Building Secure Critical and Heavy Rare Earths Capacity

Long-term supply potential of the Critical Raw Materials required to help transition towards Carbon Neutrality

Cautionary Statement

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Competent Person Statement

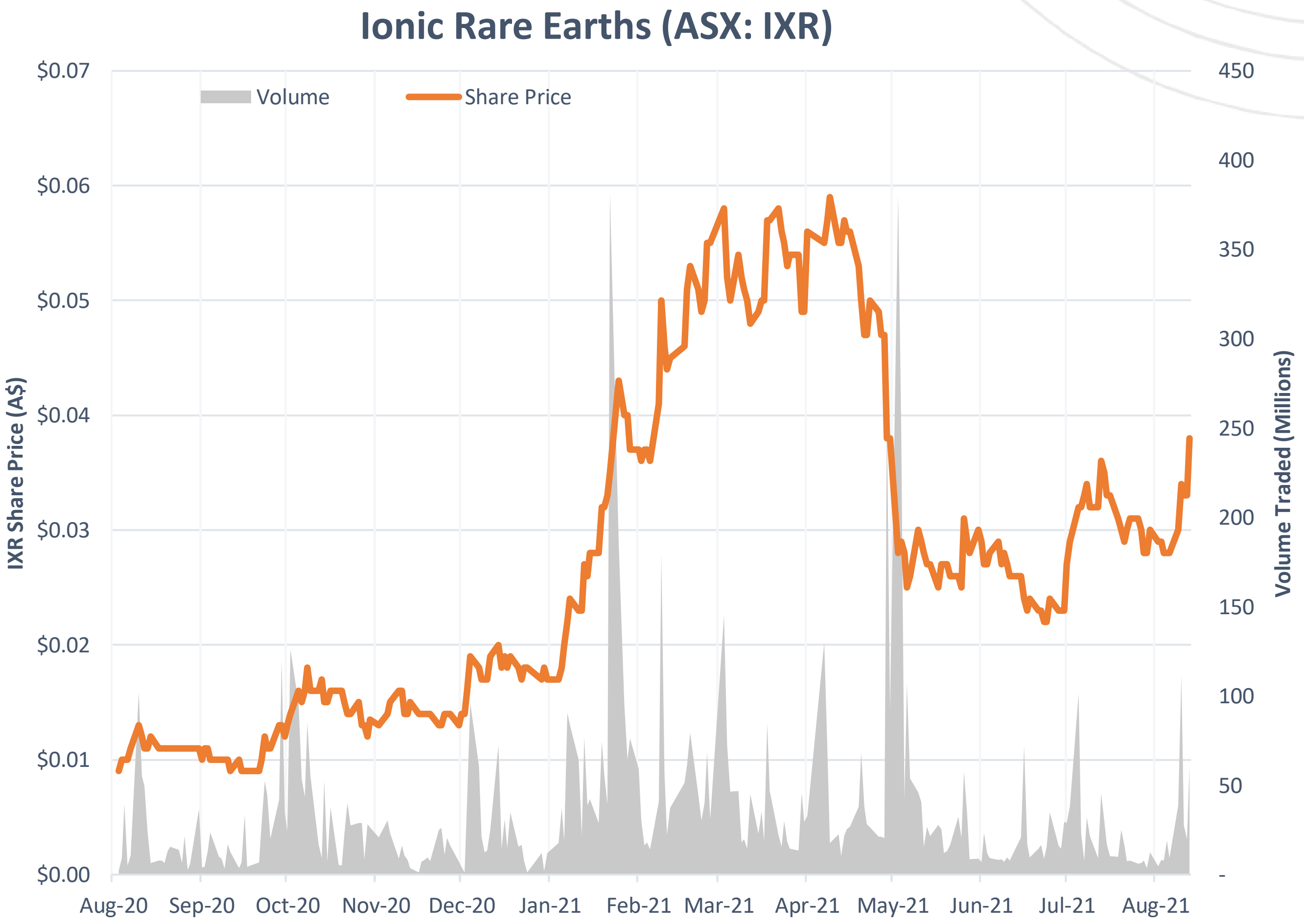
Information in this report that relates to previously reported Exploration Targets and Exploration Results has been crossed-referenced in this report to the date that it was originally reported to ASX. Ionic Rare Earths Limited confirms that it is not aware of any new information or data that materially affects information included in the relevant market announcements.

The information in this report that relates to Mineral Resources for the Makuutu Rare Earths deposit was first released to the ASX on 3 March 2021 and is available to view on www.asx.com.au. Ionic Rare Earths Limited confirms that it is not aware of any new information or data that materially affects information included in the relevant market announcement, and that all material assumptions and technical parameters underpinning the estimates in the announcement continue to apply and have not materially changed.

IonicRE Corporate Snapshot

STRATEGIC VALUE DRIVEN BY THE UNIQUE CREO/HREO BASKET

CAPITAL STRUCTURE (as @ 13/08/2021)	
Shares Outstanding	3,392,399,514
Total Options Outstanding	195,000,000 (exercisable at 1.8 to 6.0 cents)
Share Price	A$0.037
Market Capitalisation	A$126 million
52 week share price range	A$0.009 – A$0.065
Cash Balance (30/06/2021)	A$11.2 million
IXR MAJOR SHAREHOLDERS	
Major Shareholders	15%
Board, Executives, & Key Advisors	8%
BOARD AND MANAGEMENT	
Trevor Benson	Chairman
Tim Harrison	Managing Director
Jill Kelley	Executive Director
Max McGarvie	Non Executive Director
Brett Dickson	Company Secretary & CFO



The Time is Now

DEVELOPING A SECURE, TRACEABLE, CRITICAL AND HEAVY RARE EARTH SUPPLY CHAIN TO FACILITATE CARBON NEUTRALITY

The Mine – Makuutu

Makuutu is one of **less than a handful of global ionic adsorption clay (IAC) deposits** with scale to move the needle on HREO supply

Defined potential to supply **27+ year life of Mine**, with **significant exploration upside**

Simple **low capex mining and processing to produce Mixed Rare Earth Carbonate (MREC)**

No radionuclides

The Refinery – Secure Supply

Opportunity to **maximise overall revenue** from the Makuutu Mixed Rare Earth Carbonate (MREC) product

Alternative HREO refiner targeting western markets

Collaborate with western end users on **development of secure and traceable REO supply chain**

Expandable in future

The Basket – High Margin

One of the **highest value REO baskets of all projects** in development today

43% magnet REOs (Nd, Pr, Dy, Tb, plus Sm, Gd, Ho)

44% Heavy REOs (Sm to Y)

93% of forecast value derived from magnet REOs plus Y

Major source of future **Scandium** production

Increasing Demand, Reducing Supply – Becoming Urgent

World accelerating to carbon neutrality, with 8-fold demand increase in both EVs and offshore wind turbine forecast by 2030

ESG drive globally to **source sustainable critical raw materials**

Limited future HREO supply from declining reserves of IACs in southern China

Makuutu Rare Earths Project

Developing a Sustainable, Long-Life, CREO/HREO Supply

Harnessing the wide appeal of the Makuutu Basket

MAKUUTU PROVIDES A UNIQUELY BALANCED BASKET WITH 73% CRITICAL AND HEAVY RARE EARTHS

Scoping Study confirms **robust economics** for Base Case CREO and HREO production with **potential to extend beyond 27 + years Life of Mine (LOM)**

Strategic importance of Makuutu (51% IonicRE ownership moves to 60% on completion of FS ~ Oct 2022)

IonicRE has **pre-emptive right** on remaining 40% of the Project

Makuutu is unique and receiving global interest due to **high quality balanced** (CREO + HREO) basket

Non-binding MOU signed with Chinalco subsidiary **China Rare Earths Jiangsu** to accelerate Makuutu mine development to production

Discussions continue with other groups looking to secure long-term CREO/HREO supply, and **potential feed to standalone IonicRE Rare Earth Refinery**

Infrastructure in close proximity to Makuutu

- Existing highway and road access to site plus rail
- Nearby 132 kV power infrastructure with readily available low-cost hydropower
- Cell phone communications available across site
- Water available

Potential for **significant Exploration upside at Makuutu** still to be realised

Already one of **worlds largest Ionic Adsorption Clay (IAC) deposits**

Highly prospective licence EL00147 recently tested via RAB drilling with **assays confirming clay hosted REE mineralisation present**

Phase 4 drilling program underway to increase Indicated and Measured resource base

Makuutu Rare Earth Project Highlights

STRATEGIC VALUE DERIVED BY THE UNIQUE CREO/HREO DOMINANT BASKET

Ionic Adsorption Clay (IAC) deposit mineralisation is highly desirable given it produces a balanced **REO basket dominant in CREO & HREO**

Globally one of the largest IAC deposits discovered outside of southern China and SE Asia & one of less than a handful of economic size and scale

High margin basket potential, approx. **73% of basket is CREO+HREO, magnet REOs make up 43% of basket**

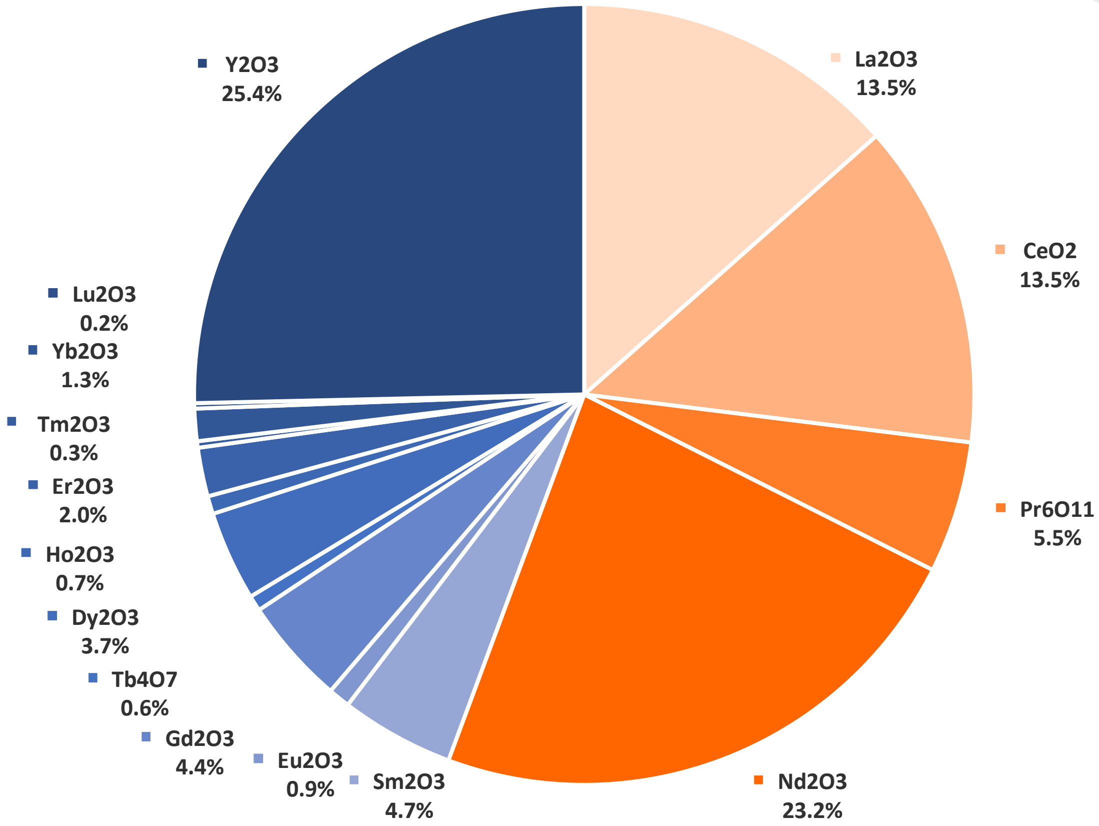
Scoping Study[1] completed in April 2021 defined a **very robust base case** with **potential upside out to 27 years**

315 Mt Mineral Resource Estimate[2] with **significant exploration upside** confirmed with mineralisation stretching across 37 km trend

Global Appeal – Strategic importance of Makuutu product basket seen as critical for governments to **deliver carbon neutral policy objectives** & major appeal to **key defence applications**

Scandium upside is significant with MRE containing ~9,450 tonne Sc_2O_3, potential annual production from 25 to ~100 tonnes per annum

MAKUUTU BASKET
HIGH VALUE CREO / HREO PRODUCT



[1] Makuutu Rare Earths Project Scoping Study reported to ASX on 29 April 2021. [2] Makuutu Mineral Resource Estimate announced 3 March 2021.

Tier-One In-Country Infrastructure already there!

EXCELLENT LOCAL INFRASTRUCTURE SUPPORTS LOW CAPEX DEVELOPMENT

LOGISTICS

Approximately 10 km from Highway 109, connecting Makuutu to both capital city Kampala and Port of Mombasa, Kenya

Approximately 20 km from rail line connecting to Port of Mombasa

POWER

Large hydroelectric generation capacity (+810MW) within 65 km of Makuutu Project area will deliver very low-cost (US$0.05/kWh), plus further capacity being developed

Existing electrical grid infrastructure immediately adjacent to site to provide stable power

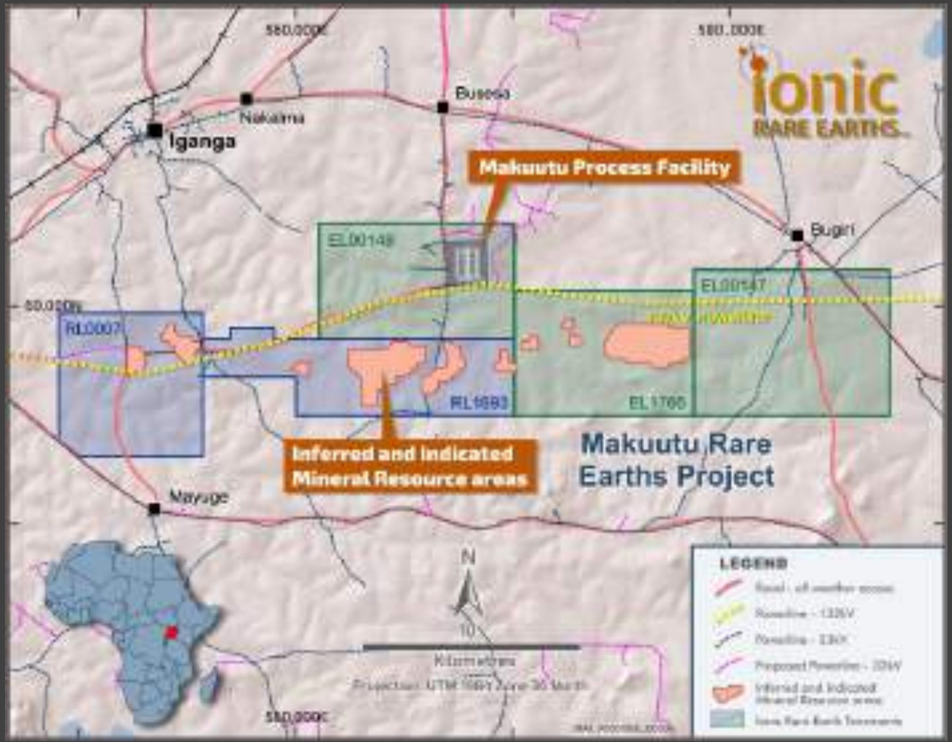
WATER

Plentiful fresh water within and near project area (water harvesting)

WORKFORCE

No camp required – low-cost professional local workforce available

Excellent local infrastructure supports low CAPEX development



Clockwise, top left: Isimba hydroelectric dam with 183 MW installed capacity at Jinja; Uganda's excellent hydro-power transmission infrastructure, with 132 kV power lines running through tenements and immediately adjacent proposed plant site; Rail line connecting to Kampala and Port of Mombasa; All weather access roads across tenements connecting site to highways; Sealed highway running directly adjacent site.

315 Mt Ionic Adsorption Clay (IAC) Mineral Resource Estimate with Upside

FURTHER IAC TARGETS IDENTIFIED AT MAKUUTU

279 drill holes (4,754 metres) completed between October 2019 and October 2020 defining **JORC MRE[1] of 315 Mt @ 650 ppm** Total Rare Earths Oxide (TREO), at a cut-off grade of 200 ppm TREO-CeO_2

67 RAB drill holes (Phase 3) announced in July **confirmed extension of mineralisation east to EL00147, between previous identified radiometric anomalies, and to northwest (application TN03573 pending)**

Phase 4 infill drilling program now underway (5,700 m approved) to be completed by November to feed into next **MRE update planned for H1 2022**

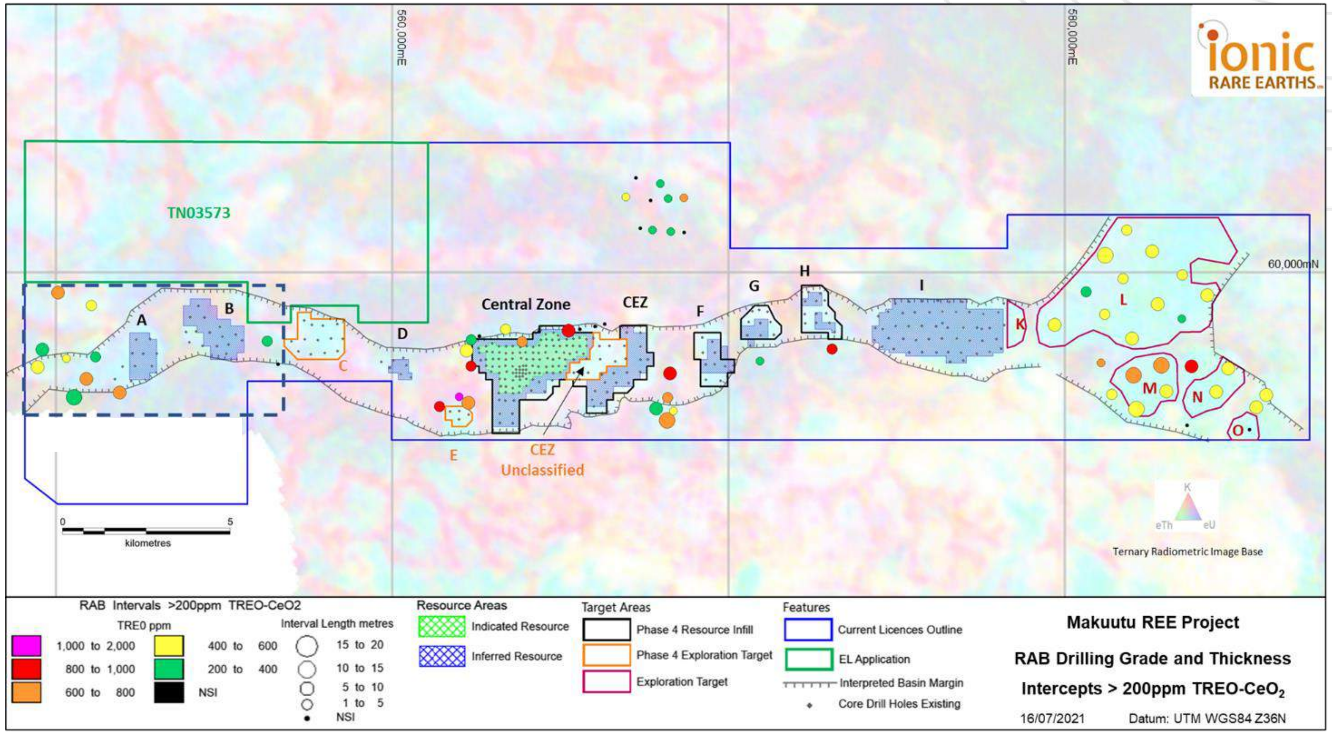
Plan to **increase Indicated and Mineral Resource classifications** to support Feasibility Study in 2022

Near term exploration extension from areas that haven't yet converted (Areas C, E, Central Eastern Zone) so expecting total MRE will increase

Shallow, near surface IAC mineralisation, with clay layer averaging 5 to 12m thick under cover approximately 3m deep. Average hole depth ~17m

Longer term, **numerous exploration targets identified** for drilling in 2022

Scandium currently not included in cut-off grade determination



Category	Estimation Domain	Tonnes (Mt)	TREO (ppm)	TREO no CeO_2 (ppm)	LREO (ppm)	HREO (ppm)	CREO (ppm)	Sc_2O_3 (ppm)
Indicated	Clay	66	820	570	590	230	300	30
Inferred	Clay	248	610	410	450	160	210	30
Total Resource	**Clay**	**315**	**650**	**440**	**480**	**170**	**230**	**30**

[1] Makuutu Mineral Resource Estimate reported to ASX on 3 March 2021. [2] Phase 3 RAB results announced 15 July and 20 July 2021.

Makuutu and Critical Raw Materials 2020

MAKUUTU BASKET CONTAINS HIGH RANKED CRMs IDENTIFIED IN 2020 EU STUDY REQUIRED TO ACHIEVE CARBON NEUTRALITY

Secure and sustainable supply of both primary and secondary raw materials, specifically of critical raw materials (CRM)

Targeting key technologies and strategic sectors as renewable energy, e-mobility, digital, space and defence is one of the **pre-requisites to achieve climate neutrality**

European Commission report identified Global **competition for resources will become fierce in the coming decade**

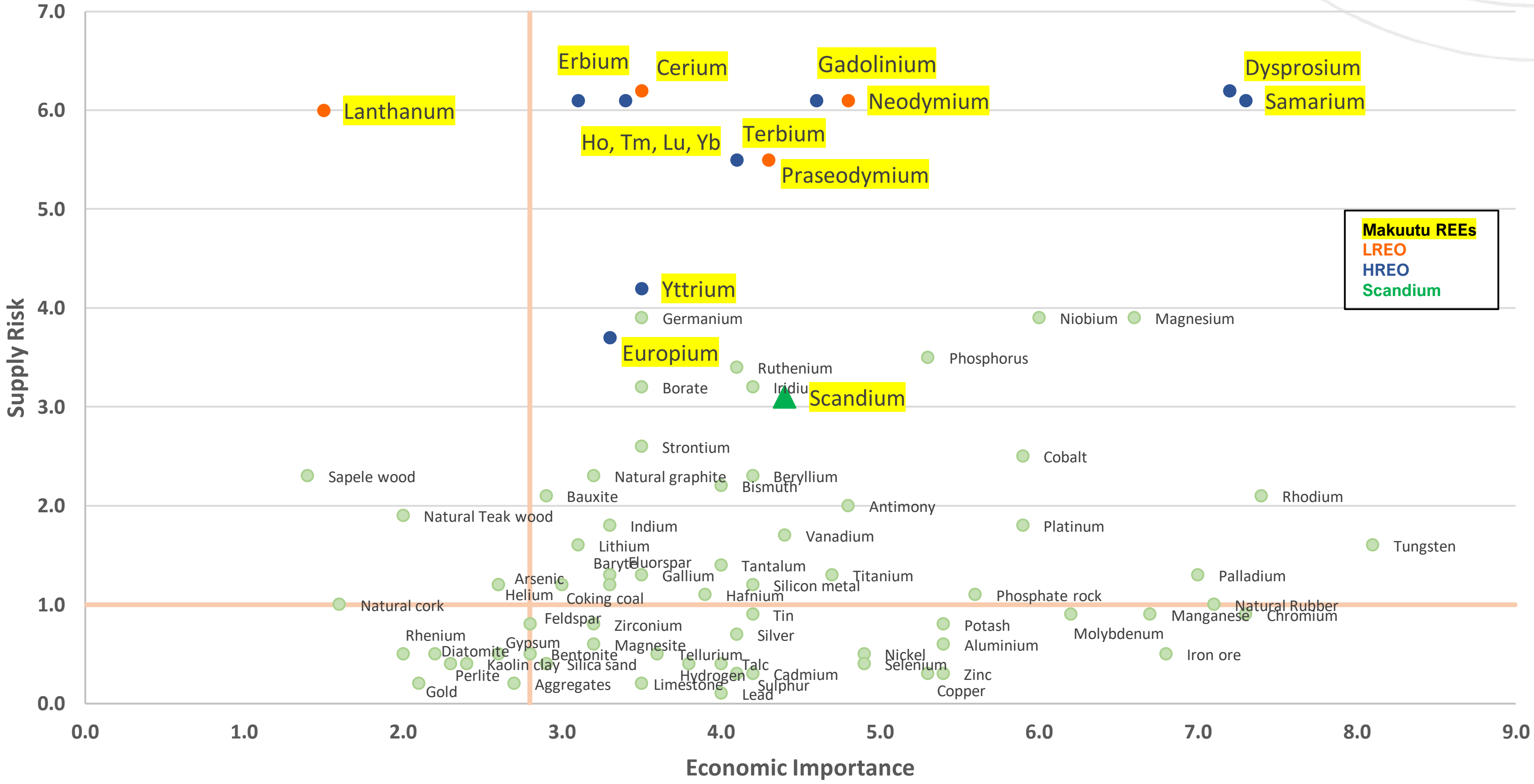
Dependence of critical raw materials may soon replace today's dependence on oil

Makuutu has all the REO requirements in appreciable quantities

Scandium potential at Makuutu to **facilitate light weighting transportation**

Long term stable supply is not a given – will **require investment further up the supply chain**

Economic Importance vs Supply Risk results for 2020 criticality assessment[1]



[1] European Commission, Study on the EU's list of Critical Raw Materials – Final Report, 2020.

REO Pricing Basis

MAKUUTU’S STRATEGIC IMPORTANCE WILL INCREASE LONG TERM

Where are the HREO going to come from beyond 2030?

95% of current world supply of HREO supplied from Chinese/Myanmar IAC deposits which are being depleted

REO demand increasing at rates that exceed forecast driven by Government Stimulus spending on electric vehicles (EVs), renewable energy, communications, defence

Global governments mandate change with Internal Combustion Engines (ICE) to be banned in several countries from 2025, with significant changes expected in Europe where demand driven by government incentives will see it overtake China by 2030 as the largest market for EVs

Offshore wind turbines need DyTb

Pledges to add 230 GW of offshore wind turbine demand committed by 2030, 1400GW target by 2050 (?)

Makuutu’s basket ~ 43% magnet REOs (Nd, Pr, Dy, Tb, Sm, Gd, Ho)

“When peering into the outlook for the next decade to come, it becomes quickly apparent that the rapid demand growth of the 2020s will soon be dwarfed by the astronomical demand growth of the 2030s – and therein lies the real defining challenge and opportunity facing the global rare earth industry today.

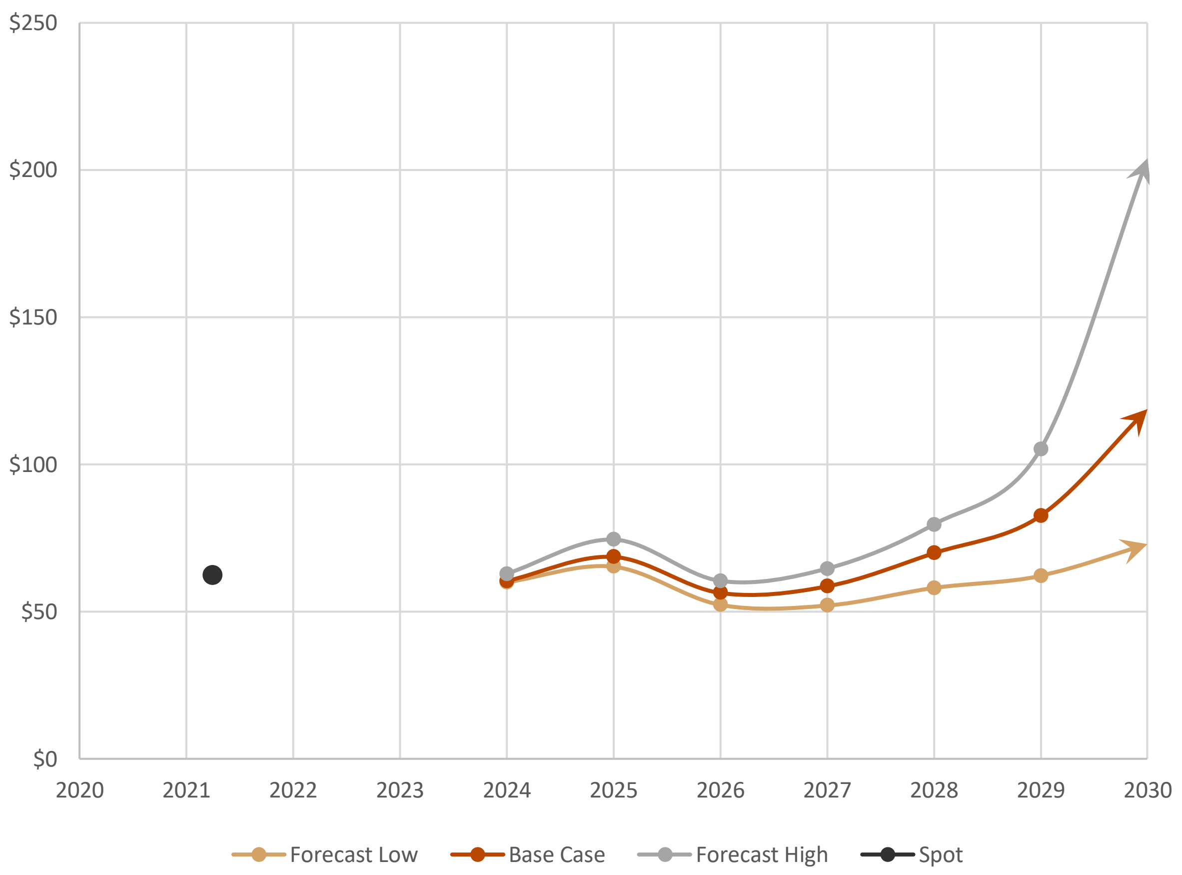
If the global industry continues to operate myopically – preparing, anticipating and investing only for a three to five-year outlook – the rate of demand growth for magnet rare earths will soon reach ‘escape velocity’; a point at which annual demand growth becomes so great (i.e. >6,000 tonnes per annum) that it is simply implausible for the already-lagging supply-side to catch up and keep up.”

Adamas Intelligence, Sept 28, 2020

Makuutu CREO & HREO Dominant Product Basket Value

REO PRICING TO 2030….

MAKUUTU PRODUCT BASKET[1], US$/KG



Makuutu's basket value which is **73% CREO + HREO dominant**

Forecast to experience **substantial appreciation over next 10 years**

Declining IAC reserves and production from China **will reduce availability of HREO to global consumers**

All CREO and HREO forecast pricing out to 2030 has been trending up since China's Export Control Ban was implemented in November 2020

Long-term magnet REO pricing forecasts released since March 2021 continue to increase, with supply deficits pending sooner than previously expected

Yttrium pricing forecast for significant increase by end of the decade

[1] Pricing specific to Makuutu product basket calculated based upon Argus Analytics research released 26 March 2021

ESG initiatives ‘front and centre’ at Makuutu

ENVIRONMENT, SOCIAL AND GOVERNANCE (ESG) FRAMEWORK IN DEVELOPMENT TO BUILD LASTING LEGACY

Environmental and Social Impact Assessment (ESIA) in progress

Baseline environmental surveys completed

Focus on carbon footprint reduction using renewable power

Rehabilitation plans aim to ensure net positive climate legacy

Water treatment for reagent recovery and rehabilitation strategy

Rehabilitation to consider development of longer term industrial programs for employment

Aligned with Uganda’s 3rd National Development Plan (NDPIII)

Agricultural Programs to increase productivity

Aquaculture and fish farming

Agroforestry

Community Support Programs identified

Working together to build a future where everyone has a pathway to health and opportunity

Establishment of an Advisory Committee to coordinate community development investment priorities

Key focus being community health and education

Community socio-economic baseline surveys across initial project area underway

Establishing Ugandan team to drive Project activity in country

Community and Stakeholder engagement ramping up

Local support for sub-district health clinics during Covid-19

Investment in Uganda – The Pearl of Africa

MAJOR INTERNATIONAL INVESTMENT INTO UGANDA IS UNDERWAY

- Ugandan law allows for 100% foreign-owned businesses, and foreign businesses are allowed to partner with Ugandans without restrictions.
- The US$10B Lake Albert Oil Project (Total (56.67%), CNOOC (28.33%) and UNOC (15%)) development encompasses Tilenga (operated by Total) and Kingfisher (operated by CNOOC) upstream oil projects in Uganda, delivering a combined production of 230,000 barrels per day, and the construction of the East African Crude Oil Pipeline (EACOP) transporting from the oilfields in Uganda 1440km to the port of Tanga in Tanzania.
- Uganda is rich in natural resources. Foreign Direct Investment (FDI) mainly goes to the coffee and mining sectors. Kenya, Germany and Belgium are the country’s main investors.
- Good support from government agencies including the Directorate of Geological Survey and Mines (DGSM)
- Transparent Mining Cadastral system implemented in Uganda for tenement management
- Ugandan Mining Act 2003 outlines royalties for base metals at 5%
- Corporate Tax Rate = 30%
- Asset depreciation given Project is > 50km from Kampala is 50% initial depreciation allowance, and 100% of the assets in a 3-year period.

Foreign Direct Investment[1]	2017	2018	2019
FDI Inward Flow (million US$)	803	1,055	1,266
FDI Stock (million US$)	11,996	13,051	14,317
Number of Greenfield Investments	8	17	29
Value of Greenfield Investments (million US$)	290	366	960

[1] Source: UNCTAD - Latest available data.

Independent REE Separation and Refining Capacity

Mine to Market HREO initiative from long-life supply at Makuutu

China Dominates Global REE Separation & Refining Capacity

ALL HEAVY RARE EARTH ROADS LEAD TO ….. CHINA

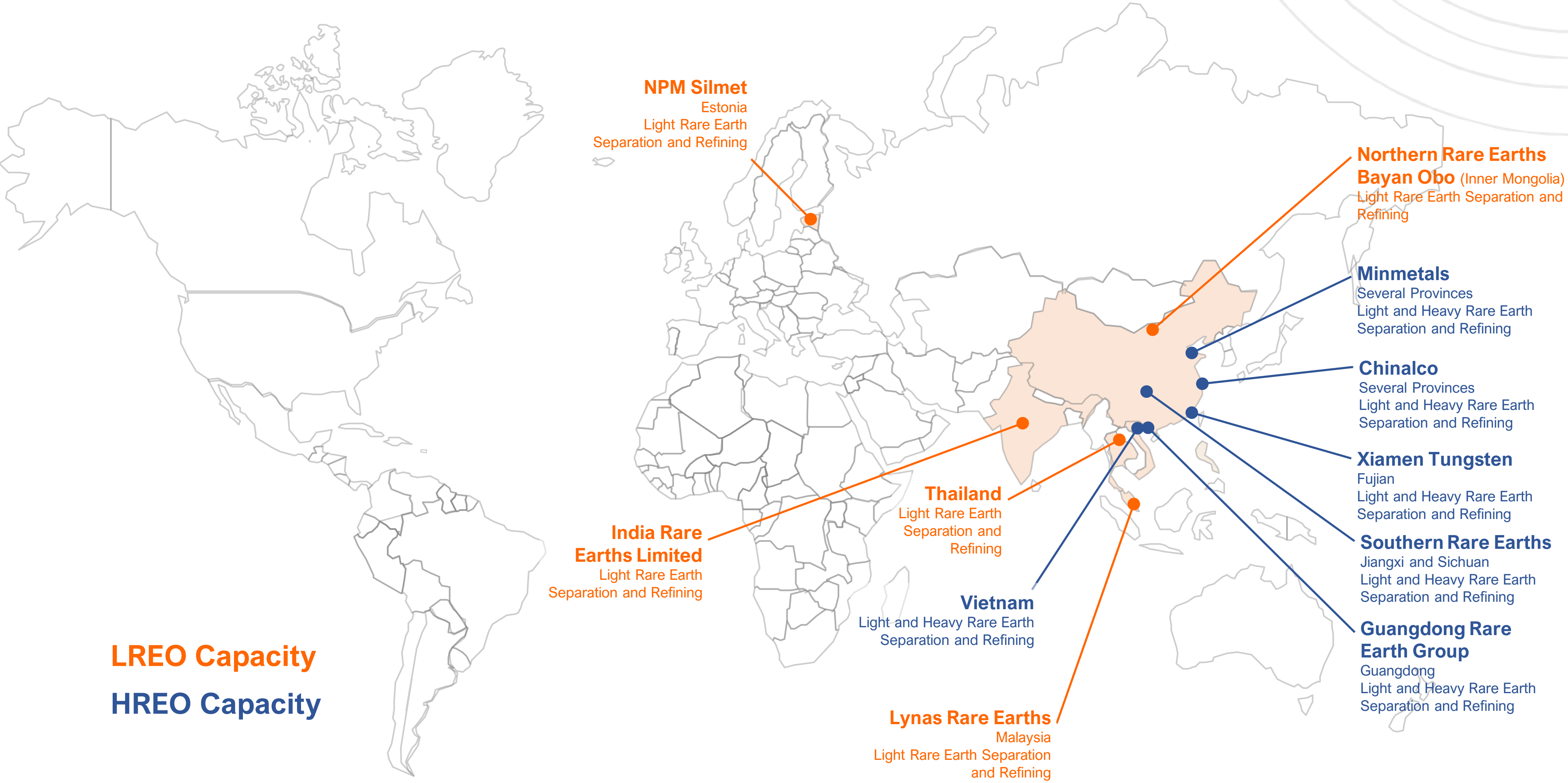
Global HREO separation and refining capacity operated and controlled by China[1]

Small capacity identified in Vietnam

China Rare Earths Jiangsu operate 4 REO Refineries
- Chinalco (Changzhou)
- Chinalco (Funing)
- Chinalco (Yixing)
- Chinalco (Changshu)

HREO refining plants in US under consideration but no committed timelines as yet

IonicRE to consider best global Refinery location with direct access to sell product to partners in US, UK, Europe, and Asia



[1] Argus Analytics.

Standalone Refinery to unlock value of balanced basket REOs

DEVELOPMENT OF REFINERY TO PRODUCE SEPARATED REOs OF INCREASING DEMAND AND DECREASING SUPPLY

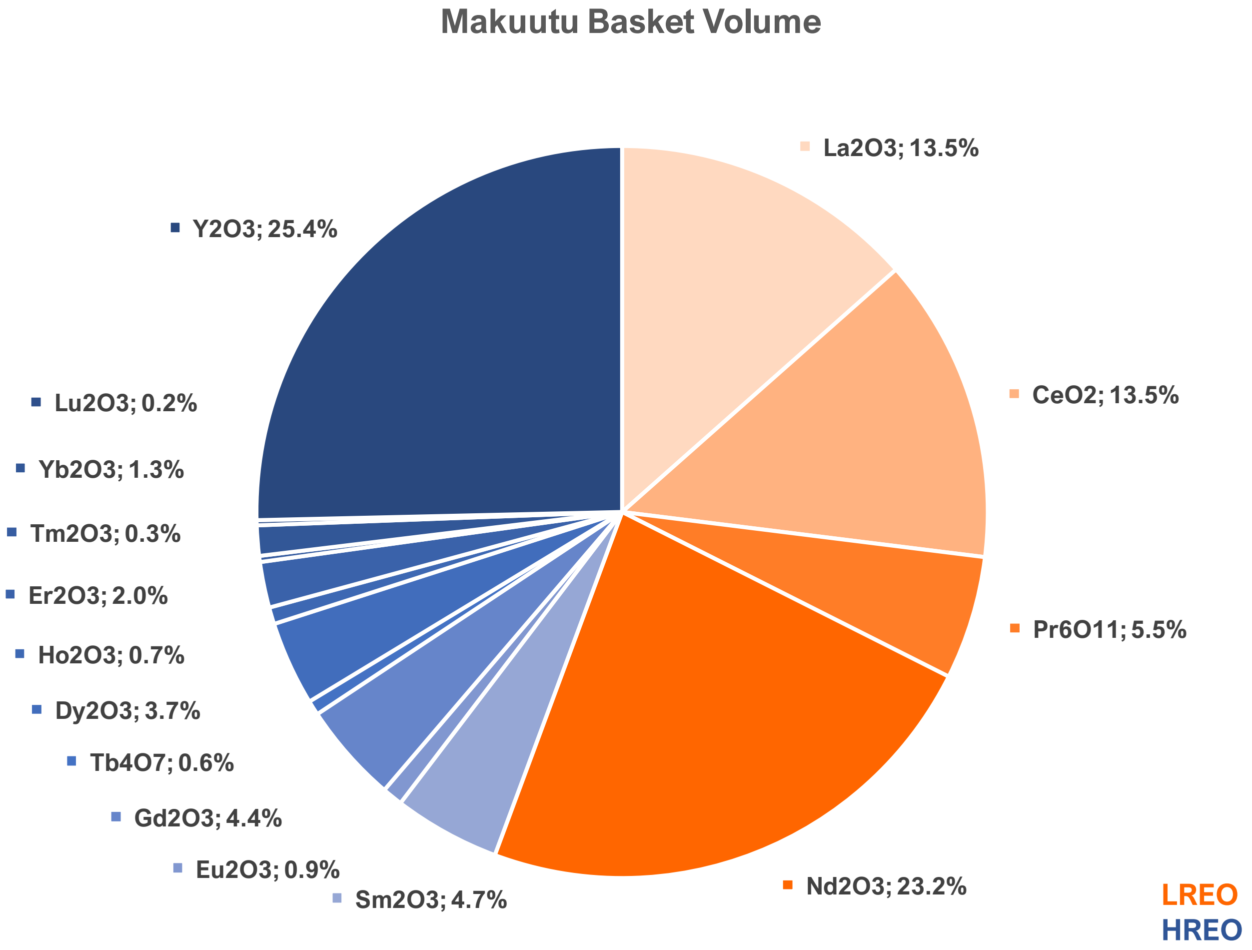
- Rare earth separation and refinery facility developed to take advantage of long life, secure and traceable supply source from Makuutu
  - 27+ years producing a basket with suite of individual REE that will be worth more in the future
  - Increase of Makuutu MRE → extension of life or increased production capacity → increased appeal to go downstream
- Ability to increase revenue from Makuutu basket
  - MREC payability from Makuutu = 70%
  - Separating and refining increases REO payability = 100%
- Potential to source additional HREO feed stocks (as heavy MREC products) by other REE mines for additional revenue generation
- Facilitate the value of the refined REOs into downstream industry
  - Opportunity for OEMs to participate in secure and traceable supply chain
- Maximise revenue upside from development of the Sc market

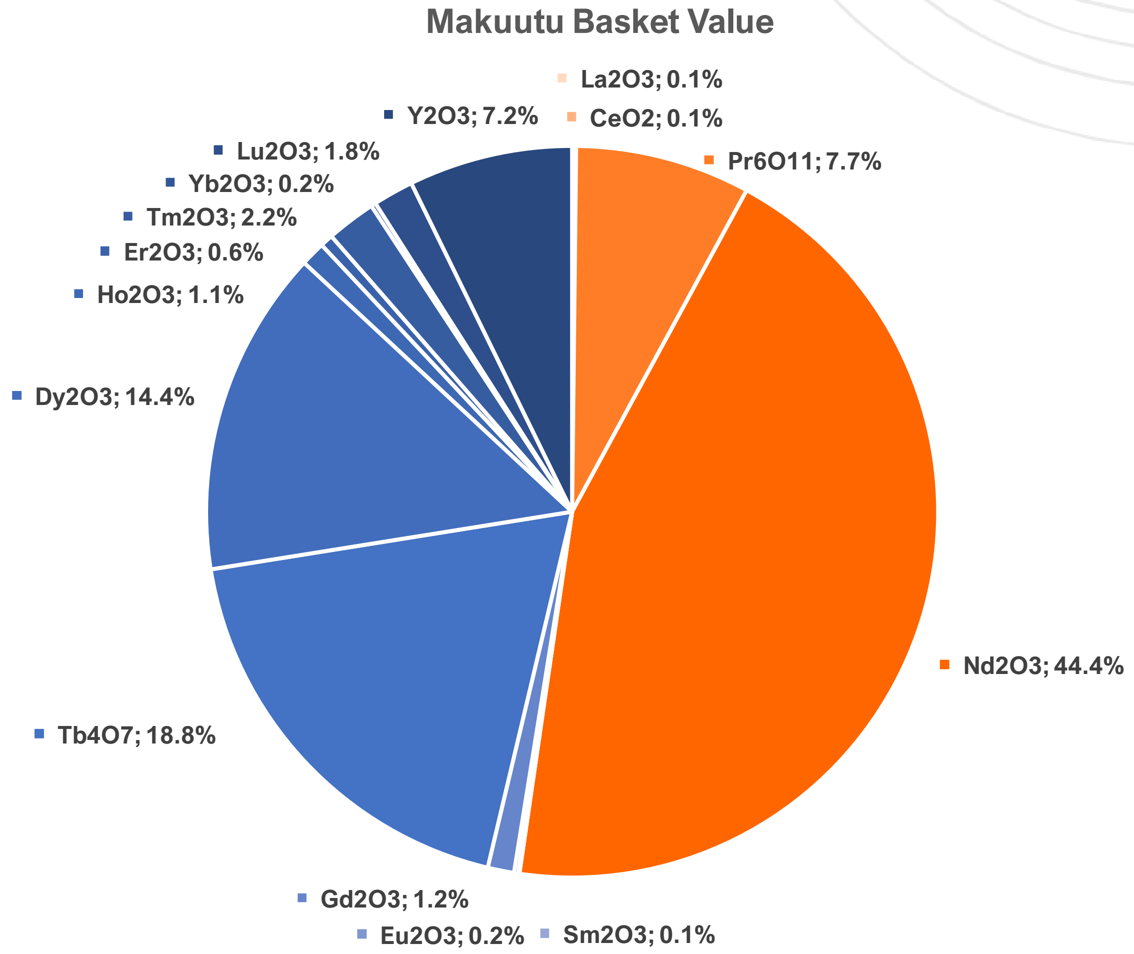
Rare Earth Element	REO Production Capacity[1] (t/annum)	Major Applications and Uses
Lanthanum (La)	580	Battery alloys, metal alloys, auto catalysts, petroleum refining, polishing powders, glass additives, phosphors, ceramics, and optics
Cerium (Ce)	550	Battery alloys, metal alloys, auto catalysts, petroleum refining, polishing powders, glass additives, phosphors, and ceramics
Praseodymium (Pr)	220	Permanent magnets, battery alloys, metal alloys, auto catalysts, polishing powders, glass additives and colouring ceramics
Neodymium (Nd)	1,000	Permanent magnets, battery alloys, metal alloys, auto catalysts, glass additives and ceramics
Samarium (Sm)	180	Magnets, ceramics, and radiation treatment (cancer)
Europium (Eu)	35	Phosphors, optical fibres, flat panel displays
Gadolinium (Gd)	170	Ceramics, nuclear energy, and medical (magnetic resonance imaging X-rays)
Terbium (Tb)	25	Permanent magnets for high temperature applications, fluorescent lamp phosphors, defence applications
Dysprosium (Dy)	140	Permanent magnets, defence
Holmium (Ho)	30	Permanent magnets, nuclear energy and microwave equipment
Erbium (Er)	75	Nuclear energy, fibre optic communications, and glass colouring
Thulium (Tm)	11	X-rays (medical) and lasers
Ytterbium (Yb)	65	Cancer treatment and stainless steel
Lutetium (Lu)	10	Age determination, medical and petroleum refining
Yttrium (Y)	1,000	Battery alloys, metal alloys, phosphors, catalytic converters, ceramics and defence
Scandium (Sc)	120	High strength, low weight aluminium scandium alloys, solid state energy storage, 3D printing, high intensity lighting

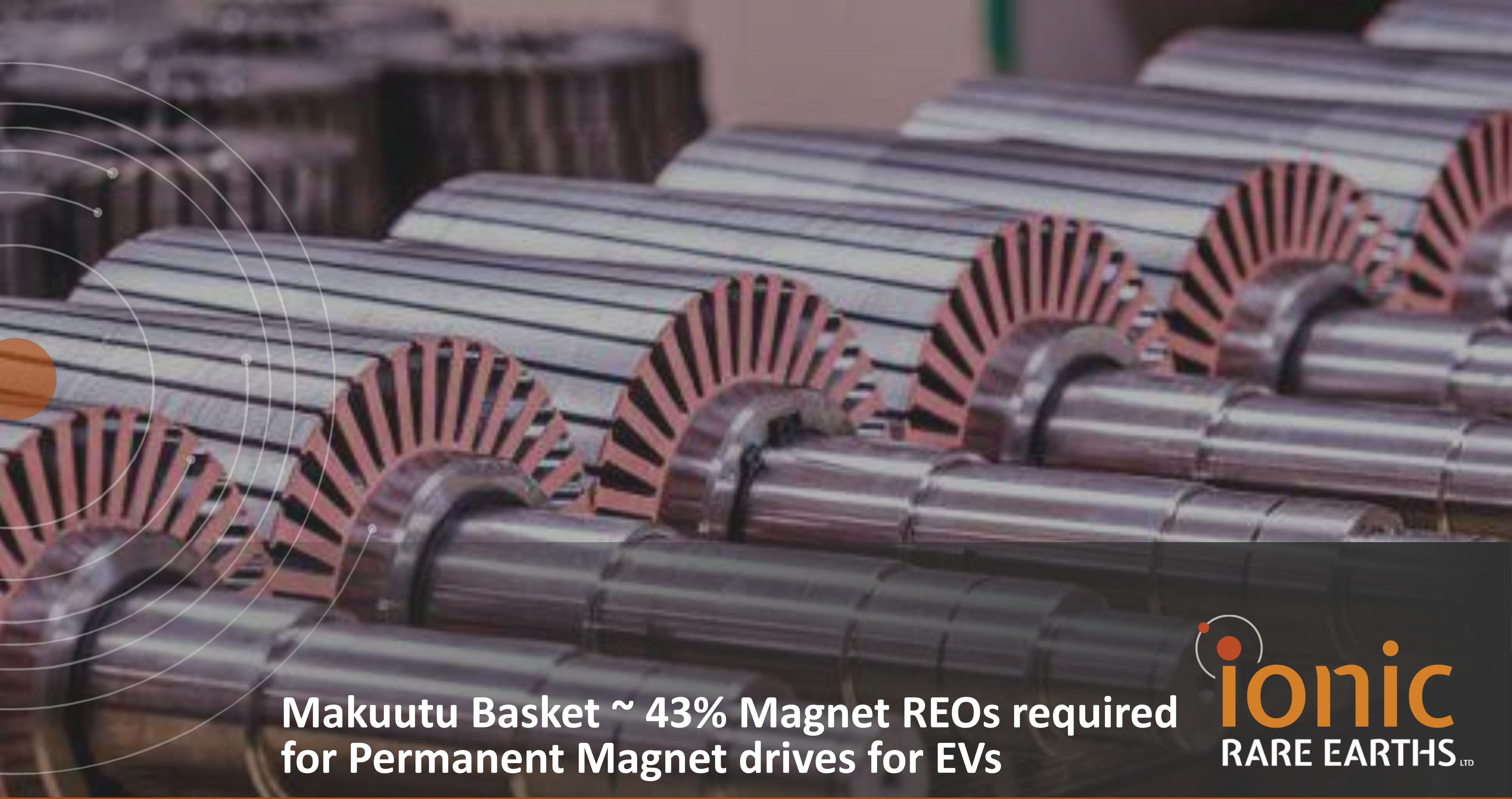
[1] ASX Announcement 9th August 2021.

Makuutu is Unique – Basket is the Key

INITIAL REFINERY PRODUCTS Nd, Pr, Dy, Tb, Y AND Sc CONTAIN > 93% OF POTENTIAL REVENUE







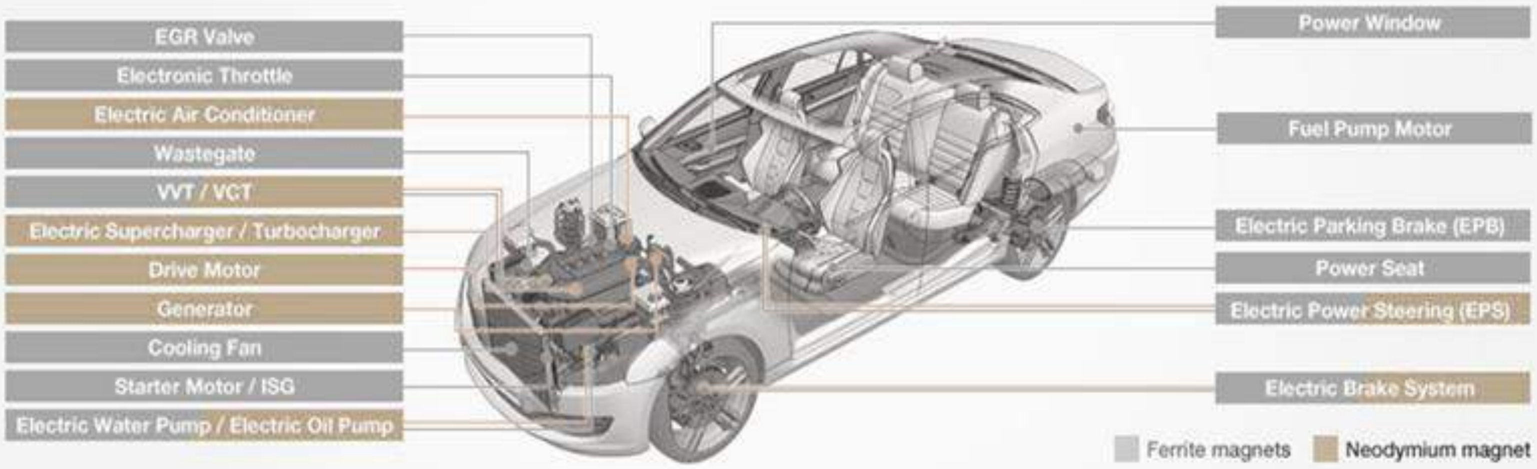
Makuutu Basket ~ 43% Magnet REOs required for Permanent Magnet drives for EVs

ionic RARE EARTHS LTD

Electric Vehicles – Driven by NdPr (and DyTb)

Nd, Pr, Dy & Tb EXPECTED TO BE IN DEFICIT BY 2027

- Worldwide EV demand driving insatiable appetite for NdPr
- NdFeB permanent magnets (PM) are essential for producing light, compact and high efficiency traction motors. Approx. 28-32% of the NdFeB magnet is magnet NdPr, with DyTb used as a minor additive (~4-8%) to improve magnet performance at high temperatures[1]
- Global governments mandate change with ICE to be banned in several countries from 2025, with significant changes expected in Europe where demand driven by government incentives will see it overtake China by 2030 as largest market for EVs
- Global EV sales in 2020 ~ 3.1 million, with global EVs sales expected to hit ~11 million in 2025, and ~23 million by 2030[2]



Proposed Internal Combustion Engine (ICE) Bans	
Year	**Country**
2025	Norway
2030	Denmark, Iceland, Ireland, Netherlands, Slovenia, Sweden, UK
2040	France, Spain
2050	Japan

[1] Pavel, et al., Role of substitution in mitigating the supply pressure of rare earths in electric road transport applications, 2017; Roskill, Rare Earths: Outlook to 2030, January 2021;
[2] Argus Analytics, March 2021;

Makuutu Basket – Producing Dy and Tb required for offshore wind turbines

Land Constrained – Go Offshore

COUNTRIES ADOPT OFFSHORE WIND TURBINES TO REACH CO_2 TARGETS

Current world offshore wind turbine capacity is 36 GW

Argus[1] estimates an additional 200 GW of installed offshore wind turbine capacity to be added by 2030, → 20% CAGR for the remainder of the decade

In its 2019 World Energy Outlook, the International Energy Agency (IEA) Sustainable Development Scenario has up to 570GW of offshore wind in 2040. If achieved, the world would be on track to reach about 1TW in 2050[2].

The International Renewable Energy Agency (IRENA) also has a 1TW ambition by 2050.

US DOE announced in March 2021 plan to develop 30GW of offshore wind turbine by 2030. Further, Achieving this target also will unlock a pathway to 110 GW by 2050.

Makuutu's existing MRE has the potential to supply the magnet REOs (in the right ratio) required for the development of 90 GW of offshore wind capacity

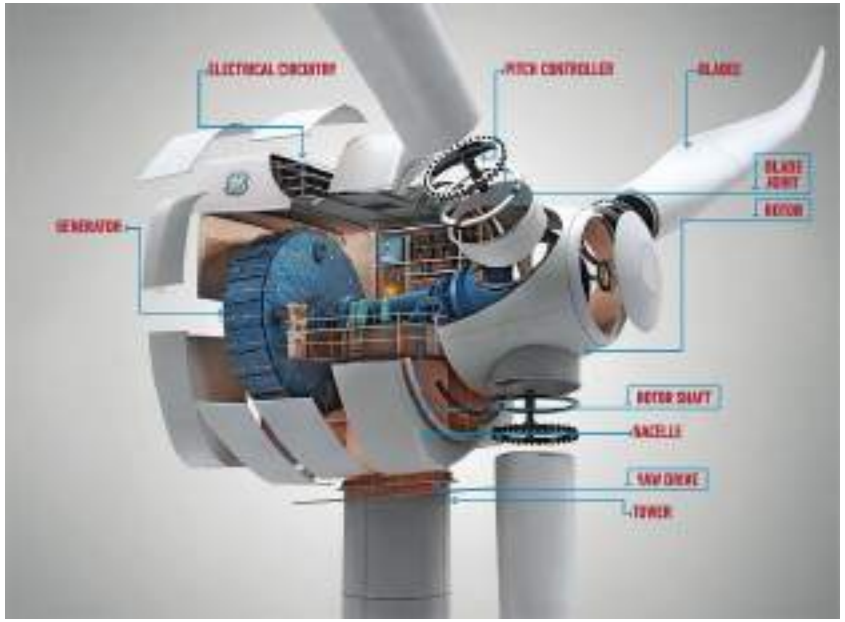
[1] Argus analytics, March 2021; [2] Ocean Renewable Energy Action Coalition, The Power of our Ocean, December 2020;

Without DyTb – No Offshore Wind Turbine Capacity

THE BASICS – HOW MUCH REO IS REQUIRED PER MW OF OFFSHORE TURBINE CAPACITY?

Rare-earth elements and boron (B) are essential for turbine designs that employ permanent magnets (NdFeB). The HREOs Dy_2O_3, Tb_4O_7 and in some cases Ho_2O_3, can be substituted to improve the operability of the NdFeB magnets. Adding these HREOs helps the high temperature direct drive turbines maintain their magnetic characteristics[1]. Substitution is not an option.

Most direct-drive turbines, but also to different extents certain technical designs with gearboxes, are equipped with permanent magnet generators, which contain NdPr and smaller quantities of DyTb. On average, a permanent magnet contains 28.5% NdPr, 4.4% DyTb, 1% B and 66% Fe and weighs up to 4 tonnes for a 6MW offshore direct drive wind turbine[2].



HALIDE* 150-MV OFFSHORE WINE TURBINE

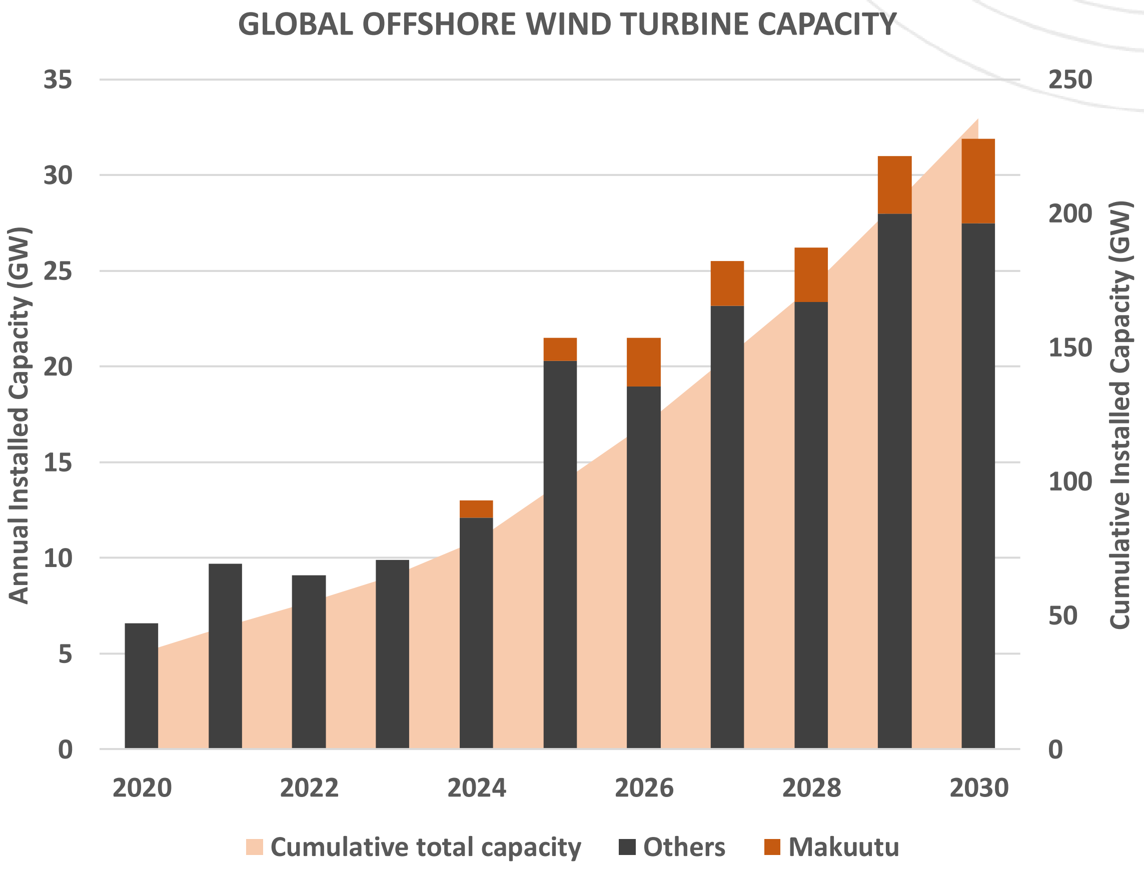
- Each 6 MW of offshore direct drive wind turbine capacity requires ~ 1,700 kg magnet REOs;
  - ~210 kg/MW Nd2O3 x 6 MW = 1,260 kg Nd_2O_3
  - ~42 kg/MW Pr6O11 x 6 MW = 254 kg Pr_6O_{11}
  - ~20 kg Dy2O3 x 6 MW = 117 kg Dy_2O_3
  - ~8 kg Tb4O7 x 6 MW = 49 kg Tb_4O_7
- HaliadeX 13 MW offshore direct drive wind turbines now under development

[1] Roskill, Rare Earths: Outlook to 2030, January 2021; [2] European Commission, Raw materials demand for wind and solar PV technologies in the transition towards a de-carbonised energy system, 2020; [3] Li et al., One Earth 3, Critical Rare-Earth Elements Mismatch Global Wind Power Ambitions, 2020; Haliade 150-6MW turbine by GE Renewable Energy @GErenewables;

Makuutu & Offshore Wind Turbine Capacity

MAGNET REO – SUPPLY FAILING DEMAND → 'ESCAPE VELOCITY' BY 2027

- Forecast offshore capacity increase by 200 GW by 2030[1,2]
- 2020 global offshore wind turbine capacity of 36 GW, with 2020 installations of 6.6 GW (+20% of 2019 capacity)
- Beyond 2030 the rate of growth of offshore wind turbine appears to exceed the capability to supply magnet REOs
- By 2025 forecast supply of magnet REOs is forecast to be below demand
- By 2027 heavy magnet REOs Dy_2O_3 and Tb_4O_7 significantly in deficit
- By 2030 demand of magnet REOs forecast to exceed supply by 40%
- Projections of future wind turbine installation growth beyond 2030 to 2050 have highlighted the inadequacy of existing REO supply chains, with an estimated 11-to-26-fold expansion of current magnet REO supply required to meet global wind turbine targets[2].
- Makuutu magnet REO production ramped up from 2024 to supply an estimated 17 GW of offshore wind turbine capacity by 2030, 11-year LOM estimated to enable 35 GW of capacity, LOM potential 90+ GW of capacity



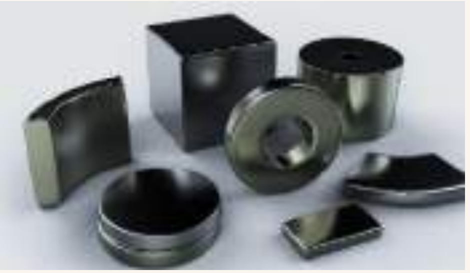
[1] Argus Analytics 26 March 2021. 2 Li et al., One Earth 3, Critical Rare-Earth Elements Mismatch Global Wind Power Ambitions, 2020.
[2] Excludes US DOE plan to add 30 GW by 2030

Key HREO Applications without Substitute – New Supply Required

HREO USED IN HIGH END FOR NICHE APPLICATIONS – NO SUBSTITUTION FOR REOS IN SPECIFIC APPLICATIONS

MRI Machine

PET Scan



NdFeB and SmCo permanent magnets

Erbium is a key input into enabling 5G technology

- IAC mines in southern China and Myanmar produce approximately 95% of the worlds production of HREO
- Export Control Ban implemented by China on 1 December 2020 now focused on prioritising Chinese consumption and strategic stockpiling
- High-value niche medical applications such as
    - Magnetic Resonance Imaging (MRI) machines using Gd;
    - Positron Emission Tomography (PET) imaging using Lu;
    - X-rays, Solid-state lasers, optical isolators and microwave equipment using Er, Ho, Tm, Yb, Y;

- Critical applications REE are essential for electronic devices as permanent magnets (PM) in speakers, computer components, global positioning systems (GPS), sonar, defence systems and lasers – will start to see this flow through to consumer item availability and cost
- Er is a key input into enabling 5G technology – Erbium doped fibre amplifiers (EDFA) are used to compensate the loss of an optical fibre in long-distance optical communication and can amplify multiple optical signals simultaneously. No Erbium, No 5G.
- Nuclear power plant use Sm-Co permanent magnets, and Dy & Er in neutron-absorbing control rods.

Makuutu has Strategic Appeal for Defence Applications

HREO & CREO crucial in Defence Applications

DEFENCE HREO SUPPLY CHAIN – MAKUUTU POTENTIALLY SUPPLIES IT ALL

- Numerous HREO & CREO materials are used in defence applications in the engines, disk drive motors, radar of the aircraft, fin actuators in missile guidance and control systems, control devices in tanks, missile systems, command and control centres; lasers, interrogators, underwater mines, countermeasures; satellite communications, radar, and sonar on submarines and surface ships; optical equipment and speakers, components in anti-missile defense systems, satellites and night vision devices among others.
- REE metals used in F-35 fighter (417kg); Virginia-class submarine (4,170kg); and Arleigh-Burke guided missile destroyer (2,360kg).
- Terfonal-D is a rare earth alloy made of Tb, Fe and Dy that is used in high-power sonar on ships and submarines.
- Stealth helicopters also use Terfenol-D speakers in their noise cancellation technology blades and NdFeB magnets.

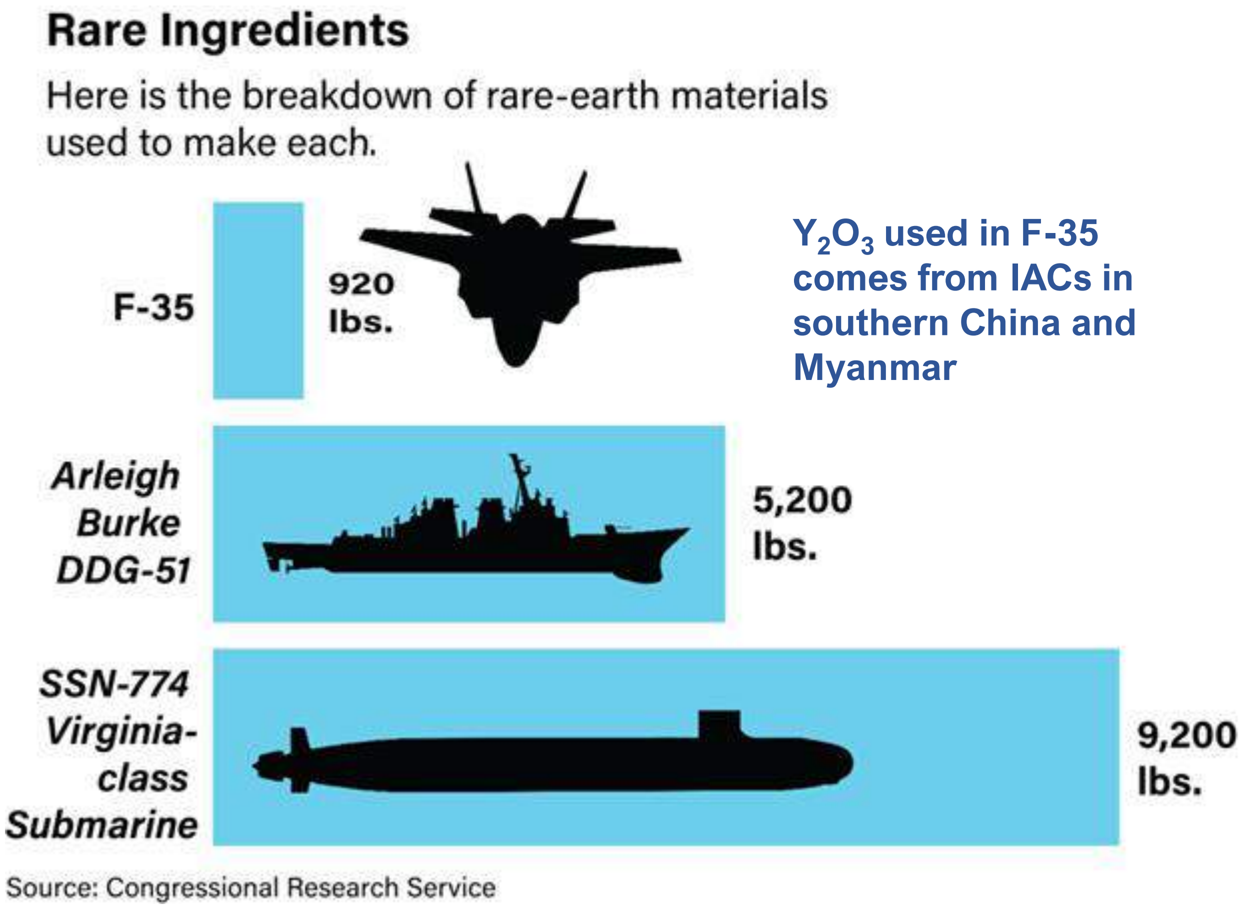
PRODUCT / APPLICATION	RARE EARTH ELEMENT (REE)	USAGE
F-35 Lightning II joint strike fighter	Y	Jet engine
ATHENA laser weapon system	Er, Yb, Nd	Optical fibers in fiber laser module
Tomahawk missile	Combination of Nd, Pr, Dy, Tb, Sm	Fin actuators in missile guidance and control systems, GPS, sensors
Joint Direct Attack Munition (JDAM) guided bombs	Combination of Nd, Pr, Dy, Tb, Sm	Fin actuators in missile guidance and control systems, GPS, sensors
AN/ALQ-184 Electronic Attack Pod	Y	Electronic jamming devices, storage batteries
Zumwalt-class destroyer	Nd, Pr, Dy, Tb, Sm	Electric motors
HUMVEE military truck	Y, Eu, Tb	Humvee-mounted Laser Avenger
F-16, F-15, F-22	Er, Sm	Jet engine, Electric systems- permanent magnets
M1A2 Abrams tank	Sm, Eu, Nd, Tb, Y	Navigation system, Laser-equipped computer main gun sight
Stinger MANPAD	Combination of Nd, Pr, Dy, Tb, Sm	Fin actuators in missile guidance and control systems, GPS, sensors
Precision-guided munitions	Combination of Nd, Pr, Dy, Tb, Sm	Fins attached to fuselage, special magnets
PATRIOT missile air defense system	Gd, Sm, Y	Radio frequency circulators
MQ-9, MQ-1 Predator drones	Y, Tb	Laser Weapon System

US Navy Virginia Class Submarine

Lockheed Martin F-35 Lightning II Joint Strike Fighter

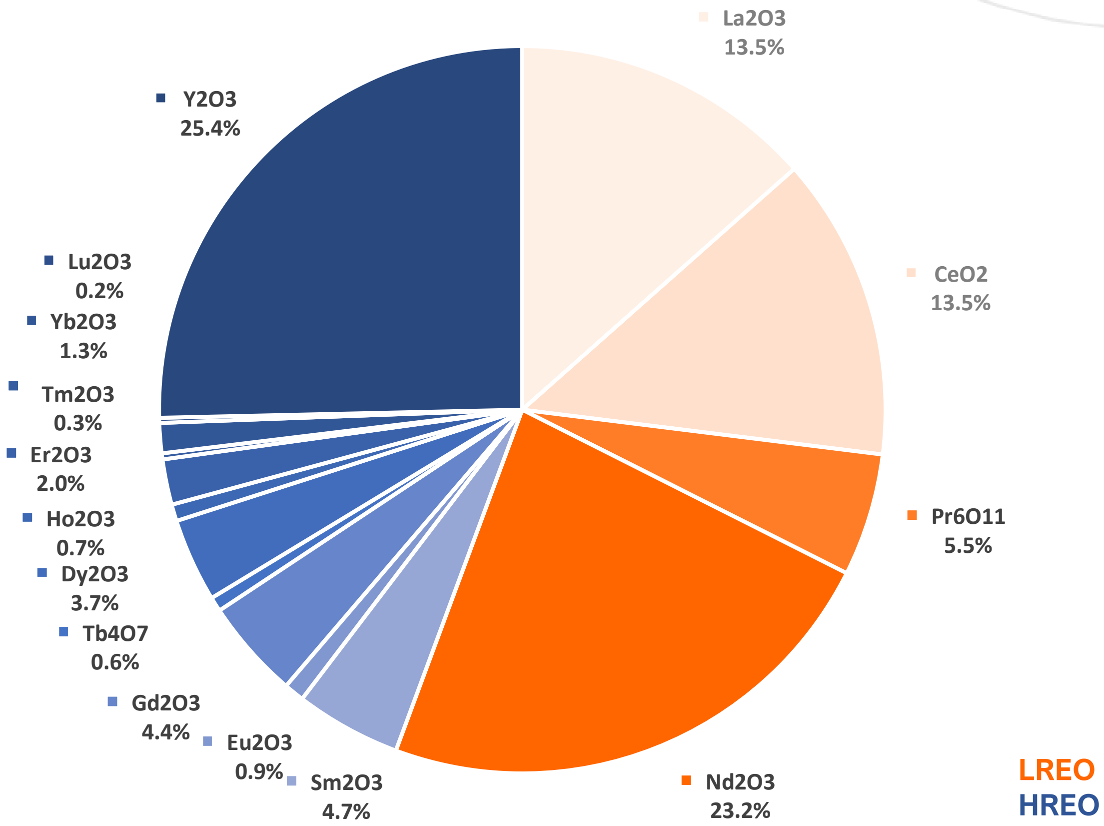
HREO & CREO crucial in Defence Applications

DEFENCE HREO SUPPLY CHAIN – MAKUUTU POTENTIALLY SUPPLIES IT ALL, PROVIDING SECURE SOURCE OPTION



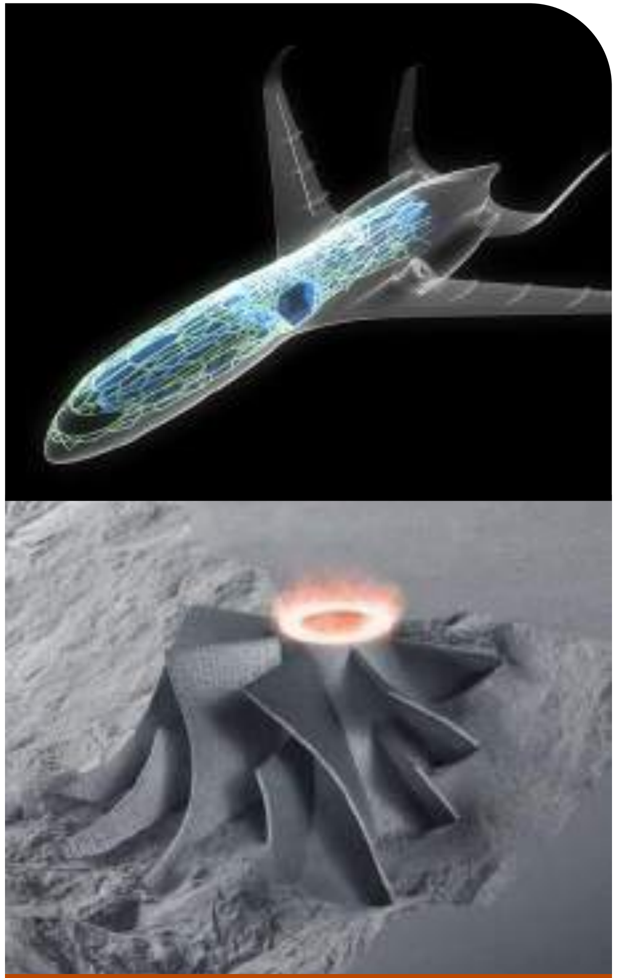
Y_2O_3 used in F-35 comes from IACs in southern China and Myanmar

Makuutu Basket ~73% used in Defence Applications



Scandium – A metal of the future to light-weight aerospace and automotive transportation

Scandium Market Overview



AN EMERGING STRATEGIC METAL WITH LARGE POTENTIAL MARKETS IN THE GLOBAL TRANSPORT SECTOR AND AEROSPACE

- The Makuutu Rare Earths Project is positioning itself to become a key player in the Sc_2O_3 market via low cost production, planning to initially produce 20-25 tpa Sc_2O_3 initially and progressively ramp up production over 10 years to approx. 90-100 tpa Sc_2O_3
- While scandium is abundant in the earth's crust, it is very uncommon to find it in economically recoverable concentrations
- Historically, it tended to be a minor or ignored potential by-product of mining, namely: rare earths, uranium, nickel-cobalt laterite, ilmenite (titanium dioxide)
- Almost all the current world's production of scandium oxide (Sc_2O_3), or scandia, is produced by re-processing titanium dioxide wastes or as a by-product from rare earth production
- Despite several large mineral endowments globally, Sc_2O_3 is predominantly produced by multiple small producers in China (approximately 15-20 tpa) with recent production capacity also being developed via processing of nickel laterite ores
- Most of this Sc_2O_3 is used in Solid Oxide Fuel Cells (SOFC), with Bloom Energy being the main consumer
- This small fragmented market has led to the belief that scandium is rare and expensive, which has hindered its growth, even with decades of technical development and use in aluminium alloys
- The light-weighting revolution occurring in the global transportation industry, combined with a growing global sector of mined supply, is unlocking a large new market for scandium
- Recently Rio Tinto and RUSAL have announced entry into Sc_2O_3 market, with a key focus being applications in 3D printing specialty components

[1] 3D printing using AP Works Scalmalloy® for the Airbus A320 https://www.airbus.com/newsroom/news/en/2016/03/Pioneering-bionic-3D-printing.html. Selective laser sintering using Scalmalloy® https://beamler.com/3d-printing-capabilities/processes/sls-selective-laser-sintering/.

Scandium Market Overview

The need for light-weighting solutions has dramatically increased the adoption of aluminium alloys in transportation. Stricter efficiency standards, the advent of the electric vehicle and the emergence of new sectors are accelerating uptake, generating new opportunities for aluminium alloys, like Al-Sc alloys, to strengthen its position as a key material for the future

AUTOMOTIVE

Aluminium content in vehicles has been steadily increasing, driven by stricter efficiency and emissions requirements

Aluminium is displacing high-strength steel (HSS), a lower cost and heavier competitor, in several components

The electric vehicle (EV) revolution is dramatically accelerating aluminium's market share through new parts (e.g. battery boxes) and the need to increase vehicle range. EVs have 35-50% more aluminium than internal combustion engine vehicles[1]

AEROSPACE

Aluminium is well-established in aerospace, with most airplanes constructed of aluminium alloys. While carbon fibre materials are lighter, they are more expensive, have a higher maintenance cost and require costly metals (such as titanium) to be used in concert. More advanced aluminium alloys can provide comparable low-cost alternative to composites

The next aerospace aluminium alloys will be strong and weldable, removing the need for rivets, providing enormous weight saving.

SPACE

While historically niche sub-sector of aerospace, the commercial space industry represents a fast-growing sector where aluminium has a long, deep-rooted history

Rockets use a range of aluminium alloys in propellant tanks, providing a strong, lightweight material which can operate over large temperature ranges

Advanced aluminium alloys, combined with 3D printing, provide the space industry a unique opportunity to mass produce reusable rockets and satellites

MARINE

Due to its high strength and high corrosion resistance, aluminium alloys are a growing material of choice for shipbuilding

'Marine grade' aluminium is 100 times less prone to corrosion than its steel counterpart[2]

'Marine-grade' aluminium alloys are both strong and weldable, which mean large sections of ships can be constructed with no joints or bolts, which reduce corrosion and the risk of water ingress

RAIL

Like aerospace, aluminium has had a long history with rail, widely used in both freight and passenger cars

Aluminium provides ~30-35% weight reduction over steel and does not corrode, leading to a much longer service life

High-speed trains realise the greatest benefit from aluminium, which require low weight and high-strength to minimise friction loss

[1] Aluminium Content in European Passenger Cars, Ducker Frontier presentation prepared for European Aluminium, Oct 2019, range depending on vehicle category
[2] Aluminium in Transport, www.aluminiumleader.com/application/transport .

Makuutu is one of the largest global Scandium resources… and growing

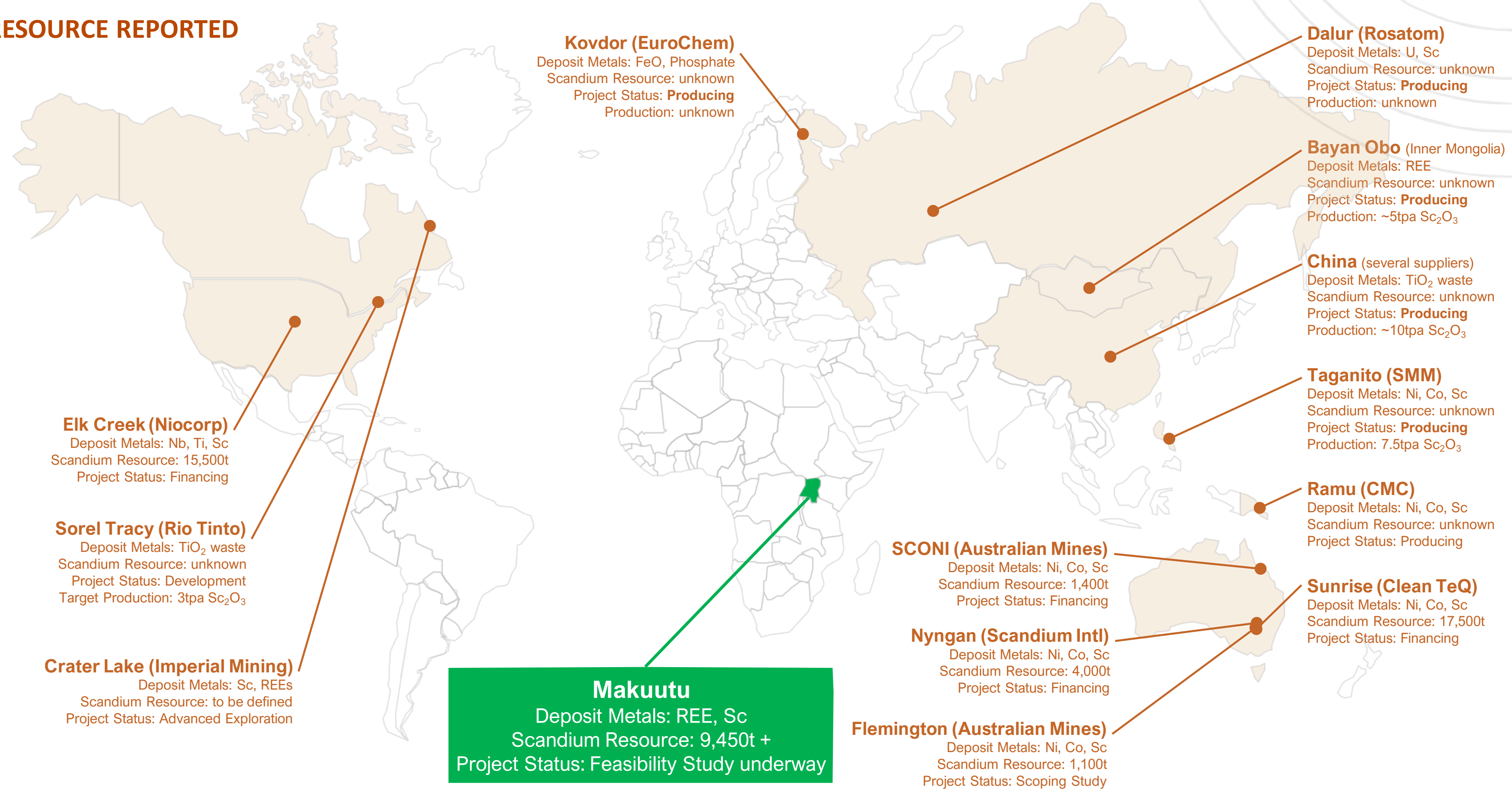
3rd LARGEST SCANDIUM RESOURCE REPORTED

Key to the success of the scandium industry is a diverse and reliable supply chain

While historically the scandium market has been dominated by Chinese supply, there are companies producing scandium or actively developing scandium supply

The Makuutu Rare Earths Project's scandium endowment and time to market make it a key future global player in the scandium market

Market expected to grow very quickly once stable supply is demonstrated



ADDITIONAL SLIDES

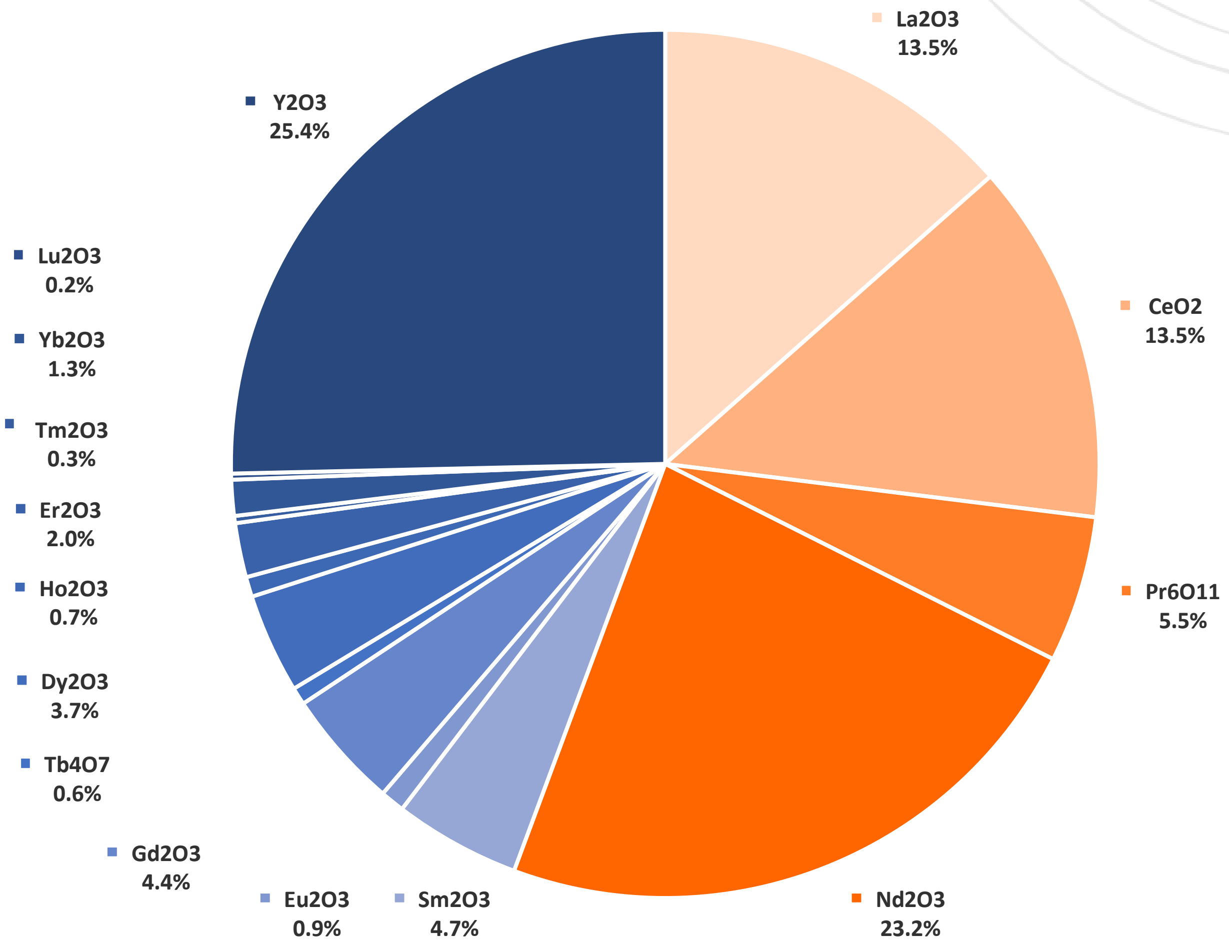
Makuutu Investment Highlights

STRATEGIC VALUE DRIVEN BY THE UNIQUE CREO/HREO DOMINANT BASKET

Highly attractive Scoping Study (11 year Base Case) economic parameters[1] ;

Post tax long term free cash flow US$766 million over 11 years
EBITDA of **US$1.28 billion**
Post tax Net Present Value (8) of **US$321 million**
Internal Rate of Return of **38%**
Pre-production CAPEX requirement of **US$89 million**
Expansion CAPEX of $212 million funded by Project free cash flow
Potential to increase **Project LOM to 27+ years with conversion of resource to higher classification**

MAKUUTU BASKET HIGH VALUE CREO / HREO PRODUCT



[1] Makuutu Rare Earths Project Scoping Study reported to ASX on 29 April 2021.

REE Hard Rock Mining/Processing vs IAC Mining/Processing

IONIC CLAY RARE EARTH ELEMENTS VS HARD ROCK RARE EARTH ELELEMENTS PROJECTS

Significant project and cost advantages associated with ionic clay projects like Makutuu

MINING/PROCESSING STAGES	IONIC ADSORPTION CLAY-HOSTED REE	HARD ROCK-HOSTED REE
Mineralisation	Soft material, negligable (if any) blasting Elevated HREO/CREO product content	Hard rock; Bastnaesite and Monazite (LREO dominant); Xenotime (HREO dominant)
Mining	Low relative operating costs: Surface mining (0-20 m) Minimal stripping of waste material Progressive rehabilitation of mined areas	High relative operating costs: Blasting required Could have high strip ratios
Processing Mining Site	No crushing or milling Simple process plant Potential for static or in-situ leaching with low reagent consumption at ambient temperature	Comminution, followed by benefication that often requires expensive (flotation) reagents to produce mineral concentrate
Mine Product	Mixed high-grade rare earths precipitate, either oxide or carbonate (+90% TREO grade) for feedstock directly into Rare Earth separation plant, low LaCe content	Mixed REE mineral concentrate (typically 30-40% TREO grade), high LaCe content, requires substantial processing before suitable for feed to rare earth separation plant
Product Payability	70-80% payability as mixed Rare Earth oxide/ carbonate/chloride	35-40% payability as a mineral concentrate
Processing - Environmental	Non-radioactive tailings Solution treatment and reagent recovery requirments (somewhat off-set by advantageous supporting infrastructure)	Tailings often radioactive (complex and costly disposal) Legacy tailing management
Processing - Refinery (Typically not on Mining site)	Simple acid solubilisation followed by conventional REE separation Complex recycling of reagents and water	High temperaturte mineral "cracking" using strong reagents to solubilise the refractory REE minerals Complex capital-intensive plant required Radionuclide issues follow REE mineral concentrates

Ionic Adsorption Clay (IAC) deposit mineralisation is highly desirable given it produces a balanced **REO basket dominant in CREO & HREO with higher value and broader appeal**

Near surface IAC mineralisation translates to **lower strip ratios** with lower cost mining methods

IAC ores require much **lower CAPEX intensity to produce refined REOs**

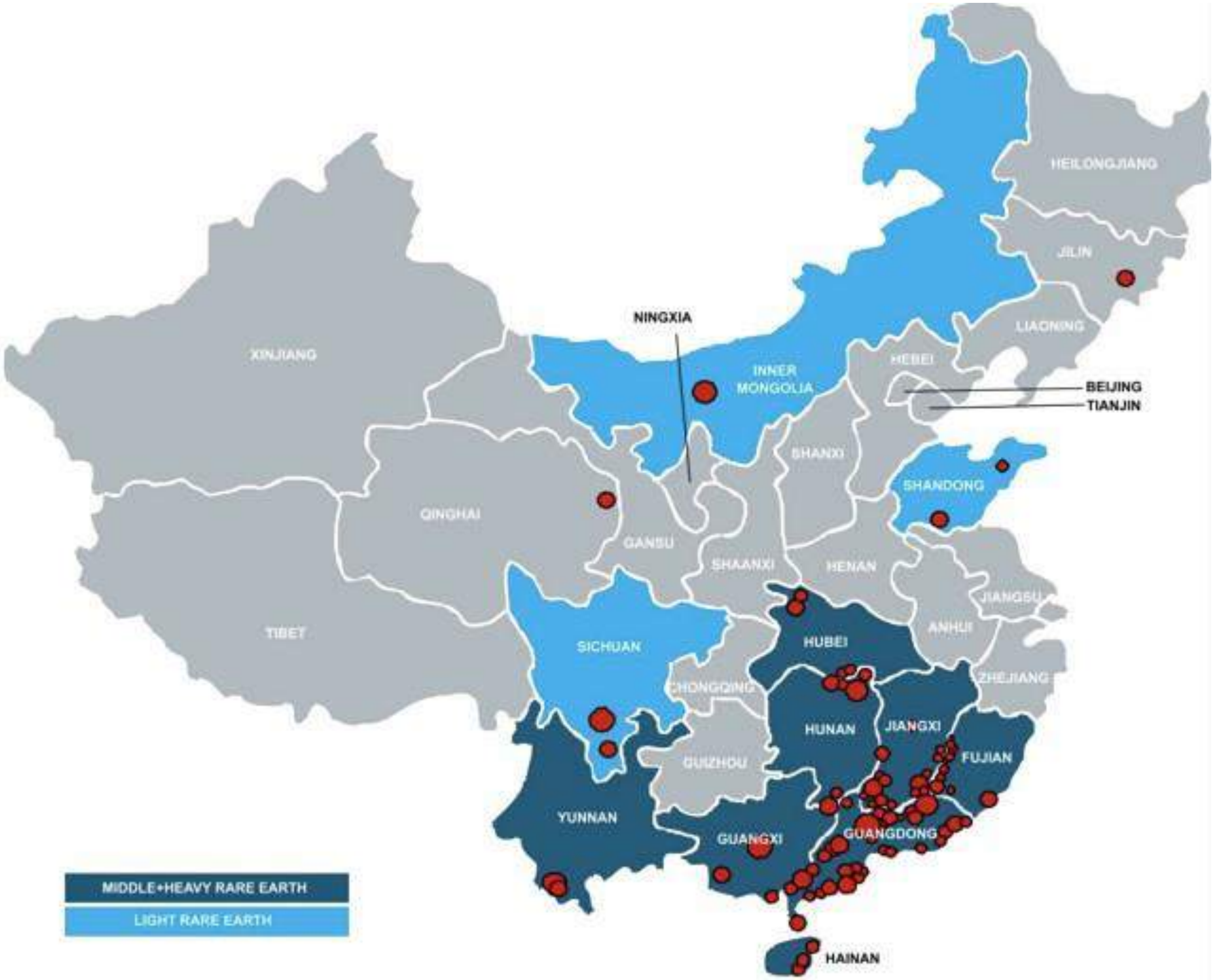
IACs produce **value added Mixed Rare Earth Carbonate** product from IAC deposits, **higher grade and basket value**

IAC product achieves **nearly double the payability**

IACs experience **none of the radionuclide issues the plague hard rock LREO Projects**

IAC separation and refining much lower CAPEX requirement

The REE Basket Problem – the Solution requires 'Balance'



Ionic Adsorption Clay (IAC) deposit mineralisation is highly desirable given it produces a balanced **REO basket dominant in CREO & HREO with higher value and broader appeal**

Hard rock rare earth mines typically >90-95% LREE, i.e. very low in HREE content

Very few true IAC deposits (<5) identified of scale outside of southern China, Myanmar and south east Asia

Increased LREE production to facilitate oversupply, and potentially suppress LREE prices, specifically NdPr

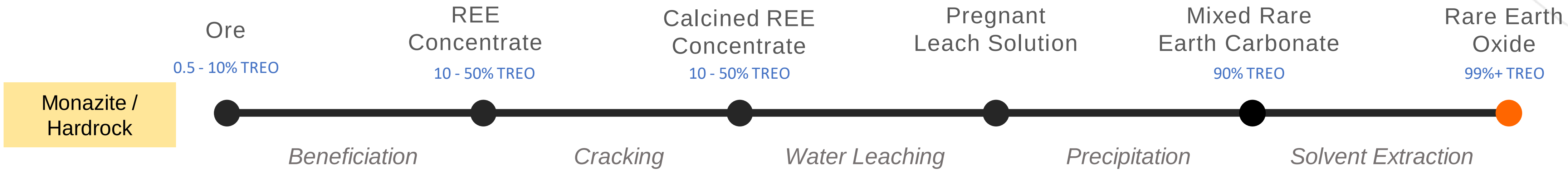
IAC HREE mines complement hard rock LREE mines in China, providing 'balance' to REE supply quotas

IAC HREE mines typically **much lower production capacity** than hard rock LREE mines

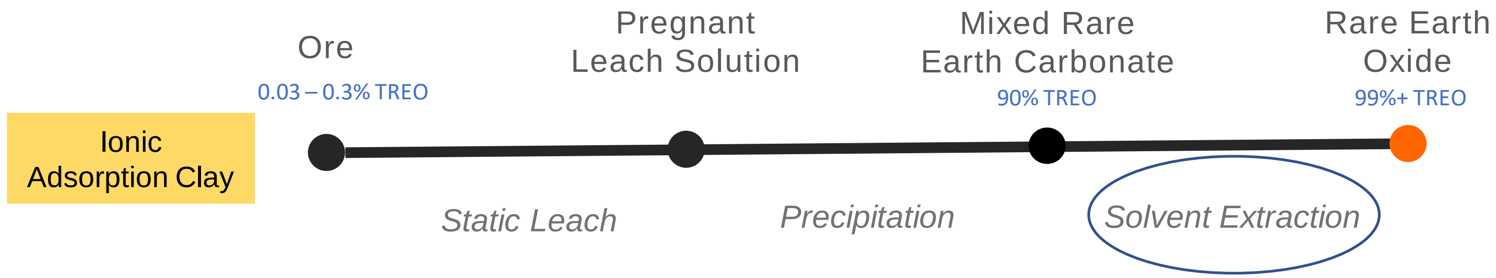
The rare earth solution for the future requires a balance; LREE readily sourced but HREE is truly rare

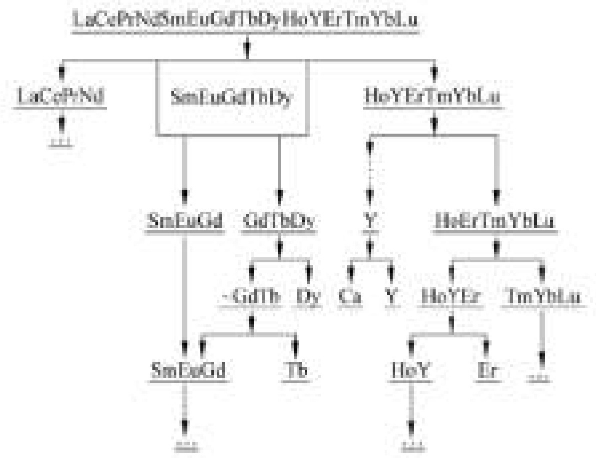
Rare Earth Oxide Production Chain – Lower Capex IAC Path

HARD ROCK LREE PROCESS ROUTE COMPLEX, CAPITAL INTENSIVE, LARGE IMPURITY LOAD TO REFINED RARE EARTH OXIDE



IAC PROCESS ROUTE A SIMPLER, LOW CAPITAL PATH TO REFINED RARE EARTH OXIDE





Typical optimised separation flowsheet for REE from ion adsorption clay deposits

Makuutu Basket is Balanced, CREO+HREO Dominant and High Value

Company		Ionic Rare Earths	Lynas Rare Earths[1]	MP Materials[2]	Arafura Resources[3]	Australian Strategic Materials[4]	Hastings Technology Metals[5]	Peak Resources[6]	Pensana Rare Earths[7]	Northern Minerals[8]	REO Pricing Argus Metals 9-Aug-21 US$/kg
Mineralisation		Ionic Adsorption Clay	Monazite	Bastnasite	Monazite	Eudialyte / Bastnasite	Monazite	Bastnasite	Monazite	Xenotime	
Project		Makuutu	Mt Weld / LAMP	Mountain Pass	Nolans Bore	Dubbo	Yangibana	Ngualla	Longonjo	Browns Range	
Development Stage		FS	Operations	Operations	DFS	DFS	DFS	DFS	DFS	PFS	
La_2O_3	%	13.5%	25.5%	34.0%	19.3%	22.1%	10.0%	27.6%	23.9%	1.9%	1.49
CeO_2	%	13.5%	46.7%	48.8%	48.7%	36.3%	39.6%	48.2%	45.9%	4.8%	1.51
Pr_6O_{11}	%	5.5%	5.3%	4.2%	5.9%	3.6%	8.0%	4.8%	4.9%	0.7%	100.75
Nd_2O_3	%	23.2%	18.5%	11.7%	20.5%	14.1%	33.8%	16.5%	17.2%	3.2%	98.40
Sm_2O_3	%	4.7%	2.3%	0.8%	2.3%	1.7%	3.9%	1.6%	2.5%	2.1%	1.93
Eu_2O_3	%	0.9%	0.4%	0.1%	0.4%	0.0%	0.8%	0.3%	0.6%	0.4%	30.50
Gd_2O_3	%	4.4%	0.1%	0.2%	1.0%	1.6%	1.8%	0.6%	1.2%	5.7%	44.15
Tb_4O_7	%	0.6%	0.1%	0.0%	0.1%	0.2%	0.2%	0.1%	0.1%	1.3%	1,332.50
Dy_2O_3	%	3.7%	0.1%	0.0%	0.3%	1.9%	0.5%	0.1%	0.6%	8.8%	421.00
Ho_2O_3	%	0.7%	0.1%	0.0%	0.0%	0.4%	0.1%	0.0%	0.1%	1.8%	152.25
Er_2O_3	%	2.0%	0.1%	0.0%	0.1%	1.1%	0.1%	0.0%	0.2%	5.3%	34.00
Tm_2O_3	%	0.3%	0.1%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.7%	800.00
Yb_2O_3	%	1.3%	0.1%	0.0%	0.1%	0.9%	0.1%	0.0%	0.1%	4.4%	15.30
Lu_2O_3	%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	802.50
Y_2O_3	%	25.4%	0.4%	0.1%	1.4%	15.8%	1.1%	0.2%	2.6%	58.2%	5.85
Sum Total		100%	100%	100%	100%	100%	100%	100%	100%	100%	
Magnet REO	%	43%	26%	17%	30%	24%	48%	24%	27%	24%	
LREO	%	56%	96%	99%	94%	76%	91%	97%	92%	11%	
HREO	%	44%	4%	1%	6%	24%	9%	3%	8%	89%	
CREO	%	54%	20%	12%	23%	32%	36%	17%	21%	72%	
CREO+HREO	%	73%	28%	17%	32%	42%	50%	24%	30%	93%	
Basket Value	REO/kg	$ 64.89	$ 28.27	$ 17.12	$ 30.46	$ 34.30	$ 48.45	$ 23.60	$ 28.79	$ 86.65	

Note. Rounding Applied to nearest 0.1%.

[1] Lynas Rare Earths website. [2] MP Materials 31 Dec 2014. [3] Arafura Resources – Nolans DFS Delivers Robust Project Economics, 7 February 2019. [4] ASM Information Memorandum Demerger Booklet, June 2020. [5] Yangibana Project – Begin the Future December 2019. [6] Project Update, Ngualla Rare Earth Project, October 2017. [7] Pensana - Longonjo PFS 15 November 2019. [8] Browns Range Project Definitive Feasibility Study, February 2015.

Strategic Partnership Activity

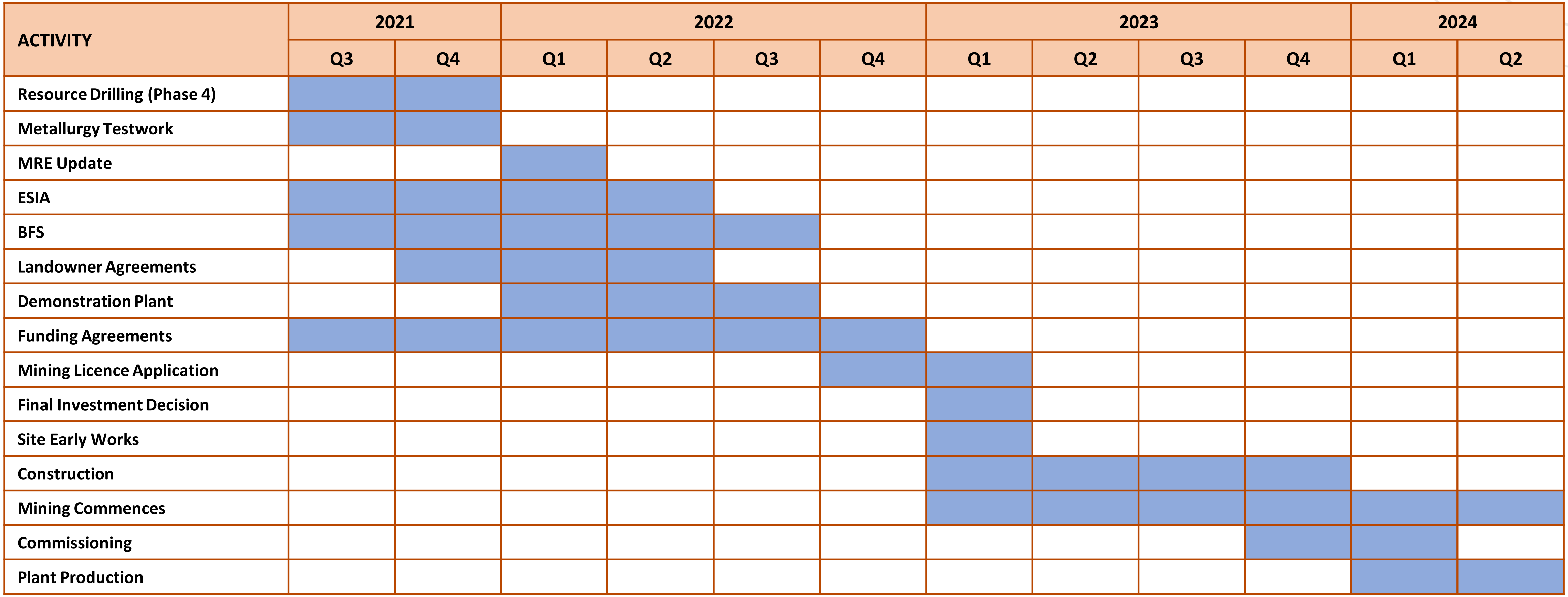
A RARE EARTH BASKET WITH 'BALANCED' APPEAL

- IAC balanced basket appeal as one of only two global IACs of scale in development
- IonicRE in April signed a non-binding MOU[1] with China Rare Earths Jiangsu, a subsidiary of Chinalco;
    - To strategically co-operate to accelerate Makuutu mine development and production for mutual benefit;
    - Potential for future investment in IonicRE, and/or the Makuutu Rare Earths Project directly, and/or off-take agreements, as agreed by the parties, for rare earth product produced by IonicRE.
    - 12-month term
    - 12 months of Due Diligence by China Rare Earths Jiangsu prior to signing non-binding MOU
    - China Rare Earths Jiangsu operates four facilities with REO refining capacity
- IonicRE continues parallel discussions with numerous global groups regarding the development of the Project, and ultimately access to the Makuutu basket
- Growing understanding of importance of IACs to provide balance to REO production capacity

[1] ASX Announcement 7 April 2021.

Makuutu Timeline to Production

ACCELERATING MAKUUTU TOWARDS PRODUCTION IN 2024



IonicRE Activity over the remainder of 2021

STEADY WORK PROGRAM UNDERWAY AT MAKUUTU

- Drilling progressing with approximately 220 holes (3,600 metres) completed to date of 5,700 metre Phase 4 infill drilling program
- Pending confirmation of application TN03555 for conversion of EL 1766 to Retention Licence
- Confirmation on status of Exploration Licence application TN03573 for area northwest of existing Makuutu Project area
- Drill assay results expected through the remainder of 2021 and into Q1 2022
- Stakeholder engagement activity in Uganda ramping up with Environmental and Social Impact Assessment draft documentation expected to be submitted to the Ugandan NEMA in Q4
- Metallurgical testwork ongoing at ALS Metallurgy, ANSTO, SGS Lakefield and other providers to optimise inputs for Makuutu
- Initiation of landowner access agreements on completion of socio-economic baseline surveys across initial mining areas
- Feasibility Study engineering continuing
- Planning for additional in country testwork and bulk sampling, test pit mining and large scale metallurgical testwork to increase confidence and de-risk Project development
- Ongoing discussions with strategic partner groups on the development of 1) Makuutu and 2) Separation and Refining facility
- Metallurgical testwork on MREC conversion to separated REOs and process modeling kicked off
- Refinement of inputs for Refinery location analysis

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