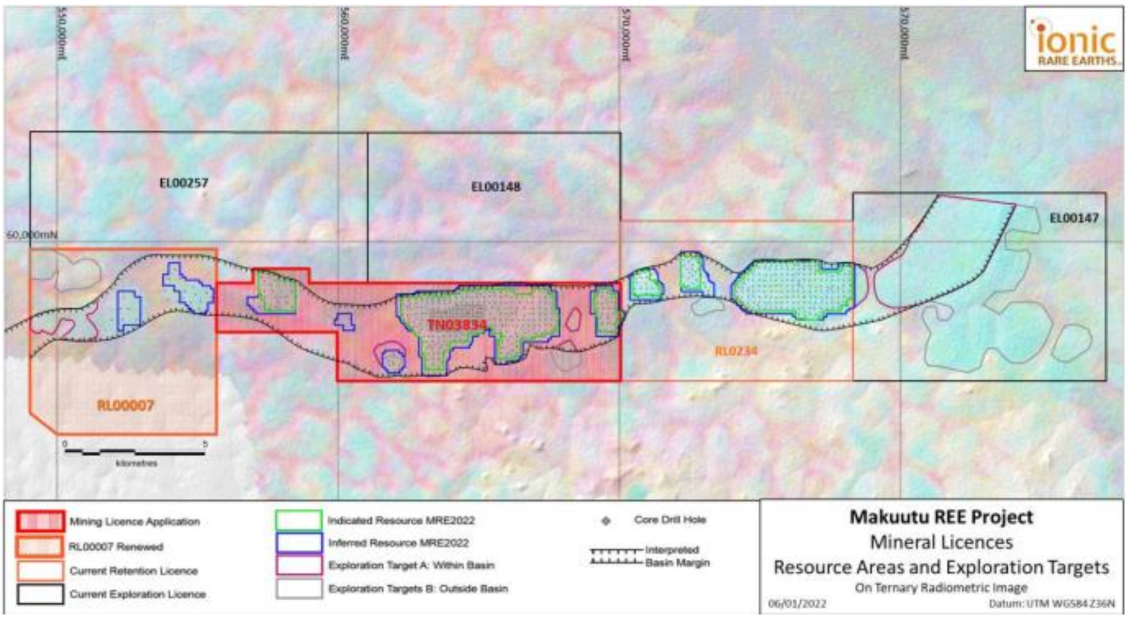
Water for Makuutu will be sourced by harvesting water from a positive rainfall environment. Excess water management will be a key focus of the Project to ensure environmental standards are met and reagent consumption is minimised. Furthermore, a wastewater management process will need to be put in place.

*The expat staff numbers are low and are expected to be phased out over time.*

The project's workforce of semi-skilled and artisanal workers comes from nearby population centres – no fly-in / fly-out cost (as all transported by road). The closest town is Iganga, which has a population of 50,000. Mayuge is ~10 km from Makuutu and the intent is to source local operations staff from the immediate districts and train staff accordingly (population of ~17,150).

Industrial facilities are available in the city of Jinja, ~40 km from Makuutu by road. Additional industrial facilities are available on the outskirts of Kampala.

Exhibit 5: **Makuutu resource map with Stage 1 MLA (TN03834 in red)**




Sources: ACF Equity Research; Company Reports.

*IAC is found in projects in Southern China, a main global supplier of HREs, giving IXR a significant competitive advantage in the market.*

A key advantage of the Makuutu project's geology is its **Ionic Adsorption Clay (IAC) mineralization**.

Rare earth elements are found in two different types of geological formation - Ionic adsorption clay and hard rock-hosted minerals. They differ in the following ways:

**Geological origin**

*IAC deposits form in tropical / subtropical weathering environments.*

**Ionic Adsorption Clay** deposits form in tropical / subtropical weathering environments, where pre-existing rocks containing REEs undergo chemical weathering. The rainfall and weathering processes leach the REEs from the parent rock, which are then adsorbed by clay minerals in the regolith.

**Hard Rock-Hosted** deposits are associated with igneous or metamorphic rocks. REEs are primarily found in minerals such as bastnäsite, monazite, and xenotime (xenotime is a mineral made of phosphate of yttrium and other REEs). These minerals crystallize from molten rock during the cooling and solidification of magma or are formed during metamorphism.

*IAC requires minimal processing and capital intensity .*

**Extraction methods**

**Ionic Adsorption Clay** extraction of REEs requires minimal processing. The weathered clay-rich regolith is dug up and then leaching methods, such as chemical processes involving salt is used to extract the REEs in ionic form.

*HRH is very capital intensive.*

**Hard Rock-Hosted** extraction is more complex and involves crushing, grinding, and multiple separation processes. These processes are needed to liberate the REE-bearing minerals from the surrounding rock and to concentrate the REEs into a usable economic form.

**Economic significance**

*IAC deposits are smaller in scale vs hard rock and therefore, of lower economic significance.*

**Ionic Adsorption Clay** deposits in China are often smaller in scale vs. to hard rock deposits and are typically of lower economic significance. They are primarily found in a few specific regions, such as parts of Southern China, e.g. Yunnan, Guangxi, Hunan.

**Hard Rock-Hosted** REE deposits tend to be larger and can be of greater economic importance. These deposits are found in various parts of the world, including China, the United States, Australia, and several African countries. Hard rock hosted REE deposits are the primary sources of global REE production.

*IAC's waste production is smaller in volume and toxicity compared to hard rock mining.*

**Environmental considerations**

*IACs can be processed at lower temperatures, less mechanical processing, requiring a lower energy consumption.*

**Ionic Adsorption Clay** extraction of REEs can have a lower environmental impact compared to hard rock mining, as the process is less energy-intensive and often involves fewer chemical reagents and reduced impact from radionuclides.

*HRH also present greater social licence to operate challenges due to presence of elevated radionuclides in waste streams which requires legacy management.*

**Hard Rock-Hosted** mining can have more significant environmental impacts due to the need for extensive processing, potential habitat disruption, and the use of environmentally challenging chemicals in the extraction and separation processes.

Exhibit 6: **Ionic Adsorption Clay (IAC) vs. Hard Rock-hosted REE**

| Mining/Processing stages | | Makuutu Ionic Adsorption Clay (IAC) | | Hard Rock-Hosted REE |
|---|---|---|---|---|
| Mineralisation | ✓ | Soft material, negligible (if any) blasting | X | Bastnaesite/Monazite (LREO); Xenotime (HREO) |
| | ✓ | Elevated HREO/CREO vs. TREO head grade | X | High La, CE component of TREO head grade, ~5% HREO content |
| | | Lower grade TREO (0.04-0.3% TREO) | ✓ | Higher grade TREO (>0.7% TREO) |
| Mining | ✓ | **Bulk Mining**, low relative opex: | X | **Selective Mining**, high relative opex: |
| | ✓ | Surface mining (0-20m), 3m of cover | X | Blasting required |
| | ✓ | Minimal stripping of waste material (Strip ratio = 0.8) | X | Could have high strip ratios |
| | ✓ | Progressive rehabilitation of mined areas | X | Grade control requirements high |
| Processing Mining Site | ✓ | No milling | X | Comminution (grind etc.) frees REE minerals |
| | ✓ | Simple process plant, bulk process methods | ✓ | Beneficiation via simple screening an option |
| | ✓ | Potential for static or in-situ leaching | X | Costly flotation produces mineral cncntrt |
| | ✓ | Low reagent volumes at ambient temperature | | |
| Mine Product | ✓ | Mixed high-grade REE $CO_3^{2-}$, +90% TREO grade | X | REE cncntrt (~20-40% TREO grade), gangue |
| | ✓ | Low La, CE content (25-30%), high HREO/CREO content (70-75%), high basket value (US$39/kg | X | High La, Ce content (~70%), low basket value/kg of product (US$13-20/kg REO) |
| | ✓ | Magnet metals ~33.3% (including 5% DY + Tb) | X | Cracking creates feed to REE separation plant |
| | ✓ | High margin product | X | Low margin product if mineral cncntrt only |
| Product Payability | ✓ | 70-80% payability as a mixed RE carbonate | X | 35-40% payability as a mineral concentrate |
| Processing - Environmental | ✓ | Non-radioactive tailings | X | Radioactive tailings (often) w/ costly disposal |
| | ✓ | Solution treatment + reagent recovery (somewhat off-set by infrastructure) | X | Legacy radionuclide tailing management |
| Processing - Refinery | ✓ | Mixed REE $CO_3^{2-}$ 90% TREO grade 'quality' feedstock to REE separation plant | X | High temp 'cracking' w/ strong reagents solubilises the refractory REE minerals |
| (Typically not Mining site) | ✓ | Acid solubilisation then usual REE separation | X | Complex plant required (high capex) |
| | | Complex recycling reagents and water | X | Radionuclides with REE cncntrts to cracking |
| | | | X | Social license - radioactive tailings |

Sources: ACF Equity Research; Company Reports.

## Uganda – Economic Overview

*Uganda has a population of 45.85m (2021).*

Uganda is a landlocked country in East Africa with a 2023 estimated population of ~48.5m. It has abundant natural resources such as gold, copper, cobalt, iron ore, tin, and oil. Uganda is a market-based economy.

**Population** - The population of ~48.5m has a median age of 16.3 in 2023, and whilst the median age is rising, this is still a young population. The fertility rate in 2023 is estimated at 4.36. The population growth rate was estimated by the World Bank in 2021 at 3.2% p.a., at which time the fertility rate was thought to be 4.69. Though these data points suggest that Ugandan population growth is slowing, it is still relatively rapid. Urbanisation is at 28.6% and growing around 1% p.a..

**Comparative advantage** - Uganda has comparative advantages in agriculture and estimated recoverable oil reserves of >1.4bn barrels, with first oil expected in 2025.

*GDP gr% 6.3% (2022).*

*The mining sector contributes 2.3 % of Uganda GDP (2021).*

**GDP** - Uganda's real GDP grew by ~6.3% in 2022 (African Development Bank) vs. 5.6% in 2021, despite higher commodity prices, tighter financial conditions, and global supply chain disruptions. Post-covid pandemic growth has been driven by a recovery in both services and industry, and good performance in agriculture.

**Inflation** - Uganda's inflation rate was ~7.2% in 2022, mainly due to higher food and energy prices. The Bank of Uganda raised the base rate four times in 2022, from 6.5% to 10%, to curb inflation. The financial sector remains well capitalized, with a capital adequacy ratio of 21.7% in 2022.

*In 1990, the Chinese government declared that RREs as protected and strategic minerals – prohibiting foreign firms from mining REEs within China and restricting foreign participation in REEs processing, except for JVs.*

**Mining (REE)** - Uganda has one of the largest ionic adsorption clay (IAC) hosted REE deposits in the world, known as the Makuutu Rare Earths Project. The project has a potential life of mine of 35 years, with a potential for significant increase with further exploration. IXR's DFS of the project was completed in March 2023 and the first production is expected in 2026, subject to development approvals.

*The REE quota and tariff action by the Chinese government will probably serve to have exactly the opposite effect of the one intended (to protect the local industry and China's strategic position and supply). The quotas and tariffs have stimulated a belated call to action from developed economies around the world to diversify global REE supply chains. The implication is that China's REE economy will fade somewhat in importance and influence.*

**The Makuutu Project is strategically important for Uganda and the global REE market (as well as IXR)**. Makuutu offers a low-cost, long-term source of CREO and HREO supply outside China. China currently dominates global REE mining, production and consumption, ~70% of both (2022A). However, China has imposed export quotas and tariffs on REEs to protect its domestic industries and environment, creating supply risks and price volatility for other countries that depend on REEs for their technological development.

**Government Support and Regulation** - The Ugandan government recognised the importance of REEs as valuable resources and sought to regulate and support their responsible development. As a result we expect REE mining and exploration activities to be subject to particularly keen government oversight and regulation in Uganda.

## Rare Earth Abundances & Applications

Rare Earth Elements (REEs) are key to the new clean energy economy. REEs are a set of 17 elements with unique physical and chemical properties used across a range of industrial and technological applications. The largest value use of REEs is the production of permanent magnets – a critical component of clean energy applications (e.g., electric vehicles and wind turbines). We expect strong demand growth in 23-33E for magnet rare earths, including neodymium, praseodymium and dysprosium.

China dominates REE mining supply, producing 70% of the world's REE output (2022A). Chinese REE market dominance is a global strategic concern because **REEs are essential materials for electric cars, defence applications and net zero electricity generation** via e.g., wind turbines. Governments, such as the EU, US and Australia and sectors such as Autos are investing significantly in vertical integration i.e. their own capacity/supply chains.

*Rare earth elements are critical components of clean energy applications such as electric vehicles.*

**LREEs and HREEs** - The rare earth elements (REEs) are a large family comprising 17 elements, including scandium, yttrium and the lanthanides, which can be sub-divided into **light rare earth elements** (LREEs), with atomic numbers 57-60, and **heavy rare earth elements** (HREEs), with atomic numbers 62-71. Light REEs include cerium, lanthanum, praseodymium and neodymium, ,. Heavy REEs include yttrium, samarium, gadolinium, terbium, dysprosium, holmium, erbium and scandium.

*Crustal abundance estimated for REEs at ~130 ug/g to 240 ug/g (150-220 ppm) – higher than most other commonly exploited elements.*

**Uses** - **Light rare earth elements** (LREEs) are used in permanent magnets (electric vehicle motors, wind turbines) and advanced metal alloys, glass polishing and catalyst markets. **Heavy rare earth elements** (HREEs) and Yttrium are also used in magnets and are critical to defence applications.

*REEs, although abundant in the Earth's crust, are difficult to mine economically.*

**Abundance** - Rare earths, despite their name, are relatively abundant in the Earth's crust (~130-240 ug/g) but are difficult to mine because though they are widely dispersed through the crust, concentrations high enough to justify economic metallurgical processing and extraction are rare. REEs do not exist as native metals due to their reactivity but occur in numerous ores and minerals. The **principal mined REE minerals** are **bastnaesite**, **monazite**, **loparite** and the **lateritic ion-adsorption clays**.

Exhibit 7: **Rare Earth Elements (REEs) and commercial uses**

| Element | Symbol | Application |
|---|---|---|
| | | **Light rare earths** |
| Lanthanum | La | Rechargeable batteries, computer screens |
| Cerium | Ce | Polishing powders, glasses, ceramics |
| Praseodymium | Pr | Ceramics, glasses, pigments |
| Neodymium | Nd | Magnets for EV, consumer electronics |
| Promethium | Pm | Ceramics, glasses, pigments |
| Samarium | Sm | Magnets, nuclear industry |
| Europium | Eu | LCD screen, Bank notes |
| Scandium | Sc | Sports equipment, aerospace industry components |
| | | **Heavy rare earths** |
| Gadolinium | Gd | LCD screens, medicine |
| Terbium | Tb | LCD screens, magnets |
| Dysprosium | Dy | Permanent magnets for electric vehicles and wind turbines |
| Holmium | Ho | Nuclear control rods, lasers |
| Erbium | Er | Glass, Lasers |
| Thulium | Tm | Lasers |
| Ytterbium | Yb | Portable X-ray machines, Lasers |
| Lutetium | Lu | Memory devices, catalyst, medicine |
| Yttrium | Y | Microwave filters, Phosphors |

Sources: ACF Equity Research Graphics; US Geological Survey.
Notes: Scandium is the lightest of rare earths, but not classified as a LREE.

## REE Processing Procedure - Generalised

The REE processing procedure involves several stages: mining, crushing, separation/flotation, purification and final product preparation.

**Mining**: Mining the rare earth-bearing minerals or ores from the ground. The ores are typically found in low concentrations and are often mixed with other minerals.

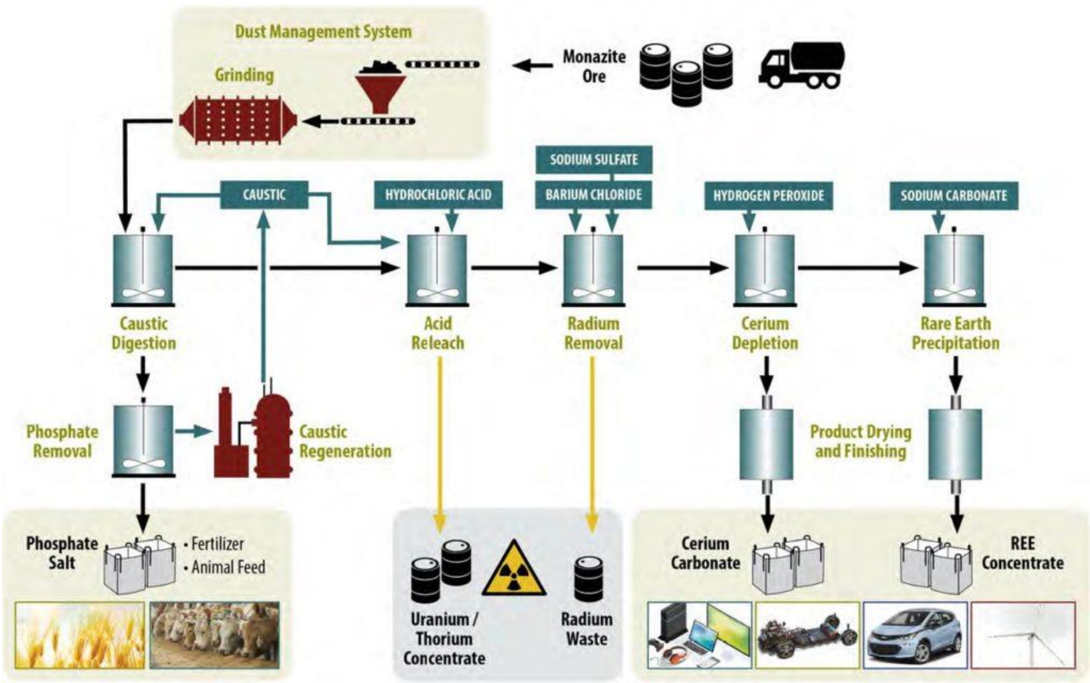
**Crushing**: Ores are crushed and milled into a fine powder. This process increases the surface area of the ores, making it easier to extract the rare earth elements.

**Separation/flotation**: Separating the REEs from the other minerals and impurities in the ore. This is done using chemical and physical separation techniques, including gravity separation, magnetic separation, and froth flotation.

**Purification**: After REEs are separated from the other minerals, they are purified to remove any remaining impurities, using solvent extraction/ion exchange techniques.

**Final product preparation**: The purified REEs are prepared for use in various applications via melting and casting into the desired shape or combining them with other materials to create alloys or compounds.

Exhibit 8: **REE generalised processing procedure**




Sources: ACF Equity Research; Company reports.

## REE Processing Procedure - IXR

As discussed above the Makuutu Rare Earths Project in eastern Uganda is an ionic adsorption clay (IAC) REE resource under development by Rwenzori Rare Metals (RRM) and Ionic Rare Earths (ASX:IXR). IXR owns 60% or RRM.

Above we provided a generalised process for REE extraction. Below we provide the specific IXR Makuutu Project approach.

**Open Pit Mine** - IXR and RMM are engaged in open pit mining.

**Heap Leaching** – IXR is planning to feed the Run-of-Mine (ROM) ore into a modular heap-leach plant. The ore is stacked and heap leached using an acidified salt solution (ammonium sulfate). This process desorbs and leaches REE from the stacked ore.

**Reagent Recovery** – After extraction, the residue is washed with water to recover residual reagents and REE.

**Rehabilitation** - The residue is returned back to the mining pits. Both the residue and mining pits will be progressively rehabilitated and returned back to agricultural use.

**Production** – IXR's process leads to the production of a mixed rare earth carbonate (MREC), this product is marketable.

**Marketable Product** – MRECs can be marketed directly. Most mining companies in REE consider a mixed REC concentrate as the beginning of the marketable part of the value chain. Whilst the market for MREC concentrate is both large and international in nature, by REE standards, MREC pricing tends to be at around a 30% discount to refined/separated rare earth oxides (REO).

## REE Processing Procedure - IXR

We expect first IXR Makuutu mine production 1Q26. The MRE is 532m tonnes @ 640 ppm total rare earth oxide (TREO) composed of critical rare earth oxide (CREO) and heavy rare earth oxide (HREO).

**The cut-off grade** is 200 ppm TREO- Cerium oxide ($CeO_2$). The cut-off grade is an economic tool for miners and indicator for investors. For IXR's Makuutu Project the cut-off grade represents the minimum TREO concentration that could be economically mined using current technologies and expected metals prices.

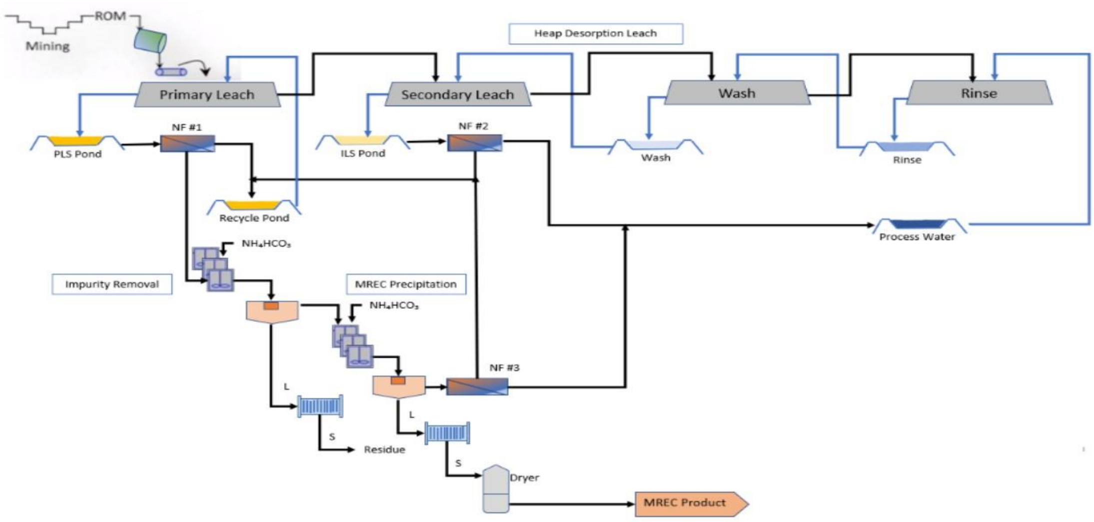
Concentrations above the cut-off grade are considered to be ore. Concentrations below the cut-off grade are considered to be waste material, that will not be mined, pending potential escalation of REE prices.

Cut off grades vary according to metals prices in particular, as well as the 'total cost' to mine and process a unit of ore. 'Total costs' include exploration costs, opex, stripping and environmental/rehabilitation costs.

For investors the cut-off grade is a signal of mining project attractiveness and risk. Low cut-off grades could suggest a low cost, efficient operation and process and higher expected future or actual metals prices – essentially a bull market for the commodity in question.

**High cut-off grades can suggest high opex and or a lowered expectation for metals prices, which in turn could challenge project returns and viability.**

Exhibit 9: IXR's REE processing procedure




Sources: ACF Equity Research; Company reports.

## REE Market Supply Drivers

*China leads the global production of REEs, accounting for 70% of total production in 2022A.*

China is currently the leading producer of REEs. The worldwide mine production of REEs in 2022A was estimated at 300,000 Mt. China accounted for nearly 70% of total production in 2022, followed by the US in second place accounting for an estimated 14% of production. For 2022, China's rare earth mine output quota was at 210,000 Mt, up 25% y/y (US Geological Survey 2023).

*We expect China's dominance to weaken.*

*IXR has a competitive advantage as Western countries move away from China's reliance in order to increase the REE supply chain.*

**China currently dominates REE mine supply** - Although China's dominance has increased, from 57% in 2020 to 70% in 2022, we expect China's dominant position to begin to weaken. China's market share has decreased from 81% in 2016 to 57-58% in 2020, over 4.6pp per annum. A similar decline rate between 2021 and 2023 would bring Chinese production below 44% of the global total at the end of 2023. This seems unlikely to be the actual case but if it is, it may go some way to explain REE pricing behaviour. It does appear nevertheless that China is heading for a significantly less dominant mining position.

*In the 1940's, the United States dominated the REE industry in production and trading - in 1949, REEs were discovered at Mountain Pass, CA (dominated by Bastnaesite, an LREE fluorocarbonate mineral).*

*The US, and Russia, were the leading superpowers and REEs were needed for nuclear weapons. Demand began to grow as new applications such as mischmetal, a rare earth alloy (e.g., used in the Alaskan oil pipeline).*

*The first record of rare earth deposits was discovered in Bayan Obo, Mongolia in 1927. By the 1950s the Chinese built a mine in Bayan Obo to recover REEs and proceeded to discover bastnaesite deposits in China from 1960-1980.*

Exhibit 10: **Worldwide REE production and reserves (tonnes)**

| Country | 2021A Production | 2022A Production | 2022A Reserves | 2022A % total reserves | Reserve classification |
|---|---|---|---|---|---|
| China | 168,000 | 210,000 | 44,000,000 | 0.48% | M+I |
| United States | 42,000 | 43,000 | 2,300,000 | 1.87% | M+I |
| Australia | 24000 | 18000 | 4,200,000 | 0.43% | M+I |
| Brazil | 500 | 80 | 21,000,000 | 0.00% | M+I |
| Burma | 35000 | 12000 | N/A | N/A | M+I |
| Burundi | 200 | - | N/A | N/A | M+I |
| Canada | - | - | 830,000 | N/A | M+I |
| Greenland | - | - | 1,500,000 | N/A | M+I |
| India | 2,900 | 2,900 | 6,900,000 | 0.04% | M+I |
| Madagascar | 6800 | 960 | N/A | N/A | M+I |
| Russia | 2,600 | 2,600 | 21,000,000 | 0.01% | M+I |
| South Africa | - | - | 790,000 | N/A | M+I |
| Tanzania | - | - | 890,000 | N/A | M+I |
| Thailand | 8,200 | 7,100 | N/A | N/A | M+I |
| Vietnam | 400 | 4,300 | 22,000,000 | 0.02% | M+I |
| RoW | 60 | 80 | 280,000 | 0.03% | M+I |
| **Total** | **290,000** | **300,000** | **130,000,000** | | |

Sources: ACF Equity Research Graphics; US Geological Survey.

**Supply growth -** In our view, supply is unlikely to develop fast enough to prevent price support with a bias toward rising prices.

*Between 1978-1989, China was averaging an increase of 40% of annual production – making it the world's largest producer.*

More explicitly, supply growth is likely to be restrained by two key factors.

*In 1990, the Chinese government strategically proclaimed rare earths a "protected and strategic mineral". This put China's domination at the forefront of REE global production.*

1. China has adopted a comprehensive set of policies (e.g., export and production quotas and tax policies) that could limit supply growth, and projects outside China might not be able to fill the gap. The tight supply-demand situation should continue to support REEs and the related Rare Earth Oxide (REO) prices.

*This declaration opened opportunities for foreign investors to participate in joint ventures (JVs) with Chinese firms, even though foreign entities were prohibited from mining in China.*

2. It takes approximately 17 years on average from mineral resource discovery to mine production (Statista). This figure seems a little extended and maybe distorted by historical data. Nevertheless, we do not expect this time frame to reduce below 7-10 years in the foreseeable future.

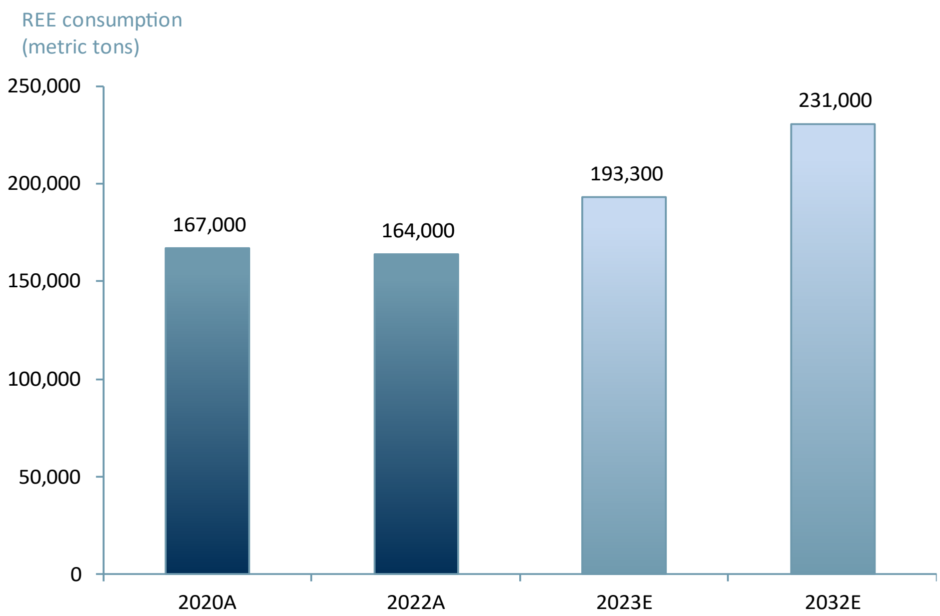
The REE demand/supply equation bodes well for explorers, miners and investors in REE mining.

## REE Market Demand Drivers

*ACF forecasts demand will grow at 5% p.a. through to 2030E.*

Global rare earth demand is forecasted to reach 193,300 Mt by 2023E, at a CAGR of 4.2% between 2023-2030 (Global Data). We expect the demand to grow faster in the next decade driven by clean energy applications where REEs are critical components, because we anticipate that many products using REE will reach growth inflection points e.g. EV adoption, wind energy etc. Demand is forecasted to grow at 6.9% per annum until 2032E to nearly 231,000 Mt, vs. approximately 164,000 Mt in 2022A (Arafura Resources).

Exhibit 11: **Worldwide REE consumption forecast**




Sources: ACF Equity Research Forecast; Arafura Resources; GlobalData.

*REEs largest application is in magnets – used in wind turbines and EVs.*

REEs largest consumption (demand) application is in permanent magnets (for use in wind turbines, and electric vehicle motors), which accounted for 43.2% of total REE consumption in 2021A, according to the US Geological Survey.

There are economic substitutes for REEs in permanent magnets, for example samarium-cobalt (SmCo) magnets still use REEs but can be an alternative to NdFeB magnets. There is also ongoing research on Iron Nitride (Fe16N2) magnets which are comparable to NdFeB magnets, without the need for REES. These have been in development for a long time and do represent a lessor product.

*REEs are also used in catalysts, polishing and metal alloys.*

REE permanent magnet consumption (43.2%) is followed by REE consumption in catalysts used in oil refineries and automobiles (17%), polishing (11.2%), and metal alloys (for use in batteries, fuel cells) at 7.1%

**Demand growth** - We forecast global rare earth demand to grow at a 5% CAGR (to ~240,000 metric tons by 2030), driven by clean energy applications.

Rare Earth Elements are subject to demand growth because of their central use in high-technology and low carbon applications.

As indicated by REE usage (above), the pathway to decarbonisation most probably includes electrification of the economy, along with greatly increased solar and wind electricity generation and significantly increased production volumes of electric vehicles (EVs).

Global sales of electric vehicles reached 10m in 2022A, with an estimated 14m expected by YE23. By YE22A EVs made up just 14% of the global auto market (IEA), suggesting there is a great deal of growth to come, followed by significant long-term replacement demand.

Inevitably, the production of EVs and low carbon technologies will ultimately rely on a steady supply of REE and rare earth oxides (REOs) / minerals, unless significant volumes of less expensive mineral substitutes are developed.

Green technologies also require raw materials such as copper for electrification; nickel and rarer commodities e.g., lithium and cobalt for EV batteries; tellurium for solar panels; and neodymium for permanent magnets.

# Permanent Magnets

*Most important rare earths used in permanent magnet production include Neodymium (Nd), Praseodymium (Pr), Dysprosium (Dy) and Terbium (Tb).*

*Permanent magnets advantages over other magnets*

*1. Provide a constant magnetic field without a power source.*

*2. Can be miniaturized and are light (ideal for small electronic devices)*

*3. Cost effective – they do not require continuous power supply to maintain an electrical field.*

*4. Portable – no power supply required means they are independent of the electrical grid.*

*5. Data storage – permanency without electrical supply means data is not lost when a device is switched off – a critical role.*

*6. Critical for sensors and actuators to detect magnetic fields, position and motion.*

*7. Motors and generators – permanent magnets convert electrical energy to mechanical energy and vice versa – a critical application*

*NdFeB permanent magnets are most used in traction motors for hybrids and EVs.*

**Permanent magnets** are materials where the magnetic field is generated by the internal structure of the material itself, as opposed to temporary or electromagnets magnets that require exposure to an external magnetic field or electric current. A permanent magnet has a magnetic field which is **'always on,'** while for example, an electromagnet is made from a coil of wire wrapped around a ferrous core and requires an electric current to generate a magnetic field. **Electromagnets are temporary** as they lose their magnetic ability once the electric current stops.

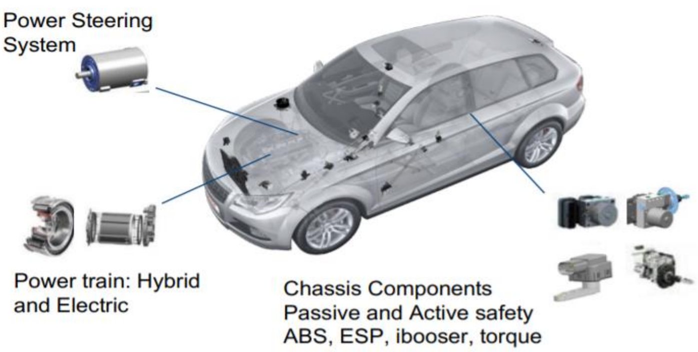
There are **four main categories of permanent magnets**: ceramic (also called ferrite), AlNiCo, Samarium Cobalt (SmCo) and **Neodymium Iron Boron** (NdFeB).

Of these, **NdFeB makes the strongest magnets**. NdFeB magnets contain the following REEs - neodymium (Nd), praseodymium (Pr), dysprosium (Dy) and terbium (Tb). Neodymium is the main element used in the production of NdFeB permanent magnets, however they often contain praseodymium because the two are difficult to separate.

Neodymium and praseodymium as mixed oxides (NdPr oxide) are typically considered the main components of permanent magnets, which are critical in many so-called high-tech products, including electric vehicles, renewable energy wind turbines, consumer electronics et al.

NdFeB permanent magnets are most commonly found in traction motors for EVs and hybrids. Additionally, permanent magnets are used in power steering systems, chassis components and Anti-lock Braking System (ABS), amongst other applications.

Exhibit 12: **Use of permanent magnets in EVs**




Sources: ACF Equity Research Graphics; Lynas Metals.

# IXR Recycling Belfast

*The REO extraction from spent magnets has a recovery of high-value magnet REO product of >99.9% REO.*

*Proprietary tech recovers high purity grade REEs used in high-performance and high-specification permanent magnets.*

Ionic Rare Earths recycling arm (currently excluded from our valuation) is operated by its fully owned subsidiary Ionic Technologies International Ltd (IonicTech) – previously Seren Technologies – for **magnet recycling**. The demonstration plant was founded in 2015, via a spin out from the Queens University in Belfast (QUB).

IonicTech has developed a process that separates and recovers REEs from mining ore concentrates and end of life permanent magnets and swarf. The process is indicated to be efficient, non-hazardous, and economically viable with a minimal environmental footprint. This gives IonicTech a "first mover" advantage in the industrial elemental extraction of separated REOs, in that the product is potentially marketable to the growing energy transition, advanced manufacturing, electric vehicles (EVs) and wind turbines markets.

Exhibit 13: IonicTech path to commercialisation


Sources: ACF Equity Research Graphics; Company Reports.

*The maiden production of high-grade magnet REOs was made up of: 4.2 kg of Nd2O3 grading 99.7%, and ~0.3% Dy2O3 (total REO content of 99.99%); and 0.6 kg of Dy2O3 grading 99.8 % (total REO content of 99.9%).*

IonicTech, during 4Q23, advanced its technology that supports the supply of sustainable, traceable magnet rare earth oxides (REO). It has commissioned and produced its first magnet REOs at the Belfast demonstration plant facility.

The Company will now utilise these products and additional near-term production of NdPr oxide (didymium oxide) to progress its engagement strategy with potential supply chain collaboration partnerships. This in turn will help IXR's Ionic Tech permanent magnet recycling business explore commercial opportunities.

*The scale of the demo plant is not meant to be CF positive at this stage but to de-risk the technology and provide support for the FS*

***Valuation*** *– At this stage, ACF has not included the Belfast recycling facility in its valuation because the demonstration plant should not be seen as revenue generating but rather a de-risking process aimed to produce material for the supply chain to mature and tighten up robustness of the study. However, there is clear revenue generating potential if the demonstration plant proves successful.*

# Management Team

➢ **Managing Director, Tim Harrison.**

Mr Harrison was appointed MD of Ionic Rare Earths in Dec 2020 and has been driving the development of Makuutu and the downstream supply chain integration through refining the acquisition of magnet recycling business, Ionic Technologies in the UK. Tim has 20+ years' experience and an extensive and successful track record in mineral processing and hydrometallurgy across multiple commodities, and experience in project development from greenfield exploration, through studies to operations. Tim has a Bachelor's degree in chemical engineering from Adelaide University and is also a Fellow of the Australian Institute for Mining and Metallurgy (AusIMM).

➢ **CFO / Company Secretary, Brett Dickson.**

Mr Dickson was appointed CFO/Company Secretary of IXR in Jun 2015. As a CPA Brett's career focused on the start-up, restructuring, management, growth and financing of emerging, publicly listed mining, exploration and oil and gas companies. Brett's experience ranges from capital and debt raisings, corporate restructuring, stock exchange listings (TSX, ASX, AIM), mineral exploration, mining and feasibility studies. Brett has a Bachelor's degree in economics and finance and is a Fellow of the Australian Society of Certified Practising Accountants.

➢ **COO, Tommie van der Walt.**

Dr van der Walt was appointed COO of IXR In June 2023 and has a proven track-record in mining project development, demonstrated exceptional leadership skills and a deep understanding of project delivery in Africa – focusing on mine optimisation. Tommie oversees all aspects Makuutu, which will include further growth strategies for the mine. Tommie has a Bachelor's degree in Mechanical Engineering from the University of Pretoria, a Master's Degree in Business Management from the University of Cape Town and a PhD in Business Administration from the Potchefstroom Business School, University of North West, South Africa.

# Forecasts

*

*The charts show our 5-year forecasts for key metrics for IXR beginning at first production in 2026E.*

*Note that columns and lines show our forecast values.*

*The revenues chart shows dramatic acceleration in growth in 2026E based on first production expectations for 2026E.*

*Revenue decline is due to several factors: peak production is expected in 2028 and then declines thereafter, REO prices and grades fluctuate over the LOM.*

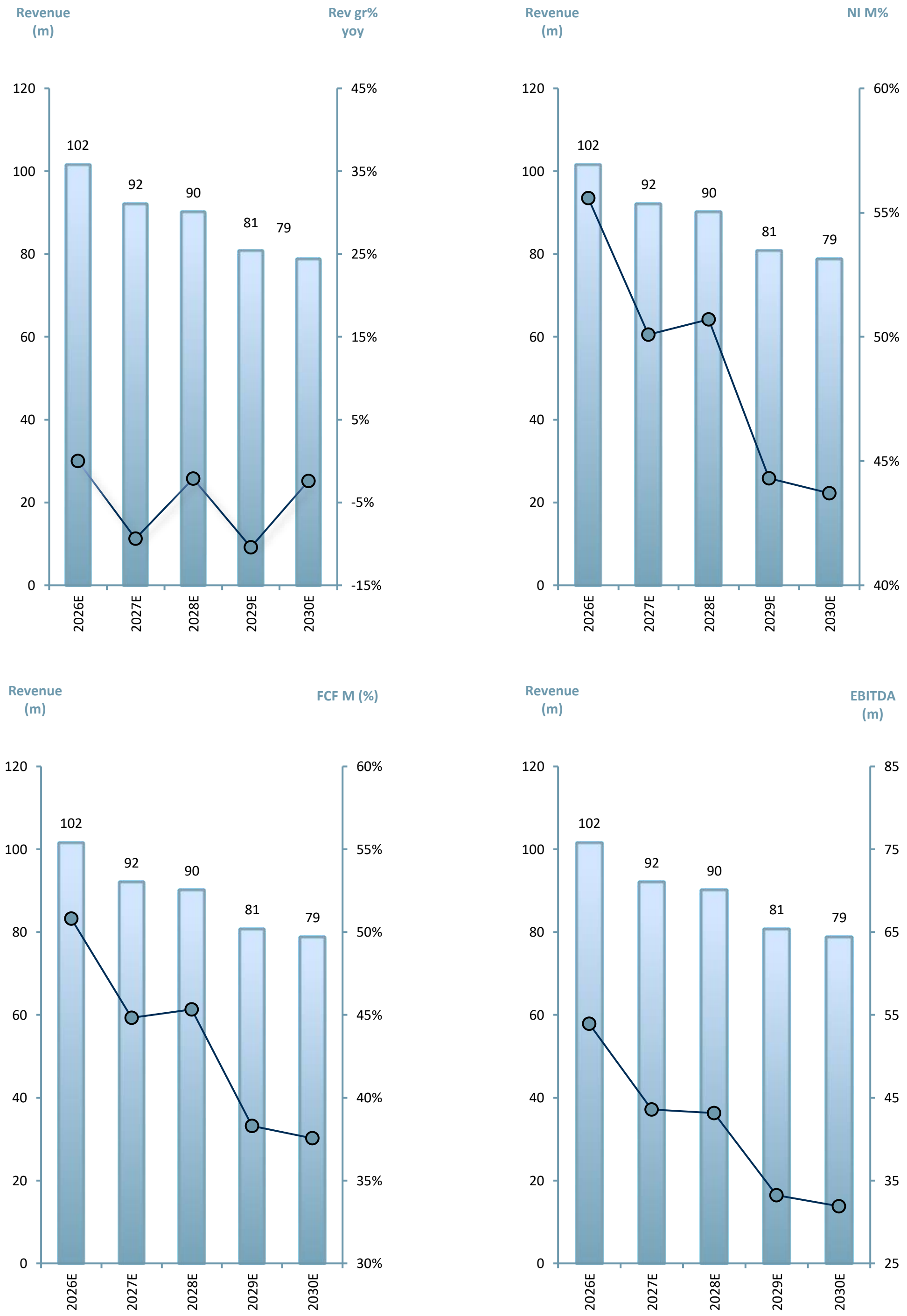
*Furthermore, current revenues are based on the DFS MRE of 172.9 Mt and does not include the latest upgrade potential to 532 Mt.*

*The upgrade is nevertheless conservatively imputed in our valuation to provide an indication or its potential impact.*

*Revenues may change in further notes as we include the MRE upgrade and other milestones.*

*Currently IXR is non-revenue generating.*

Exhibit 14: IXR financial metrics




Our forecasts are based upon management guidance and our own sensitivity analysis. We focus on cash proxies (EBITDA) and free cash flow (FCF). However, Net Income remains important for assessing elements of balance sheet strength, nevertheless we are strongly of the view that only cash matters.

# Valuation

*Revenue decline is due to several factors: peak production is expected in 2028 and then declines thereafter, REO prices and grades fluctuate over the LOM.*

*Furthermore, current revenues are based on the DFS MRE of 172.9 Mt and does not include the latest upgrade potential of 532 Mt.*
*We have nevertheless imputed a conservative contribution to the NPV in our valuation from the MRE upgrade to provide an idea of potential.*

*We see current fair value for IXR at A$0.072 per share (fully diluted) for phase 5 Makuutu and excluding Belfast.*

*We have imputed a conservative contribution to the NPV in our valuation from the MRE upgrade of 17 Oct 2023 to provide an idea of potential.*

Exhibit 15: **IXR WACC, DCF and Value Range**

| ACF est. $ (m) | 2026E | 2027E | 2028E | 2029E | 2030E |
|---|---|---|---|---|---|
| Revenue | 101.5 | 92.0 | 90.1 | 80.7 | 78.8 |
| EBITDA | 53.92 | 43.58 | 43.15 | 33.23 | 31.90 |
| Net Income | 56.4 | 46.1 | 45.7 | 35.8 | 34.4 |
| FCF | 53.92 | 43.58 | 43.15 | 33.23 | 31.90 |
| CPS (diluted) (AUD) | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |

| Makuutu Rare Earths WACC Calc | |
|---|---|
| Pre-tax cost of debt | 0.9% |
| ETR | 40.5% |
| After-tax cost of debt | 0.5% |
| Current Leverage | 0.0% |
| Debt/(Cash) | 0.0 |
| Equity | 88.6 |
| Target Leverage | 21.5% |
| D / (D+E) | 17.7% |
| | |
| ACF β adj levered | 1.2 |
| rf | 4.1% |
| ERP | 5.0% |
| Cost of equity | 10.1% |
| Risk adj. | 2.0% |
| WACC | 10.4% |

**Note:** Successful issue of draft EIS and permitting will significantly reduce our WACC.

| Valuation Range | IXR's Share (A$ m) | % of Valuation |
|---|---|---|
| Makuutu DFS MRE 19 Mar 2023 | 99.56 | 34% |
| Makuutu P5 drill results update 17 Oct 2023 (1Q24) | 192.18 | 66% |
| Belfast recylcing demo plant | 0.00 | 0% |
| Total NPV (A$m) FX | 291.74 | 100% |
| Cash | 11.12 | |
| Debt | 0.01 | |
| Total NPV (A$m) FX | 291.74 | |
| Net Debt/(Cash) | 11.12 | |
| Fair Value ($m) | 302.85 | |
| NoSh (m) | 4,218.01 | |
| NoSh (diluted) (m) | 4,224.71 | |
| Intrinsic Value Per Share USD | 0.0717 | |
| Close Price USD | 0.0210 | |
| **VR (low - high)** | **0.068** | **0.075** |
| VR Spread | 5.00% | |
| Implied VR Return (low - high) | 224.3% | 258.4% |

**Note:** implied value range in this ACF research note is based upon diluted shares in issue at the date of this note.

## Project NPV

*We have not modelled the magnet recycling demo plant in Belfast. At the moment is not Rev/CF generating – it is a de-risking process aimed to produce material for the supply chain to mature and tighten up robustness in the study. We will model it in as milestones are met in 2024.*

ACF has taken a highly conservative valuation approach and we value IXR on a single DCF valuation of phase 1 of the Makuutu Project, which includes the company's expectations for rare earths production. We have included the recent P5 MRE upgrade of 208% (MRE 532Mt vs. the original 172Mt ore reserve estimate) assuming no margin gains from scaling up production volumes. We have not attempted to capture any value from the Belfast recycling project, which would believe has potential of additional upside.

**Metals Price Deck -** Our price assumptions are using the base case scenario of forecasted REO individual pricing from Adamas Intelligence. We have taken a conservative approach in using the base case price basket versus the upside.

**Metal grades** – We have taken the global grades of REO forecasted in the company geology reports.

**WACC** – We have used a conservative WACC of 10.4% as opposed to the DFS assumption of 8.0% given that Ionic is non-revenue generating and first production is not expected until 2026E. In addition equity risk premiums have risen. As milestones are reached, we would expect our valuation to rise through de-risking.

*Our production schedule is more conservative than IXRs, for example we assume the start of production is later and peak production is further out i.e. in 2028.*

**Makuutu Project –** Our base assumptions are informed by the operating parameters in the company's mine plan. We assume that the mine will produce on average per year ~4,500t. Our model assumes a life of mine of 35 years.

Exhibit 16: **Makuutu Cash Flow Model showing first 10 of 35 periods**

*Revenues etc., including FCF in our cash flow model represent the entire value of the project. In our financial forecasts for IXR we have adjusted these values to capture IXR's 60% majority stake. This means the revenues, FCF et al have lower values in our forecasts and valuation.*

*The table here does not capture the recent MRE upgrade, which is imputed conservatively in our valuation.*

| Makuutu Rare Earths DCF in A$m | 2023A | 2024E | 2025E | 2026E | 2027E | 2028E | 2029E | 2030E | 2031E | 2032E |
|---|---|---|---|---|---|---|---|---|---|---|
| Production (000 t) | 0 | 0 | 0 | 5,426 | 5,573 | 5,720 | 3,284 | 3,366 | 3,448 | 3,530 |
| Revenue | 1 | 1 | 0 | 152 | 138 | 135 | 121 | 118 | 107 | 115 |
| Mining tax | 0 | 0 | 0 | 8 | 7 | 7 | 6 | 6 | 5 | 6 |
| Operating cost | 0 | 0 | 0 | 64 | 66 | 64 | 65 | 64 | 64 | 65 |
| Working Capital | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Capex | 0 | 121 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **Cash flow pre-tax** | **1** | **-120** | **0** | **80** | **65** | **64** | **49** | **47** | **37** | **44** |
| Taxes | 0 | 0 | -22 | -24 | -19 | -19 | -15 | -14 | -11 | -13 |
| Tax rate (%) | 0 | 0 | 0 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| **Cash flow after-tax** | 1 | -120 | 0 | 56 | 45 | 45 | 34 | 33 | 26 | 31 |
| NPV | 1 | -109 | 0 | 42 | 30 | 27 | 19 | 17 | 12 | 13 |
| **Total NPV (A$m)** | 166 | | | | | | | | | |

Source: ACF Research Estimates; Companies reports.

Note: The NPV model above only shows the first ten years rather than the entire LOM of 35 years.

# Peer Group

Exhibit 17: **Trailing IXR peer group metrics**

| TTM Metrics / Company Name | Market | Tkr | MCAP US$(m) | EV $(m) | Tonnes prdctn | EV/M+I+I ($/t) | MCAP/M+I+I ($/t) | EV/M+I ($/t) | MCAP/M+I ($/t) |
|---|---|---|---|---|---|---|---|---|---|
| **Ionic Rare Earths** | **XASX** | **IXR** | **59** | **52** | **146,645** | **0.10** | **0.11** | **0.10** | **0.11** |
| Lynas Rare Earths | XASX | LYC | 3,960 | 3,413 | 22,922 | 62.74 | 72.79 | 119.76 | 138.95 |
| Arafura Rare Earths | XASX | ARU | 275 | 190 | 149,277 | 3.40 | 4.92 | 5.45 | 7.88 |
| Rainbow Rare Earths | XLON | RBW | 114 | 107 | 26,260 | 3.51 | 3.76 | 4.57 | 4.89 |
| Peak Rare Earths | XASX | PEK | 65 | 48 | 887,000 | 0.23 | 0.30 | 0.24 | 0.33 |
| **Average** | | | | | | **17.47** | **20.45** | **32.50** | **38.01** |
| **Median** | | | | | | **3.46** | **4.34** | **5.01** | **6.38** |

Sources: ACF Equity Research; Refinitiv.

IXR does not make up a constituent of our average or median values in the peer group metrics at the bottom of exhibit 17. We have excluded Ionic from these values to make comparison with the rest of the peer group as clean and undistorted as possible.

In our rare earth peers we use companies involved in exploring and developing rare earths that will be used in permanent magnets. We suggest that these are useful peers. The peers except for Lynas Rare Earths (ASX:LYC) are all non-revenue generating like IXR and in the exploration and development phase.

We compare the peers using multiples based on their potential resource expectations of Measured + Indicated + Inferred (M+I+I) in tonnage (t). We then analyse the company's EV and MCAP to determine the value of each tonne of resource at X dollars.

Compared to its peers, Ionic Rare Earths has the lowest valuation per tonne, suggesting the IXR is significantly undervalued.

## Peer Group Selection

**Rainbow Rare Earths** (RBW**, LSE** listed) specialises in the exploration and development of rare earth elements (REEs) with projects in South Africa and Burundi. RBW has a flagship project, Phalaborwa, in South Africa and owns 90% of the Gakara asset in Burundi that has produced high-grade TREO (total rare earth oxide) concentrate of 52-56%, weighted towards NdPr (Neodymium and Praseodymium), which account for 19.5% of contained TREO and 85% of the value of the concentrate.

**Lynas Rare Earths** Ltd (LYC**, ASX** listed) specialises in the mining, extraction and processing of REEs, in Australia and Malaysia. Lynas holds an interest in the Mount Weld Project and the Kalgoorlie project in W. Australia. Lynas's high-quality products include Neodymium and Praseodymium (NdPr) used in magnets, Lanthanum (La), Cerium (Ce) and Mixed Heavy Rare Earths (MHREs).

**Arafura Rare Earths** Ltd (ARU, **ASX** listed) specialises in the exploration and development of mineral properties and the production of REEs, e.g. NdPr MREOs. Arafura's primary asset is its Nolans project in the Northern territory of Australia. ARU also has the Aileron-Reynolds project which is made up of six exploration licenses covering ~1,240km$^2$.

**Peak Rare Earths** Ltd. (PEK, **ASX** listed) specialises in exploration and evaluation of mineral licenses in Tanzania. PEK explores for NdPr deposits. It holds 100% interest in the Ngualla rare earth project in S. Tanzania. The deposits offer high composition NdPr to REO and low levels of radionuclides and acid consuming elements.

## Financial Projections

*We have not modelled the magnet recycling demo plant in Belfast. It is excluded from our valuation and has significant upside potential. At the moment the Belfast recycling project is not Rev/CF generating – it is a de-risking process aimed at producing material for the supply chain. We plan to model the recycling project and establish valuation potential as milestones are met, which we currently expect to start in 2024.*

*Revenue decline is due to several factors: peak production is expected in 2028 and then declines thereafter, REO prices and grades fluctuate over the LOM. Furthermore, current revenues are based on the DFS MRE of 172.9 Mt and does not include the latest upgrade potential of 532 Mt.*

*Revenues may change in further notes as we include the MRE upgrade and other milestones in these projections/metrics tables.*

*We have nevertheless imputed a conservative contribution to the NPV in our valuation from the MRE upgrade to provide an idea of potential.*

*Currently IXR is non-revenue generating.*

| P&L A$ (m) | 2026E | 2027E | 2028E | 2029E | 2030E |
|---|---|---|---|---|---|
| **Revs** | **102** | **92** | **90** | **81** | **79** |
| gr% | | -9% | -2% | -10% | -2% |
| Total Expenses | -48 | -48 | -47 | -47 | -47 |
| **EBITDA** | **54** | **44** | **43** | **33** | **32** |
| % Revs | 53% | 47% | 48% | 41% | 41% |
| FV adj. | 0 | 1 | 2 | 3 | 4 |
| % Revs | N/M | 0 | 0 | 0 | 0 |
| **EBIT** | **54.2** | **43.9** | **43.4** | **33.5** | **32.2** |
| EBT | 54 | 44 | 43 | 34 | 32 |
| % Revs | NM | NM | NM | NM | NM |
| ETR | 0 | 0 | 0 | 0 | 0 |
| **NI** | **56** | **46** | **46** | **36** | **34** |
| % Revs | NM | NM | NM | NM | NM |
| Adj EPS (p) | 0.8 | 0.6 | 0.6 | 0.5 | 0.5 |
| Basic EPS (p) | 0.013 | 0.011 | 0.011 | 0.008 | 0.008 |
| Diluted EPS (p) | 0.013 | 0.011 | 0.011 | 0.008 | 0.008 |
| **Balance Sheet A$ (m)** | 2026E | 2027E | 2028E | 2029E | 2030E |
| PP&E | 9 | 12 | 14 | 16 | 19 |
| **Total Fixed Assets** | **80** | **97** | **113** | **129** | **146** |
| Current assets | 71 | 64 | 63 | 57 | 55 |
| Cash | -40 | 8 | 51 | 89 | 121 |
| **Total Current Assets** | **31** | **73** | **114** | **146** | **176** |
| **Total Assets** | **111** | **169** | **227** | **275** | **322** |
| Creditors | 27 | 25 | 24 | 22 | 21 |
| Other liabilities | 0 | 0 | 0 | 0 | 0 |
| Loans | 0 | 0 | 0 | 0 | 0 |
| **Total Liabilities** | **27** | **25** | **24** | **22** | **21** |
| **Net Assets** | **84** | **144** | **203** | **253** | **300** |
| Share Capital | 78 | 78 | 78 | 78 | 78 |
| Accum. Profit/(loss) | 0 | 0 | 0 | 0 | 0 |
| **Total Equity** | **84** | **144** | **203** | **253** | **300** |
| **Total Equity & Liabilities** | **111** | **169** | **227** | **275** | **322** |
| Basic NAV (p) | 2 | 3 | 5 | 6 | 7 |
| Diluted NAV (p) | 28 | 48 | 67 | 84 | 99 |
| **Cash Flow A$ (m)** | 2026E | 2027E | 2028E | 2029E | 2030E |
| EBT Profit/(loss) | 54 | 44 | 43 | 34 | 32 |
| Finance costs | 0 | 0 | 0 | 0 | 0 |
| **FV adj. + Other adj.** | **0** | **1** | **2** | **3** | **4** |
| Cash Taxes | 0 | 0 | 0 | 0 | 0 |
| WCap change | -71 | 7 | 1 | 7 | 1 |
| **Net CFO** | **-15** | **52** | **47** | **42** | **36** |

Source: ACF Equity Research Estimates; Companies reports.

## Risks to our Assumptions

**Project development risk** – This includes failure to reach 12-month targets set out for the UK recycling facility.

**Commodity price risk** – IXR is highly exposed to commodity price volatility. A potential fall in prices could lead to its projects becoming economically unviable. Risk mitigation steps could include measures to hedge risk such as stockpiling when prices are low and price hedging when prices rise above expectations. REE mining extraction is capital intensive and relatively inefficient (small product volumes require mining of large ore volumes). Product prices are relatively high to compensate and may suppress demand/encourage research into substitutes.

**Funding availability** – Mining is capital-intensive and requires a significant amount of investment as well as working capital. If the company is unable to raise capital for its exploration and development activities, it will adversely impact the timelines for its mining projects. Also, too much new equity (raising money via issuing equity) will lead to dilution while debt funding will increase interest costs thereby putting further pressures on cash flows. We estimate that in 2021 AUM $30trn were formerly inaccessible to companies without an ESG with metrics. We believe the AUM filtered informally at this time using ESG filters is far in excess of AUM $30trn.

*IXR scores well on ESG / sustainability within the smaller mining companies' cohort. We expect IXR's ESG credentials to enhance its fund-raising capability.*

**Regulatory risk** – Mining projects tend to attract high regulatory interest given their impact on the environment as well as on the country's natural resources. IXR's assets are in Africa and recycling is planned in the UK, both are subject to extensive country specific laws and regulations. Failure to comply with them could lead to delay or complete shutdown of the development of the assets. IXR is ESG focused but does not have an ESG policy on its website or (unsurprisingly for its current scale) use big data collection and analysis at this time. Big data collection and analysis can reduce several risk types and wastage and lead to efficiencies.

*Investors should note that IXR has assets in the UK (recycling under development) and exploration and mining assets in Africa which have a commensurately higher risk profile.*

**Personnel risk** - Small and mid-sized companies are more dependent on their C-suite/executive management teams than global large/mega-caps. The loss of key personnel can have a disproportionate impact on valuation and investor perception compared to similar events at larger more mature (often ex-growth) companies.

**Political risk** – China dominates the REE industry, from processing through to value added products. The ongoing geopolitical tensions are already weaponizing commodities and the continuation of the Russian/Ukraine war could affect relations with China reducing the ability to find processing centres for sales of rare earths.

# Glossary

| | |
|---|---|
| **ABS** | Anti-lock Braking System – a safety system in vehicles that prevent the wheels from locking up and then skidding during heavy breaking. |
| **AiM** | AiM Stock Exchange – London Stock Exchange sub-market. |
| **APC** | Advanced Propulsion Centre – UK non-profit that facilitates funding for UK-based research and development (R&D) projects developing net-zero technologies. |
| **ASX** | Australia Stock Exchange – Australia's primary exchange. |
| **Ce** | Symbol for chemical element Cerium, atomic number 58. |
| **CAGR** | Compounded Annual Growth Rate – Average annual growth rate of an investment over a period longer than one year. |
| **CREO** | Critical Rare Earth Oxides |
| **DFS** | Definitive Feasibility Study – basis for a commitment to proceed with project development, detailed design and construction. |
| **Dy** | Symbol for chemical element Dysprosium, atomic number 66. |
| **EBIT** | Earnings before interest and tax (also often referred to or equates to operating profit). |
| **EBITDA** | Earnings before interest, depreciation and amortisation – the presentation of EBITDA by companies is not a requirement of UK GAAP or IFRS accounting standards. However, in certain cases it can act as a close proxy to free cash flow. |
| **EBT** | Earnings before tax. Also often expressed as profit before tax. |
| **EPS** | Earnings Per Share – value of earnings per outstanding share of common stock. |
| **Er** | Symbol for chemical element Erbium, atomic number 68. |
| **ESG** | Environmental, Social and Governance – quantifiable metrics used to screen a company's sustainable business activities. |

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| **ESIA** | Environmental and Social Impact Assessment – assessment of the impact of mine development and operations on water resources and associated water environments. |
| **ETR** | Effective Tax Rate – the % (percent) of income a corporation (or individual) pays in taxes. |
| **Eu** | Symbol for chemical element Europium, atomic number 63. |
| **EV** | Electric Vehicle – a vehicle that uses one or more electric motor for propulsion. |
| **FCF** | Free Cash Flow generated in ACF's models after all obligatory cash costs have been satisfied such as Interest payable (Ip), cash taxes and maintenance capex (as opposed to investment capex). FCF represents the cash remaining for theoretical distribution or investment after all obligatory cash-based costs including net interest payable have been deducted. |
| **Gd** | Symbol for chemical element Gadolinium, atomic number 64. |
| **GDP** | Gross Domestic Product – monetary measure of the market value of goods and services produced during a specific time period by a country/ies. |
| **HCM** | Human Capital Management – practices and methods used by corporates to manage employees. |
| **HRE** | Heavy Rare Earths – chemical elements with atomic numbers 63 and greater. |
| **HREO** | Heavy Rare Earth Oxides |
| **Ho** | Symbol for chemical element Holmium, atomic number 67. |
| **IAC** | Ionic Adsorption Clay deposits – lateritic or weathered crust elution-deposited rare earth ore, a significant source of REEs. |
| **IXR** | Ionic Rare Earths – the subject company of this ACF Equity Research research note. |

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| **JV** | Joint Venture – generally a legal structure between two corporate entities involving participation in equity capital in the JV vehicle. JV can also refer to more informal arrangements. |
| **La** | Symbol for chemical element Lanthanum, atomic number 57. |
| **LOM** | Life of Mine – the time (years) it takes for ore reserves go be extracted via available capital. |
| **LREE** | Light Rare Earth Elements - chemical elements with atomic numbers 62 and lower. |
| **Lu** | Symbol for chemical element Lutetium, atomic number 71. |
| **MCap** | Market Capitalization – total value of a publicly traded company's outstanding shares (formula = NoSh * s/p). |
| **MEMD** | Ministry of Energy and Mineral Development – Uganda |
| **MLA** | Mining License Application – license to businesses that wish to engage in large-scale mining operations. |
| **MREC** | Mixed Rare Earth Carbonate – rare earth solids that can be used as raw materials for extracting single REOs. |
| **Nd** | Symbol for chemical element Neodymium, atomic number 60. |
| **NdFeB** | Neodymium Magnets – are used in high performance motors, brushless DC motors, magnetic separation, magnetic resonance imaging (MRI), sensors, switches and loudspeakers. |
| **NdPr** | Neodymium + Dysprosium – NDpR oxide is used in the production of NdFeB magnets. |
| **NoSh** | Number of Shares in issue (NoSh). |
| **NPV** | Net Present Value (NPV) refers to the current value of future cash flows generated by the project |
| **PLS** | Pregnant Leach Solution - |
| **Pm** | Symbol for chemical element Promethium, atomic number 61. |

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| **Pr** | Symbol for chemical element Praseodymium, atomic number 59. |
| **QUB** | Queen's University Belfast – IXR's Ionic Technologies is a spin-out company from QUB. |
| **RAB** | Rotary Air Blast – most common shallow drilling method where a piston-driven hammer-like object drives the drill bit into the rock fragmenting the hard surface. |
| **REE** | Rare Earth Elements – group of 17 chemical elements that have similar properties and can be found together in geologic deposits. |
| **REO** | Rare Earth Oxides |
| **RRM** | Rwenzori Rare Metals Limited - a private company in Uganda that owns 100% of the IXR Makuutu project. |
| **Sc** | Symbol for chemical element Scandium, atomic number 21. |
| **Sm** | Symbol for chemical element Samarium, atomic number 62. |
| **Shareholders' Equity** | Shareholders equity is a line on the balance sheet calculated from the deduction of total liabilities from total assets and represents the value (or lack of it) available for distribution to shareholders should the entity wind up operations. It differs from the equity value expressed in market capitalisation (MCap), which is number of shares in issue (NoSh) multiplied by share price. The ratio Debt/Equity commonly uses the Debt/MCap formula as opposed to the Debt/Shareholder equity formula. |
| **Tb** | Symbol for chemical element Terbium, atomic number 65. |
| **Tm** | Symbol for chemical element Thulium, atomic number 69. |
| **TREO** | Total Rare Earth Oxides |
| **TSX** | Toronto Stock Exchange – Canada's largest stock exchange. |
| **U** | Symbol for chemical element Uranium, atomic number 92. |
| **WACC** | Refers to the weighted average cost of capital for the firm. |

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| **Y** | Symbol for chemical element Yttrium, atomic number 39. |
| **Yb** | Symbol for chemical element Ytterbium, atomic number 70. |
| **Zn** | Symbol for chemical element Zinc, atomic number 30. |

# Notes [Intentionally Blank]

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Managing Director
Head of Research
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