Peak Rare Earths

PEK.AX – INITIATION OF COVERAGE

MST Access

A research platform of MST Financial

5 September 2023

De-risked Path to Take High Value NdPr Project from BFS to Execution

NEED TO KNOW

- World-class asset: high-grade ore, low radioactivity
- Supportive strategic partner and major shareholder
- De-risked pathway to development

Advanced rare earth project: Peak Rare Earths holds an 84% stake in the Ngualla Rare Earth Project in Tanzania. Ngualla ranks among the world's largest and highest-grade undeveloped NdPr oxide projects. (NdPr are among the most valuable rare earth elements and are utilised in magnet manufacturing).

Binding offtake signed with strategic partner: Peak has signed a binding offtake agreement with Shenghe Singapore (Shenghe) for 100% of Ngualla's rare earth concentrate over at least 7 years.

MOU with strategic partner for potential funding and construction: Peak has also signed a non-binding MOU with Shenghe to potentially provide a funding solution and technical support for project development.

Investment Thesis

Ngualla ticks the boxes on scale, quality, margin: Ngualla has an 18.5Mt ore reserve at 4.80% total rare earth oxide (TREO) (21.26% NdPr) and an initial mine life of 24 years, utilising less than 20% of the 214Mt mineral resource. Production is estimated at 18ktpa of TREO in the first 6 years, averaging 16ktpa overall. The concentrate is high-grade, rich in NdPr, with minimal radionuclides.

PEK provides important supply to strategic partner: Shenghe, China's largest rare earth concentrate importer and Peak's major shareholder (19.8%), has a binding agreement stipulating that Shenghe will purchase 100% of Ngualla's concentrate and 50% of any future mixed rare earth carbonate (MREC) and separated oxide production for an initial 7-year period. The agreement fills a significant supply gap for Shenghe, replacing its current supplier, US-based MP Materials, which is shifting its supply back to the US.

Progressing a de-risked development pathway: Peak's MOU with Shenghe provides a fixed-price construction package and a funding solution. This collaborative approach prioritises cost efficiency, accelerated construction, and minimal equity dilution, leveraging Shenghe's technical and financial prowess for the benefit of Peak shareholders. Construction is targeted to commence in CY2024 and production in CY2026.

Global trends shaping rare earths demand: The demand for rare earths, particularly NdPr, is set to rise due to their use in EV motors and wind turbines. In 2022, these applications accounted for $3.8 bn in NdPr consumption, with this number projected to reach $36.2 bn by 2035.

Valuation: A$1.13 ($2.65 with Project Selldown)

Our base-case valuation is A$1.13 per share, fully diluted. Our base-case valuation assumes Peak maintains its 84% ownership of the Ngualla Project. We apply a 75% risk factor and assume dilution for a A$286m equity raise to fund Peak's equity contribution to the project (we assume 50:50 debt and equity). In a scenario in which Peak divests a minority stake in the project, and implements the strategic development and funding solution with Shenghe, our valuation would rise to A$2.65 per share, fully diluted.

Risks

Key risks include inability to access funding, project delays, escalation in capital costs, a fall in the NdPr price, and continuity of key persons.Equities Research Australia

Mining and Energy

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Peak Rare Earths Limited (ASX: PEK), a leading mineral exploration and development company, is driving low-carbon technology advancements with its Ngualla Rare Earth Project. Since its discovery in 2010, Ngualla has grown to be a global leader in high-grade NdPr deposits, essential for manufacturing electric vehicles and wind turbines. The company's strategic focus on this project embodies its commitment to sustainable development and green transformation.

https://peakrareearths.com/

Valuation	**A$1.13**
Current price	**A$0.45**
Market cap	**A$120m**
Cash on hand	**A$25.852** (as of 30June)

Upcoming Catalysts and Newsflow

Period	
2HCY23	FEED finalised; exploration results released
1HCY24	Final Investment Decision; project funding finalised
2HCY24	Project construction commenced

Share Price (A$)

Source: FactSet, MST Access.

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PEK Limited — PEK.AX

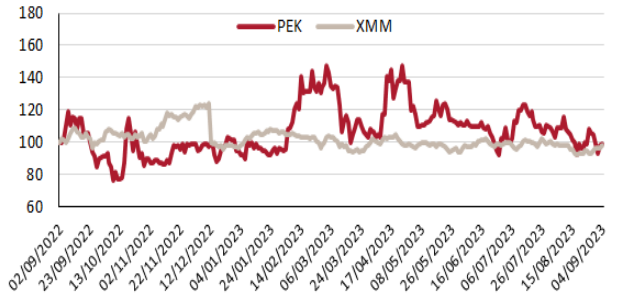
Year end 30 June

MARKET DATA		
Share Price	A$/sh	0.45
52 Week Low	A$/sh	0.36
52 Week High	A$/sh	0.74
Market Cap (A$m)	A$m	119
Net Debt / (Cash) (A$m)	A$m	(4)
Enterprise Value (A$m)	A$m	115
Shares on Issue	m	265
Performance rights	m	8
Shares Issued during Capital Raise	m	464
Potential Diluted Shares on Issue	m	737

INVESTMENT FUNDAMENTALS		Jun-21	Jun-22	Jun-23e	Jun-24e	Jun-25e
Reported NPAT	A$m	(5)	(23)	(11)	(11)	(6)
Underlying NPAT	A$m	(5)	(23)	(11)	(11)	(6)
EPS Reported (undiluted)	¢ps	(3.1¢)	(11.7¢)	(5.5¢)	(5.4¢)	(1.4¢)
EPS Underlying (undiluted)	¢ps	(3.1¢)	(11.7¢)	(5.5¢)	(5.4¢)	(1.4¢)
P/E Reported (undiluted)	x	N/A	N/A	N/A	N/A	N/A
P/E Underlying (undiluted)	x	N/A	N/A	N/A	N/A	N/A
Operating Cash Flow / Share	A$	(0.02)	(0.06)	(0.05)	(0.05)	(0.01)
Price / Operating Cash Flow	x	n/m	n/m	n/m	n/m	n/m
Free Cash Flow / Share	A$	(0.02)	(0.06)	(0.05)	(0.05)	(0.86)
Price / Free Cash Flow	x	(20.4)	(7.5)	(8.2)	(8.3)	(0.5)
Free Cash Flow Yield	%	-4.9%	-13.3%	-12.2%	-12.1%	-191.2%
Book Value / Share	A$	0.27	0.34	0.42	0.37	0.53
Price / Book	x	1.68	1.32	1.06	1.21	0.85
NTA / Share	A$	0.27	0.34	0.42	0.37	0.53
Price / NTA	x	1.68	1.32	1.06	1.21	0.85
Year End Shares	m	207	207	208	208	672
Market Cap (spot)	A$m	93	93	94	94	303
Net Cash / (Debt)	A$m	3	9	25	14	(279)
Enterprise Value	A$m	90	84	68	80	581
EV / EBITDA	x	n/m	n/m	n/m	n/m	n/m
Net Debt / Enterprise Value		(0.0)	(0.1)	(0.2)	(0.1)	2.4

PRODUCTION AND PRICING	Jun-24e	Jun-25e	Jun-26e	Jun-27e	Jun-28e
Ore Mined (Kt)	-	-	-	186	1,800
Total Mill Feed (Kt)	-	-	-	-	723.0
Concentrate production at 45% TREO (Kt)	-	-	-	-	33.34
NdPr Price (US$/kg)	-	-	-	-	170.7
Realised Basket Price (US$/kg)	-	-	-	-	23.1

12-Month Relative Performance vs S&P/ASX Metals & Mining



Profit & Loss (A$m)	Jun-21	Jun-22	Jun-23e	Jun-24e	Jun-25e
Revenue	-	-	-	-	-
Expenses	(4)	(15)	(11)	(11)	(12)
EBITDA	**(4)**	**(15)**	**(11)**	**(11)**	**(12)**
D&A	(0)	(0)	(0)	(0)	(0)
EBIT	**(4)**	**(15)**	**(12)**	**(12)**	**(12)**
Interest	(0)	(8)	0	0	6
Tax	-	-	-	-	-
Underlying NPAT	**(5)**	**(23)**	**(11)**	**(11)**	**(6)**
Exceptionals					
Reported Profit	**(5)**	**(23)**	**(11)**	**(11)**	**(6)**

Balance Sheet (A$m)	Jun-21	Jun-22	Jun-23e	Jun-24e	Jun-25e
Cash	3	9	25	14	8
Receivables	1	1	0	0	0
Inventory	-	-	-	-	-
PP&E	0	0	0	0	573
Exploration	54	59	60	60	60
Other	4	4	4	4	4
Assets	**62**	**74**	**90**	**78**	**645**
Creditors	1	2	1	1	1
Debt	-	-	-	-	286
Other	6	0	0	0	0
Liabilities	**6**	**3**	**1**	**1**	**287**
Shareholder's Equity	**55**	**71**	**88**	**77**	**357**

Cashflow (A$m)	Jun-21	Jun-22	Jun-23e	Jun-24e	Jun-25e
Receipts from Customers	-	-	-	-	-
Payments to suppliers and employees	(5)	(12)	(11)	(12)	(12)
Interest Received	0	0	0	0	6
Other					
Net Cash From Operations	**(5)**	**(12)**	**(11)**	**(11)**	**(6)**
Capex	(0)	(0)	(0)	-	(573)
Exploration	-	-	-	-	-
Other	-	0	-	-	-
Net Cash From Investing	**(0)**	**(0)**	**(0)**	**-**	**(573)**
Equity	8	33	28	-	286
Borrowings	-	-	-	-	286
Other	(3)	(14)	(0)	(0)	(0)
Net Cash From Financing	**5**	**19**	**27**	**(0)**	**573**
Effects of FX	(0)	(0)	(0)	-	-
Net Increase / (Decrease) in Cash	**0**	**7**	**16**	**(11)**	**(6)**

Source: Company reports, MST Access.

Thesis: Shovel-Ready, High-Grade and De-risked

Company profile: shovel-ready project at world-class deposit

Peak Rare Earths (ASX: PEK) is advancing the Tier-1 Ngualla Rare Earths Project (the Ngualla Project) in Tanzania, situated 1,050km from Dar es Salaam port. The company has an 84% interest in the project via its fully-owned subsidiary, Ngualla Group UK Limited, with the Tanzanian Government holding the other 16% through a free-carry agreement.

Flagship asset, Ngualla: a world-class, high-grade deposit with a de-risked, sequenced strategy

The Ngualla Project is one of the world's largest rare earth mineral resources, with 214.4Mt at 2.15% TREO. Notably, its Ore Reserve measures 18.5Mt at 4.8% TREO[1], where valuable NdPr represents 1.02%, placing it as the second-highest NdPr[2] concentration in the world, only surpassed by Lynas (ASX:LYC). The NdPr oxide contributes to 97 of Peak's basket value. The project's early years of production, Years 1–6, indicate annual mining of 1,223.6 ktpa at a grade of 5.4% TREO. This production will lead to a concentrate output of 40.5 ktpa, maintaining a consistent concentrate grade of 45.0% TREO, with NdPr forming 22.2% of this concentrate basket. This impressive resource profile, combined with the strategic reserve figures, emphasises Ngualla's longevity and potential for sustained value creation.

Securing Ngualla's future with offtake agreement

Binding offtake agreement with Shenghe: Peak and Shenghe Resources have signed a binding offtake agreement and a non-binding MOU covering concentrate offtake and strategic co-operation in developing and funding the Ngualla Project. Shenghe is a leading entity in rare earth mining, processing, and distribution. The company is listed on the Shanghai Stock Exchange with a market capitalisation of around US$3.1 bn, and is currently the largest importer of rare earth concentrate into China, distributing its products within China and to overseas markets. The offtake agreement guarantees the purchase of 100% of Ngualla's concentrate production and half of any future Mixed Rare Earth Carbonate (MREC) and separated oxide output for an opening span of 7 years. Shenghe holds an approximate 19.8% stake in Peak and appointed a Non-Executive Director to Peak's board in November 2022, strengthening the companies' alliance.

Exit of MP Minerals opens additional opportunity: Shenghe has been importing 100% of the concentrate from MP Materials (operator of one of the world's largest rare earth mines, Mountain Pass) into the Chinese market over the last 5 years following the restart of the Mountain Pass Mine in 2017. However, MP Materials, a NYSE-listed company valued at US$4 bn, is moving downstream to produce NdPr oxide and magnets as part of its strategic expansion. This transition will cut around 15% of the global rare earth mineral concentrate supply, leading to a procurement shortfall for Shenghe and an opportunity for Peak to supply the required concentrate.

Financial discussions accelerating

Peak, requiring funding for its ~US$321m pre-production capital and other associated costs, has also entered a non-binding MOU with Shenghe. This MOU supports both development and funding, with Shenghe proposing a fixed-price EPC solution and the provision of a project funding solution on mutually agreeable terms. Importantly, Shenghe is considering acquiring a substantial non-controlling equity stake in the project via a Peak subsidiary, thereby reducing Peak's financial burden. The strategy aims to limit equity dilution for Peak shareholders, combining Shenghe's investment, potential prepayments for sales, and possible access to Chinese banking solutions.

Board and management

Peak's board and management team have deep expertise across mining and metallurgy as well as commodities and capital markets. Their history of successfully securing funds and executing projects speaks to their capabilities. With hands-on experience in Tanzanian and emerging markets, the team's skill set in both sector development and financing underlines Peak's strong positioning for growth.

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[1] 'Total rare earth oxides' (TREO) represents the total concentration of rare earth oxides present in a material or deposit. It is a crucial metric in the assessment of the economic viability of a rare earth project, as it helps determine the quantity of recoverable rare earths.

[2] NdPr, comprising Neodymium and Praseodymium, are among the most valuable rare earth elements utilised in magnet manufacturing. They represent the majority of value in of the light rare earth deposits.

Rare earths outlook: fuelling the future of energy transformation

The price of rare earths, especially NdPr, is projected to rise, driven predominantly by the surging demand in energy-transition applications like EV motors and wind turbines. In 2022, these applications consumed magnet rare earth oxides, including NdPr, valued at $3.8 bn, a figure that Adamas Intelligence predicts will experience a 19.1% CAGR, surging to $36.2 bn by 2035. This escalating demand is primarily driven by passenger EV traction motors and increased by wind power generators.

NdPr oxide is anticipated to witness the most significant value increase, expected to skyrocket 11-fold by 2035 as per Adamas Intelligence. This surge is attributed to comprehensive demand growth, escalating prices, and a trend towards employing more NdPr in high-grade rare earth magnets (NdFeB). However, supply analyses from Adamas Intelligence suggest that by 2035, NdPr oxide supply will struggle to meet this booming demand, leading to pronounced shortages of these essential magnet materials.

Tanzania: attractive business jurisdiction

Located on the Indian Ocean, Tanzania offers political stability, economic growth, and expanding sectors, marking it as a notable investment destination in East Africa. The nation has achieved a growth rate of 7.6% pre-pandemic, coupled with declining inflation and poverty.

Mining sector growth

Under President Samia Suluhu Hassan's leadership, Tanzania is leveraging its mineral wealth, targeting a 10% GDP contribution from mining by 2025. The sector's rapid growth, marked by 8 significant mining agreements, positions Tanzania as a prime mining investment hub.

Enhanced international relations and business climate

Following a visit by US Vice President to Tanzania, an MOU was announced between Tanzania and the Export-Import Bank of the United States, paving the way for US$500m in export financing. Furthermore, a B2 Positive credit rating from Moody's in 2023, prompted by political stability and reforms, signals an investor-friendly climate.

Potential near-term catalysts

- 2HCY23: FEED finalised; exploration results released
- 1HCY24: Final Investment Decision; project funding finalised
- 2HCY24: Project construction commenced

Recent events

2022

- February: Shenghe Resources acquired 19.9% interest in Peak from Appian Pinnacle Holdco Limited
- August: Russell Scrimshaw appointed as Executive Chairman
- October: Ngualla Project BFS Update released

2023

- April: Framework agreement executed and special mining licence granted for the Ngualla Rare Earth Project by the Government of Tanzania
- March: Ian Chambers appointed as Non-Executive Director
- May: A$27.5m equity raising completed
- June: Exploration program commenced; Nick Bowen appointed as Non-Executive Director
- July: Hannah Badenach appointed as Non-Executive Director
- August: Binding offtake agreement and EPC and funding MOU signed with Shenghe

Valuation A$1.13 per share ($2.65 per share with Project Selldown)

Our base-case valuation is A$1.13 and assumes Peak maintains its 84% ownership of the Ngualla Project. We apply a 75% risk factor to account for outstanding project risks (financing, construction, commissioning) and assume dilution for a A$286m (US$200m) equity raise to fund Peak’s equity contribution to the project (we assume 50:50 debt and equity).

Additionally, we examined a scenario in which Peak divests a minority stake in the asset to Shenge in exchange for project construction funding. In this case, Peak's valuation rises to A$2.65 per share, also on a fully diluted basis.

As a cross check against peers, utilising an EV/contained NdPr multiple, we derived a risk-adjusted valuation of A$2.02 per share on a fully diluted basis.

Risks

Key risks include inability to access funding, project delays, escalation in capital costs, a fall in the NdPr price, and continuity of key persons.

Flagship Ngualla Rare Earths Project

Snapshot of the Ngualla Project

Location: Tanzania, 1,050km from Dar es Salaam port

Ownership: Peak 84%, Government of Tanzania 16%

Ore processing capacity: 800,000 tpa

Initial mine life: 24 years

Mineral Resource: 214Mt

Ore Reserve: 18.5Mt @ 4.80% TREO

Project overview

Peak owns 84% of the advanced pre-production Ngualla Project. The Government of Tanzania holds the remaining 16% by virtue of its free-carried interest. The plan is for rare earth elements to be extracted and processed from this high-grade and valuable deposit and for rare earth mineral concentrate to be produced.

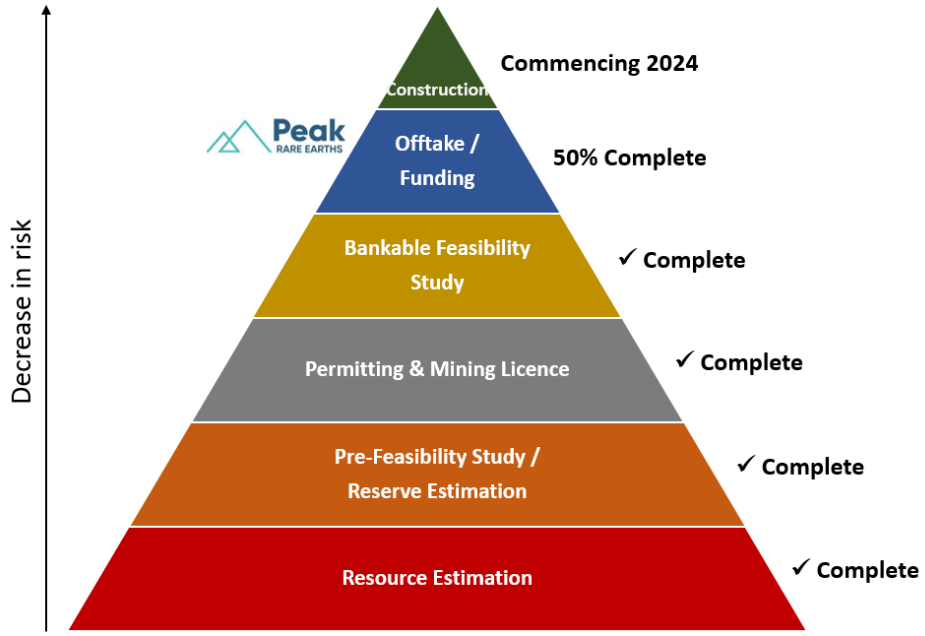
Key features supporting the project's competitive edge in the concentrate production market are:

- its status as a near-term, high-grade concentrate producer
- the high-value NdPr assemblage in the concentrate: NdPr (neodymium + praseodymium) comprises 22–23% of TREO but ~97% of rare earth basket value (among the highest of current and near-term concentrate producers)
- its primary bastnaesite mineralogy (high REO content, ease of processing, and market demand)
- minimal radionuclide levels, reducing environmental and regulatory complications
- lower levels of acid-consuming minerals due to natural leaching.

Current project status

The Ngualla Project is well progressed, with a Bankable Feasibility Study (BFS) completed. It holds a Special Mining Licence, and has secured a binding offtake with Shenghe, significantly de-risking the project. The Tanzanian authorities have approved an Environmental and Social Impact Assessment, granting the project an Environmental Certificate (EC), which are required for mining. Additionally, a Framework Agreement with the Tanzanian government is in place. Peak expects a Final Investment Decision by May 2024.

Figure 1: Project development stages: Ngualla well progressed and significantly de-risked



Source: Peak.

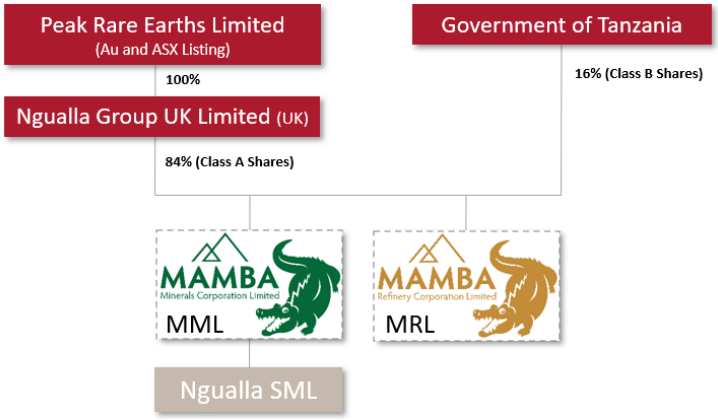
Framework Agreement and corporate structure

On 17 April 2023, Peak and the Tanzanian Government executed a binding Framework Agreement (FA) for the Ngualla Project. The FA outlines collaboration terms for the parties concerning the project's development and operation; it covers licensing, development, economic benefit sharing, and governance.

Through the FA, Peak and the Tanzanian Government co-established two entities, both 84% owned by Peak (via subsidiaries) and 16% by the Tanzanian Government:

- **Mamba Minerals Corporation Limited (MML)** – holder of the Special Mining Licence for the Ngualla Project
- **Mamba Refinery Corporation Limited (MRL)** – set to oversee any future Tanzanian refining and downstream operations.

Figure 2: Corporate structure



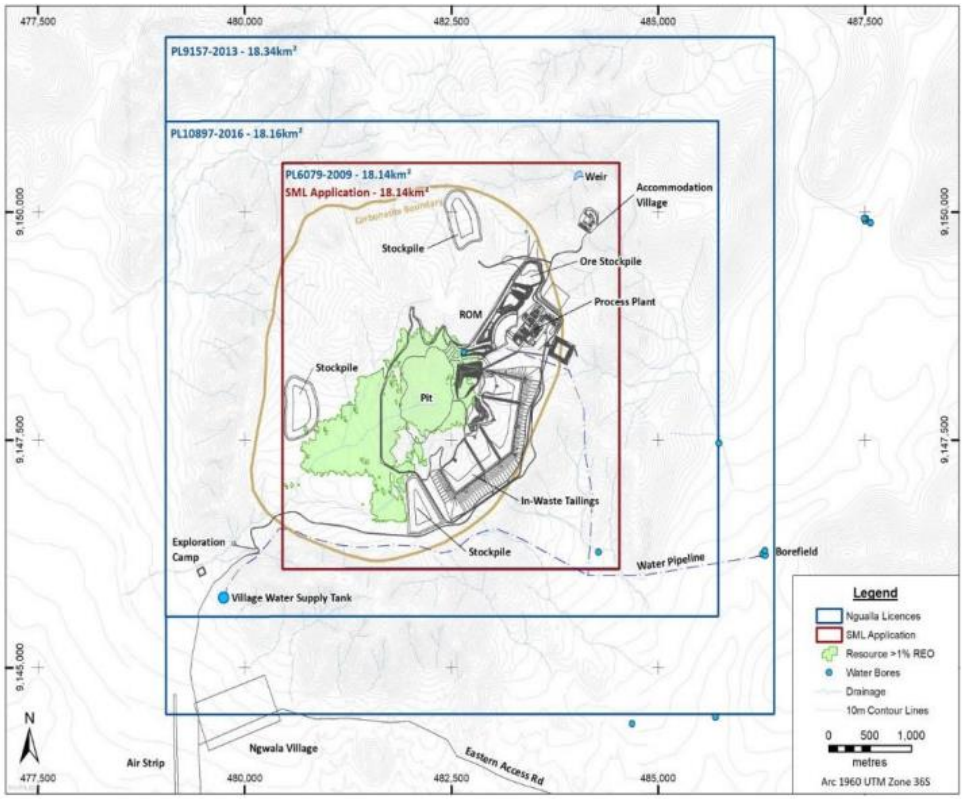
Source: Peak

Special Mining Licence (SML)

Following the FA, the Special Mining Licence (SML) was granted to MML. In Tanzania, an SML, issued by the Ministry of Minerals, permits large-scale mining of economically valuable or strategic minerals. The SML covers about 18km² (see Figure 3). The FA's key principles include:

- a long-standing tenure of the lower of 33 years and mine life, with the ability to further extend
- downstream optionality
- right to export concentrate to third parties
- equity ownership of 84% with fiscal stability provisions.

Figure 3: Special Mining Licence area



Source: Peak.

Project indicative timeline: targeting FID by May 2024

Figure 4 shows the indicative timeline, which aims for a Final Investment Decision (FID) by May 2024. The first concentrate production is projected for April 2026, 2 years post FID.

Figure 4: Indicative timeline to FID

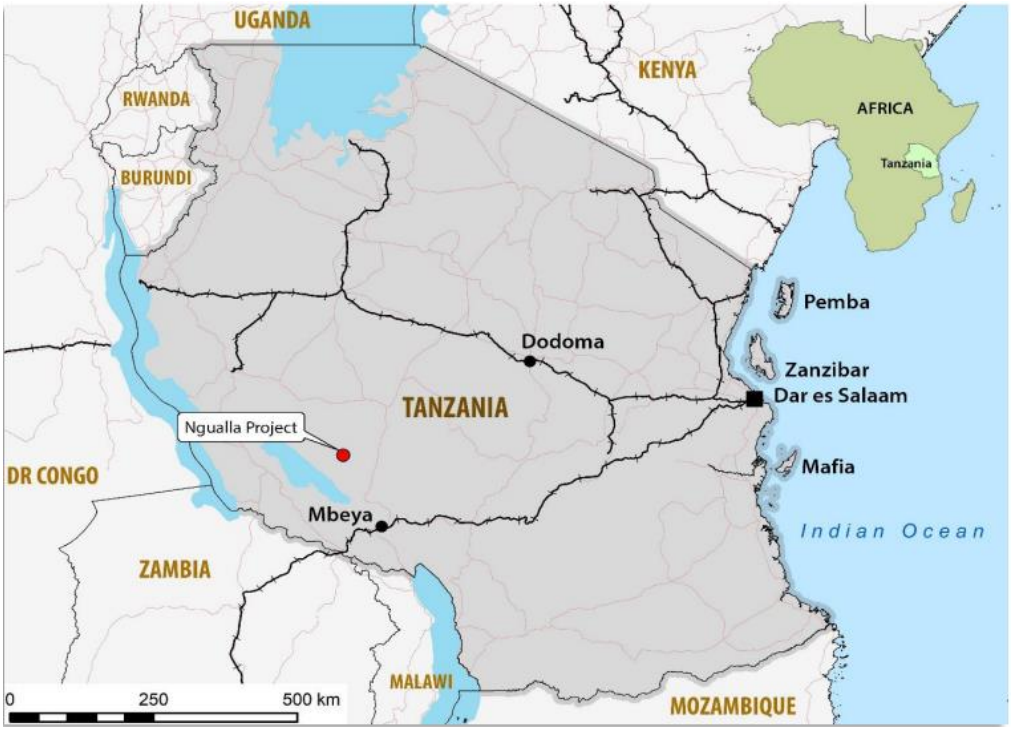
TAKS	2023					2024											2025											2026										
	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
FEED																																							
Decision on EPC / EPCM execution model					✓																																		
Project-level interest discussions																																							
Funding discussions																																							
Enabling Works and Early Works																																							
Final Investment Decision (FID)										✓																													
Construction																																							
Commissioning																																							
Ramp-up																																							
First concentrate																																	✓						

Source: Peak.

Location

The Ngualla Project is located in Tanzania, which has a growing economy and a rapidly expanding mining industry. The project is located near the Ngwala Village and approximately 150km from the city of Mbeya in the Songwe Region and on the edge of the East African Rift Valley.

Figure 5: Ngualla Project location



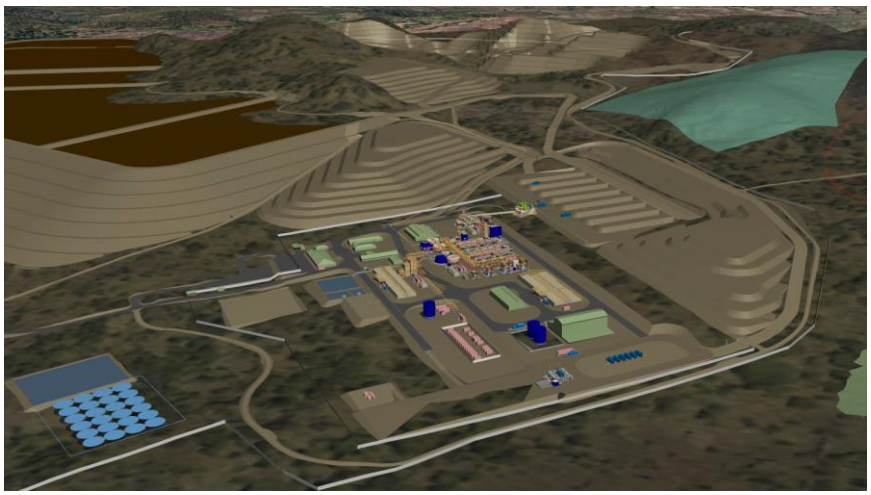
Source: Peak.

Infrastructure

Site layout

The site has been arranged to keep the physical footprint to a minimum (see Figure 6). All required infrastructure, including the accommodation village, process buildings, stockpiles, water resources and the tailings storage facility, will be located within the current licence boundaries. The planned layout will also incorporate space for future expansion of selected process units, enabling Peak to increase the capacity of the initial facility.

Figure 6: Proposed site layout



Source: Peak.

Transportation and logistics

Road and air to the project site: The Ngualla Project is accessible via the Southern Access Road, which encompasses the recently upgraded 48 km stretch connecting Ngwala Village to Kininga Village (see Figure 7). Additionally, Ngualla has an existing airstrip (see Figure 8). While the primary mode of access for cargo and personnel is by road, the airstrip is mainly utilised for transporting workers to and from the mine, as well as for expedited shipments of critical equipment and spares.

Figure 7: Ngualla access road

Source: Peak.

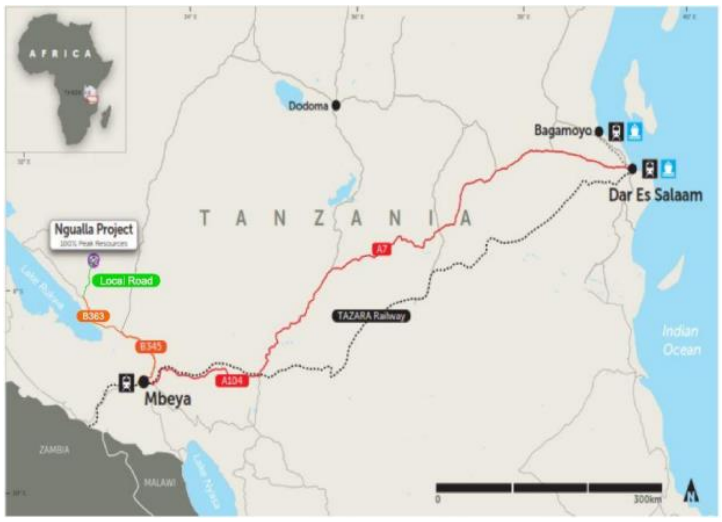
Figure 8: Ngualla airstrip

Source: Peak.

Road to the port: Two main road routes, both approximately 1,050 km, connect Ngualla to the port of Dar es Salaam (Figure 9).The southern route, due to its better condition, is the preferred, cost-effective option. Peak expects approximately 2,000 truck journeys p.a. of bagged concentrate product to the port. The bags will then be containerised prior to shipping to customers.

In addition to trucking, Peak is currently evaluating the potential to utilise a rail option with the Tanzanian and Zambian Rail Authority (TAZARA) to support construction activities and to transport consumables and concentrate during operations. The TAZARA line runs from Mbeya to Dar es Salaam and has the potential to significantly reduce overall trucking requirements.

Figure 9: Road and rail routes from Ngualla to the port of Dar es Salaam



Source: Peak.

Cargo from the port: Dar es Salaam is Tanzania's principal port, handling ~95% of the country's international trade. The port handles a wide range of cargo, including containers, bulk goods, and liquid bulk, and has facilities suitable for export of containerised concentrate. The port has consistent annual operations and is not seasonal. It was modernised and expanded in recent years to increase its capacity and improve efficiency.

The port will be used for Ngualla's inbound and outbound cargo, with exported rare earth concentrate product packaged in double-lined 1 m³ bulk bags Figure 11.

Figure 10: Port of Dar es Salaam

Source: Peak.

Figure 11: Concentrate transported in 1m³ bulk bags

Source: Peak.

Tailings disposal and management

The TSF has been designed by industry leaders, Knight Piésold Consulting, and will be constructed and managed in accordance with global best practices for dam and tailings management. The TSF will be built in phases. Stage 1 offers a year's storage, using materials from the TSF footprint due to initial run of mine (ROM) waste limitations. Later stages will mainly use ROM waste.

The TSF will have 4 cells: 2 for barite and 2 for TREO tails. At any time, 2 cells will operate while 2 are elevated. The TSF basin has a liner to minimise seepage. Each cell has an underdrainage system to capture and return seepage to its pond. Tailings are added via a spigoted system. Every cell contains a decant turret and causeway, with a pump to direct discharge to the processing plant.

Approvals for tailings storage and waste dumps are still pending.

We note that Peak is employing many recognised best practices for tailings management, including the application of the Global Industry Standard on Tailings Management. However, it is important to

recognise that while this approach is theoretically sound, the effectiveness of these measures depends on correct and careful implementation, regular monitoring, and ongoing management.

Power supply

The Ngualla site, with an estimated maximum power demand of 10.8 MW, will be served by a hybrid plant composed of a diesel generator battery and solar PV station, delivered at 11 kV, 50 Hz. Solar PV is set to contribute around 25% of total power.

Water supply

The project's water supply will be piped from a selected and well-tested bore field, providing for the accommodation camp, process plant, and a standalone village supply.

Waste from the reverse osmosis and demineralisation plants will be discharged into the Tailings Storage Facility (TSF). Reclaimed water from the TSF will be recycled to the process plant, ensuring zero discharge.

Accommodation

The accommodation village for the Ngualla Project will be located to the southwest of the mine site. During the construction phase, the project will require a workforce of ~800 personnel, which will fall to ~280 during a steady-state operation.

Figure 12: Ngualla accommodation camp

Source: Peak.

Communication

A site-wide fibre-optic network will be established, enabling the deployment of IP telephone, high-speed internet, and VPN connections. This arrangement will ensure reliable communication within the operational mine site, process plants, power facilities, and external connections.

Geology: unearthing a top-tier deposit

The project is focused on the Ngualla carbonatite, a pipe-shaped rock formation in a weak zone along the eastern side of the Congo and Kalahari regions. This location lines up with the western border of the Red Sea-East African Rift.

The Ngualla deposit is situated within a carbonatite complex (Figure 13) and is primarily composed of 2 types of minerals, bastnasite and monazite. This complex includes 3 main carbonatite rocks – calcite carbonatite, ferroan dolomite, and magnesiocarbonatite – and 3 silicate-rich igneous rocks.

Within the project area, key mineralisation zones include:

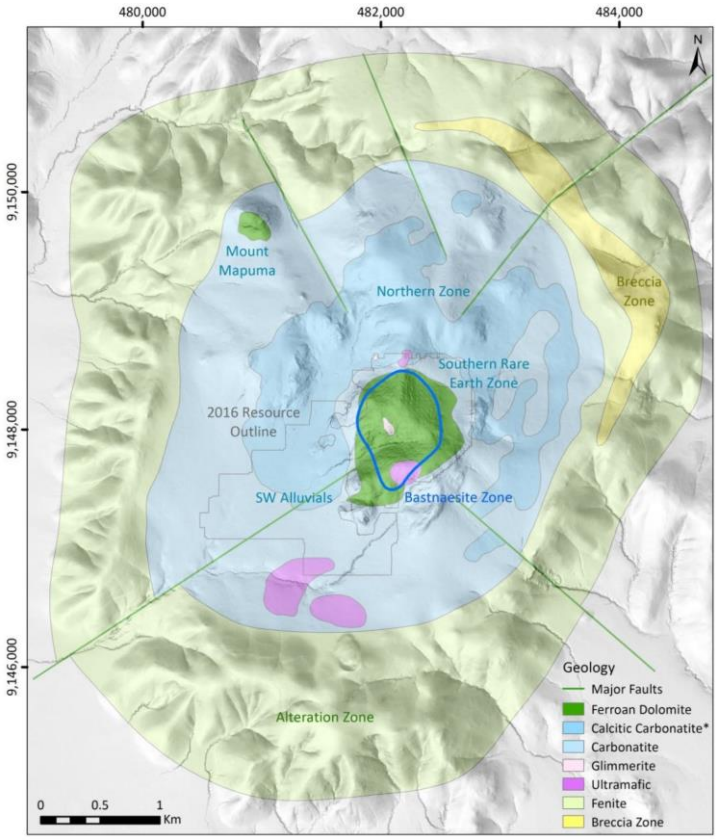
- Southern Rare Earth Zone (SREZ), consisting of the Bastnaesite and Monazite Zones (Figure 15)
- Southwest Alluvials
- Northern Zone.

Ferroan dolomite, a crucial source of rare earth minerals, is predominantly located around Mt Ngualla. This deposit is partially overlaid with ferricrete, a type of iron oxide deposit. Another significant exposure of ferroan dolomite is found at Mt Mapuma in the northwest.

What sets ferroan dolomite apart is its dense, unique composition with assorted minerals that form tiny spaces between the crystals, and that fact that it contains minimal magnetite. This mineral composes the majority of the Bastnaesite Zone and stands out due to its unique chemical composition, which includes a lower phosphate content, a higher barium content, and a different ratio of calcium to magnesium.

Overall, the Bastnaesite Zone exhibits a consistent geology and mineralogy, both for rare earth materials and associated non-valuable materials (gangue).

Figure 13: Ngualla carbonatite complex

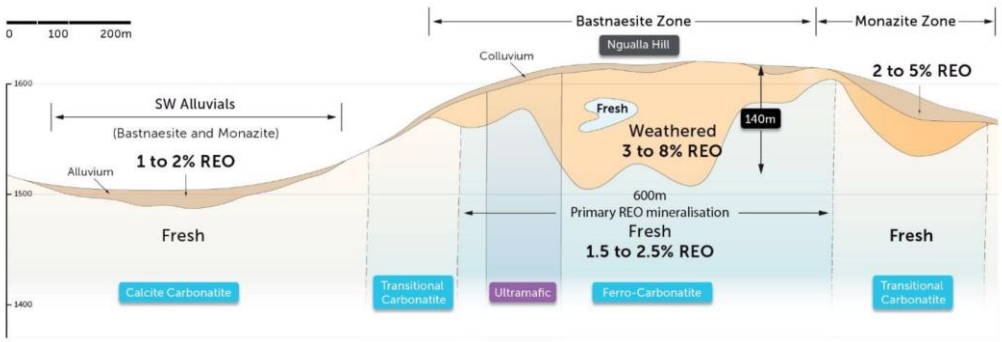


Source: Peak.

Understanding Ngualla's weathering patterns and impact

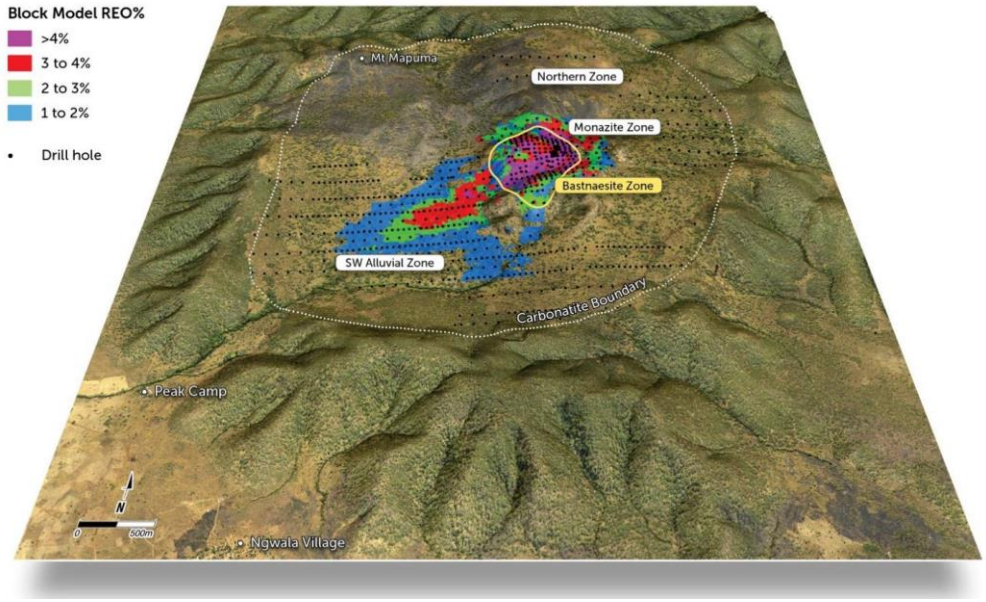
An uneven weathering profile is both established and preserved across the Bastnaesite Zone, Monazite Zone, and SW Alluvials (Figure 14). This weathering process is a crucial factor for the release and concentration of Ngualla's economically contained rare earth minerals.

Figure 14: Weathered Bastnaesite Zone of the Ngualla deposit



Source: Peak.

Figure 15: Oblique view looking north of the Ngualla carbonatite showing drill holes



Source: Peak.

Bastnaesite Zone: Metallurgical tests highlight the high-grade Weathered Bastnaesite Zone (BZ) as the most favourable due to its consistent rare earth and gangue mineralogy. This zone represents 22% of the overall Mineral Resource, set at a 1% TREO cut-off.

Monazite Zone: The Monazite Zone, which has over 3% TREO in its weathered and rocky soil layers, shows higher phosphate levels than the BZ. This area, likely shaped by calcite carbonatite erosion, contains some monazite but no bastnaesite or synchesite.

Northern Zone: The Northern Zone (NZ), 1 km north of the SREZ, is a prime exploration area for rare earths, covering 1 km². It's also rich in niobium-tantalum and phosphate, overlapping with rare earths. Mineralisation extends from the SREZ's borders into the NZ. Rare earth grades in the NZ range from 0.5% to 3% TREO, with a higher magnet rare earth content than the SREZ. The NZ has significant potential for expanded and higher-grade rare earth discoveries.

Resource and Reserve

The Ngualla deposit contains one of the world's largest and highest-grade undeveloped rare earth deposits. It has a Mineral Resource of 214 Mt, with an Ore Reserve of 18.5 Mt at 4.8% TREO, constituting 887 kt of REO. These reserves include 21.3% of neodymium and praseodymium (NdPr). The 24-year LOM is based solely on these reserves, which represent less than 20% of the total mineral resource of 4,620 kt TREO.

Figure 16: Ngualla Project Mineral Resource summary – all resources ⩾1% TREO

Category	Tonnage (Mt)	TREO %	Contained TREO (kt)
Measured	86.1	2.61%	2,250
Indicated	112.6	1.81%	2,040
Inferred	15.7	2.15%	340
Total	**214.4**	**2.15%**	**4,620**

Mineral Resources estimated at a cut-off grade of 1% TREO

Source: Peak.

Figure 17: Ngualla Project Ore Reserve (October 2022)

Category	Ore (Mt)	TREO %	Contained TREO (kt)
Proved	17	4.78%	813
Probable	1.5	5.10%	74
Total	**18.5**	**4.80%**	**887**

Source: Peak. Note: In estimating Ore Reserves, a NdPr Oxide price of US$49/kg was assumed, net payability.

Figure 18 summarises the TREO composition within the Weathered Bastnaesite Zone, based on a cut-off grade of 3% TREO. It is worth noting that while NdPr makes up ~22% of the TREO composition it represents almost 97% of the total basket value[3].

Figure 18: Ngualla Project Mineral Resource – TREO breakdown

	TREO grade			% of Total REO		
	Measured	Indicated	Inferred	Measured	Indicated	Inferred
	%	%	%	%	%	%
La_2O_3	1.346	1.43	1.328	27.61	27.83	27.45
CeO_2	2.354	2.478	2.327	48.28	48.22	48.07
Pr_6O_{11}	**0.233**	**0.244**	**0.23**	**4.77**	**4.74**	**4.75**
Nd_2O_3	**0.803**	**0.842**	**0.821**	**16.46**	**16.38**	**16.96**
Sm_2O_3	0.078	0.082	0.076	1.6	1.59	1.56
Eu_2O_3	0.014	0.015	0.014	0.29	0.28	0.28
Gd_2O_3	0.03	0.031	0.029	0.61	0.6	0.6
Tb_4O_7	0.002	0.002	0.002	0.04	0.05	0.05
Dy_2O_3	0.004	0.004	0.003	0.07	0.07	0.07
Ho_2O_3	0.00	0.00	0.00	0.01	0.01	0.01
Er_2O_3	0.002	0.002	0.002	0.03	0.03	0.03
Tm_2O_3	0.00	0.00	0.00	0.00	0.00	0.00
Yb_2O_3	0.001	0.001	0.00	0.01	0.01	0.01
Lu_2O_3	0.000	0.000	0.000	0.000	0.000	0.000
Y_2O_3	0.010	0.010	0.008	0.200	0.190	0.160
REO	**4.88**	**5.14**	**4.84**	**100.00**	**100.00**	**100.00**

Source: Peak. Note: The Weathered Bastnaesite Zone Mineral Resource ⩾3% TREO is contained within and is a subset of the total All Resources Ngualla Mineral Resources ⩾1% TREO.

Mining

Mining method

Conventional mining methods will be used, using hydraulic excavators, dump trucks, and drill-and-blast techniques. The entire ore deposit is composed of oxidised material, defined as 'free dig', meaning it can be dug up without the need for blasting. Only fresh waste material requires use of the blasting process.

[3] Based on concentrate basket value relies on projected prices supplied by Adamas for the Bankable Feasibility Study (BFS).

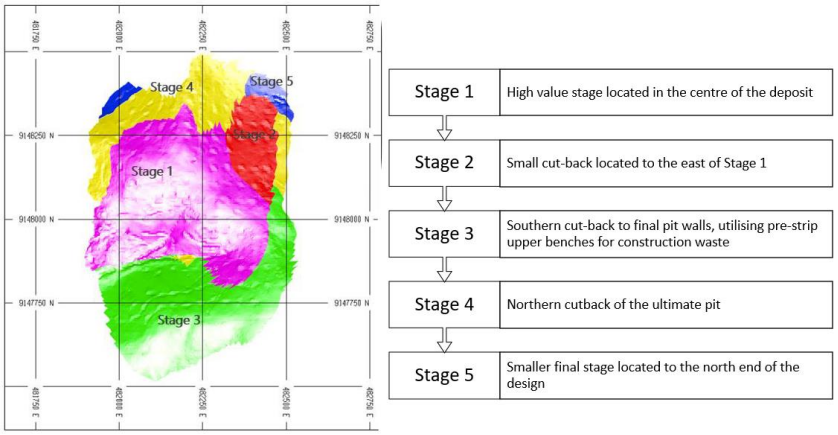
[4] The specific activity of radiation, measured in Bq/g (becquerels per gram), represents the rate at which radioactive decay occurs within a substance. It tells us how many radioactive decays are happening per second in each gram of the material.

Extraction will take place in 2.5 m benches. Ore will be transported to designated areas on the ROM pad or a specific low-grade stockpile. All mining waste will be deposited directly onto a set location on the TSF dam wall, eliminating the need for other external waste dumps.

Mine design

The pit design is divided into 5 stages, scheduled for optimal extraction of the deposit (see Figure 19).

Figure 19: Final pit design stages



Source: Peak, revised by MST.

Figure 20 outlines each mining stage's ore quantity, TREO%, total TREO kt, waste, total material, and strip ratio.

Stage 1 is the most valuable stage of the project, contributing 35% of the total rare earth oxide yield with a low strip ratio of 0.96. Although smaller, accounting for 5% of the total TREO, Stage 2 has the lowest strip ratio of 0.73.

Figure 20: Material movement across Ngualla pit stages

Stage	Ore				Waste	Total	Strip ratio
	Mt	TREO %	TREO kt	TREO % of Total	Mt	Mt	W:O
1	6.2	4.9	306.2	35%	6	12.2	0.96
2	0.9	4.9	45.2	5%	0.7	1.6	0.73
3	2.8	4.5	126	14%	9.8	12.6	3.52
4	6.4	4.8	307.5	35%	11.8	18.1	1.85
5	2.2	4.7	102.3	12%	4.4	6.6	2.03
Total	**18.5**	**4.8**	**887.1**	**100%**	**32.7**	**51.1**	**1.77**

Source: Peak, MST.

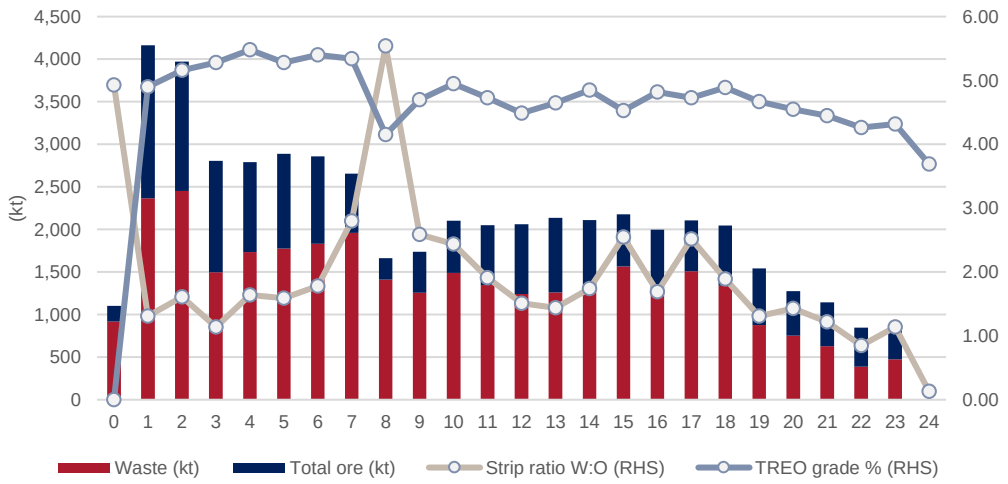
Mine waste rock will be used for constructing TSF walls, eliminating the need for an external rock dump. For the initial 7 years, long-term ore stockpiles are created to process the highest-grade material consistently. From Year 7, lower-grade ore stockpiles are mixed with open-pit ore for plant feed.

Production details

The Ngualla Project's mine production summary is shown in Figure 21.

The BFS schedules the project with a 24-year mine life, with an average of ~2.17 Mt mined annually. This includes around 0.77 Mtpa of ore and 1.4 Mtpa of waste. The crusher feed remains steady at about 800 kt/year. The average strip ratio is 1.77, with a lower strip ratio across the first 5 years, averaging 1.64.

Figure 21: Ngualla Project mine production summary



Source: Peak, MST.

Figure 22 outlines the project's production metrics, as per the BFS, for the first 6 years and the life of mine (LOM). The TREO maintains a healthy average grade of 5.4% for the first 6 years before gently tapering off throughout the remaining mine life to 4.32% by Year 23. The project's final year primarily utilises reclaimed stockpiled ore, displaying a lower TREO grade of 3.69%, signifying effective resource management.

Figure 22: Ngualla Project production outputs

Production Metrics	Unit	Years 1-6	LOM
Annual tonnes mined	ktpa	1,224	787
Grade mined	% TREO	5.40%	4.80%
Strip ratio (waste:ore)	ratio	1.7x	1.7x
Annual tonnes milled	ktpa	800.7	794.8
Recovery (TREO)	%	42.6%	42.6%
Concentrate production (dry)	ktpa	40.5	36
Concentrate production (TREO)	ktpa	18.2	16.2
Concentrate grade	% TREO	45.0%	45.0%
NdPr (of concentrate basket)	% of TREO	22.6%	22.3%

Source: Peak.

Processing

Beneficiation flowsheet

The Ngualla ore concentration process flowsheet (Figure 24) will upgrade the ore feed to produce a high-grade mineral concentrate. The key steps in this beneficiation process are shown in Figure 23.

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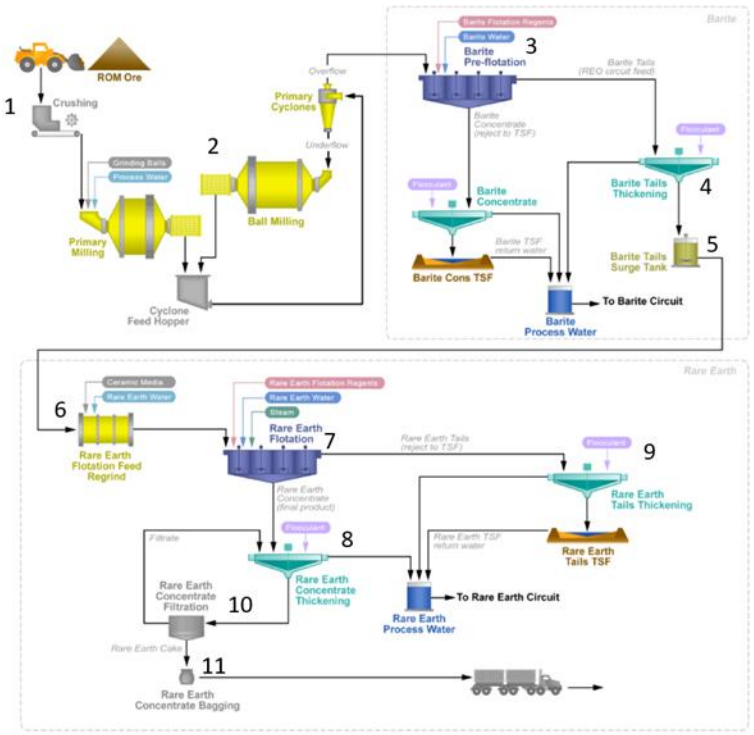
Figure 23: The key steps in this beneficiation process

Process Name	Process Description
1 Primary crushing	ROM Ore is processed through a 500mm grizzly, then reduced to ≤ 200mm by a feeder breaker before milling.
2 Grinding	Ore is processed through an open circuit primary SAG mill and a closed circuit secondary ball mill with cyclones, reducing its size from 25mm to a final 53µm.
3 Barite flotation	Barite is separated from mill slurry through a pre-flotation circuit, involving a rougher flotation and two cleaning stages, before rare earth flotation.
4 Barite concentrate thickening	The dewatered high-grade barite concentrate is stored in the barite tailings facility.
5 Barite tails thickening	Barite flotation tails, the feed for the TREO flotation circuit, are thickened and dewatered before regrinding.
6 Flotation feed regrind	The regrind mill, using ceramic media, reduces barite tails from 53µm to 38µm in a single pass.
7 Flotation	Post-regrind, the slurry is heated, treated with flotation reagents, and sent through the rougher feed hopper and four cleaning stages for further conditioning.
8 Concentrate thickening	The final concentrate is dewatered in the rare earth concentrate thickener with the addition of flocculant, achieving a 65% mass solids content.
9 Concentrate tails thickening and TSF deposition	The final rare earth tails are dewatered in the thickener with flocculant, achieving a 55% mass solids content, and then pumped to the rare earth tailings storage facility.
10 Concentrate filtration	The rare earth concentrate is filtered to achieve a final moisture content of around 15% solids.
11 Concentrate handling and product despatch	The bagging plant loads bulk bags to the designated weight, which are then either shipped or stored in the concentrate storage.

Source: Peak.

Figure 24: Ngualla flowsheet



Source: Peak.

Throughput and recoveries

The process plant has a nameplate capacity of 800 ktpa. On a weighted average, considering the anticipated production, the TREO recovery is designed at 42.7%.

Output and production schedule

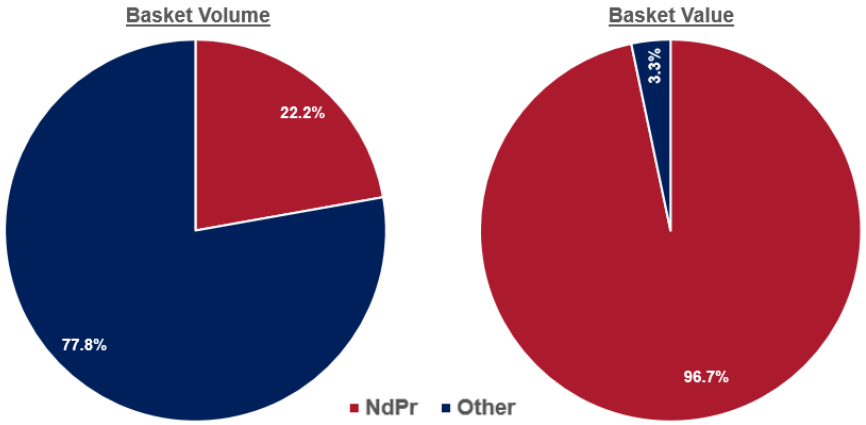
Over the first 6 years, the Ngualla Project is projected to produce an average of 40.5ktpa concentrate (dry) at 45% TREO, amounting to ~18ktpa TREO. Throughout the LOM, this average is expected to be 36ktpa at 45% TREO, translating to ~16ktpa TREO.

Figure 25: Ngualla Project expected production outputs

	Unit	Years 1-6	LOM
Annual tonnes milled	ktpa	800.7	794.8
Average grade milled	%	5.4	4.8
Concentrate production	ktpa (dry)	40.5	36
Concentrate grade	%	45	45
Concentrate production	**ktpa TREO**	**18.2**	**16.2**
NdPr % (of concentrate basket)	% mass	22.6	22.3

Source: Peak.

Figure 26: Ngualla concentrate basket: NdPr's volume (LHS) versus value (RHS)



Source: Peak.

Proof of concept: Ngualla's metallurgical testing at pilot plant

ALS Metallurgy's Perth laboratory conducted a pilot program for the Ngualla Project, using 56 dry tonnes of Ngualla ore representative of the site's weathered bastnaesite mineralisation. The crushed and uniformly mixed sample, with a 5.9% TREO grade, was processed at 250 kg/h following Peak's milling and two-stage flotation flowsheet, successfully producing 2 tonnes of >40% TREO concentrate.

The pilot plant testwork verified the operating and design parameters used in this study, providing a solid basis for a robust beneficiation flowsheet to process Ngualla ore.

Figure 27: Beneficiation pilot plant at ALS laboratory in Perth

Source: Peak.

Peak also undertook test work on the leaching and separation stages for the Ngualla concentrate, which is fundamental for the transformation of flotation concentrates into REOs. Utilising a sample from the ALS pilot plant, Peak examined dry roast and solvent extraction processes at the Sydney-based laboratory of the Australian Nuclear Science and Technology Organisation (ANTSO).

Upon campaign completion, Peak successfully produced 4 high-purity separated rare earth oxides from the Ngualla concentrate, positioning it among the few rare earth development firms that have successfully demonstrated processing capabilities. These included:

- NdPr oxide
- cerium carbonate
- lanthanum carbonates
- a combined medium and heavy rare earth product.

Radiation management

The Ngualla ore has relatively low thorium and uranium concentrations, averaging 54 ppm and 15 ppm respectively throughout its LOM. The concentrate has thorium and uranium levels averaging 415 ppm and 106 ppm, respectively. Tailings will have even lower levels due to substantial removal of thorium and

uranium. The specific radioactivity of the concentrate sits at 3.0 becquerels per gram[4] (Bq/g), well under the 10 Bq/g threshold for definition as a Class 7 Hazardous Goods Radioactive Substance. This allows the concentrate to be transported as General Cargo without the requirement to be treated as radioactive goods.

The average thorium and uranium levels in the concentrate are not expected to vary significantly as they are a function of concentrate grade, which is maintained at approximately 45% REO. The radiation levels at the Ngualla Project are significantly lower than those at many other rare earth deposits. For example, Figure 28 presents a comparison between Lynas' rare earths mine at Mt Weld and the Ngualla Project.

Figure 28: Radiation comparison: Mt Weld Rare Earth Mine vs Ngualla Project

Material	Mine	Avg. Thorium (ppm)	Avg. Uranium (ppm)	Specific Activity (Bq/g)
Ore	Mt Weld	660	25	3.02
	Ngualla Project	54	15	Not mentioned
Concentrate	Mt Weld	1,495	25	6.44
	Ngualla Project	415	106	3.00

Source: MST, Mt Weld Rare Earths Project Mine Closure Plan, March 2021, p. 40-41

For context, the uranium content in the Ngualla concentrate is akin to some types of granite commonly found in homes, which can house up to 100 ppm of uranium. Moreover, the concentrate's radioactivity is far less than the 33,000 Bq found in everyday items such as smoke detectors containing americium-241.me

Despite these relatively low levels, Peak plans to adhere to strict safety protocols, routinely monitoring radioactivity to ensure compliance with regulations and guarantee the safe handling and transportation of materials.

[4] The specific activity of radiation, measured in Bq/g (becquerels per gram), represents the rate at which radioactive decay occurs within a substance. It tells us how many radioactive decays are happening per second in each gram of the material.

Downstream Optionality

MREC refinery and other downstream options

Peak has provided an undertaking to the Government of Tanzania to assess the feasibility of developing downstream operations in the future. Peak will initially assess the potential to develop an intermediate mixed rare earth carbonate (MREC) facility, which could also be used to process concentrate from other rare earth projects in Tanzania as well as East and Southern Africa.

One potential opportunity available to Peak would be to develop an MREC facility in Tanzania and a final stage separation and refinery facility in Teesside.

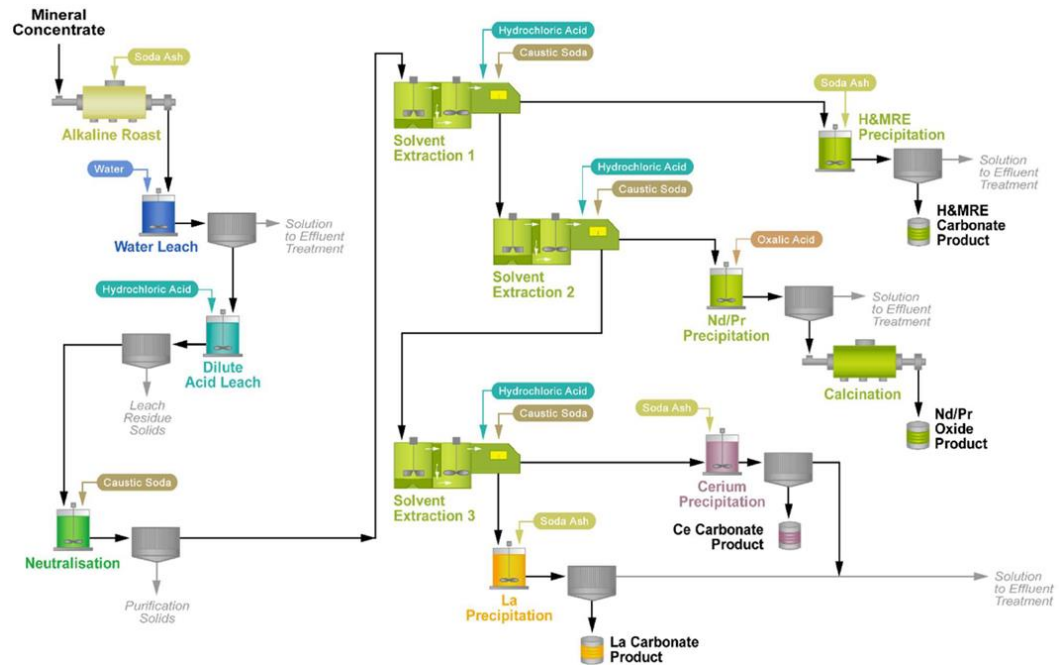
Refinery flowsheet and production

The refining process includes alkali roast processing, washing, filtering, and low-strength hydrochloric acid leaching. Through solvent extraction, four distinct products are derived:

- NdPr oxide
- cerium carbonate
- lanthanum carbonates
- a combined medium and heavy rare earth product.

The refinery process depicted in Figure 29 uses a standard, low-risk method. It first separates mid and heavy rare earths, then NdPr, and finally cerium and lanthanum. The energy-efficient alkali roast reduces acid use and, given Ngualla's bastnasite mineralisation, doesn't generate high-radionuclide waste.

Figure 29: Refinery flowsheet



Source: Peak.

BFS Shows a Robust Project

We first review Peak's financial projections from the 2022 BFS before outlining our independent analysis.

BFS (2022) Estimates and Outcomes – Strong Metrics

Capital cost estimation (BFS)

Development capital cost: Peak anticipates the Ngualla Project's total upfront capital expenditure to be US$320.7m (2022 real dollars). This figure, as outlined in the 2022 BFS, represents a 64% increase from the 2017 BFS estimate, and a 44% rise after adjustment for the 14% expansion in targeted production capacity. Several factors contributed to this increase in assumed upfront capital costs, including:

- inflationary cost pressures, especially for fabricated steel, concrete, and fuel
- scope expansions and modifications in the BFS update, including:
  - increasing targeted production capacity
  - substituting a heavy fuel oil power plant with a hybrid light fuel oil, solar, and battery power plant.

The pre-production capital cost for the Ngualla Project as shown in the 2022 BFS is detailed in Figure 30.

Figure 30: Upfront capex at Ngualla Project (2022 BFS)

Item	Capital cost (US$m)	% of total
Plant	95.7	30
Services	35.0	11
Accommodation camp	25.0	8
Tailings	18.2	6
Mining	16.5	5
Regional roads & infrastructure	11.4	4
Access roads	11.0	3
Earthworks	9.3	3
Airstrip	5.7	2
Other	12.6	4
Direct cost subtotal[a]	**240.5**	**75**
EPCM	32.6	10
Owners cost	14.3	4
Contingency	33.4	10
Total upfront costs	**320.7**	**100**

Source: Peak.

[a] Direct costs include US$20.6m in growth allowances that have been added to the bare (neat) cost quantities.

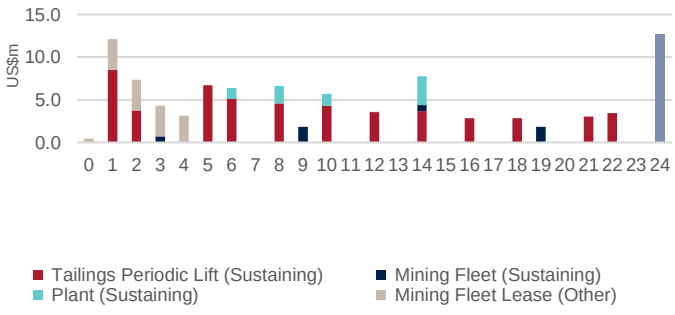
Sustaining capital cost: Figure 31 outlines the sustaining costs and additional operational capital expenditure. It is assumed that a leasing arrangement will be adopted for the mining fleet. Figure 32 presents Peak's projected annual costs related to sustaining and other capital expenditures over the LOM.

Figure 31: Sustaining capex and other capital costs (2022 BFS)

Cost	LOM sustaining capital cost (US$m)
Sustaining capital	
TSF periodic lifts	52.2
Plant sustaining capital	8.2
Mine fleet sustaining capital	5.1
Total sustaining capital	**65.5**
Other capital expenditure	
Mine fleet lease	14.4
Closure cost	12.7
Total: sustaining + other capital	**92.6**

Source: Peak.

Figure 32: Timing of sustaining capex and other capital costs (2022 BFS)



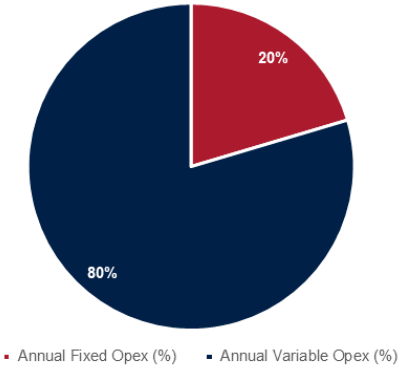
Source: Peak.

Operating cost estimation (BFS)

Figure 34 summarises the average annual operating costs of production and cost of goods sold. Peak projects that, including selling costs, operating expenses will average US$93.3m p.a. (in 2022 real dollars).

Figure 33 highlights that the majority of the Ngualla Project's opex (~80%) is variable throughout the LOM, offering flexibility and potentially enhancing resilience in poor market conditions.

Figure 33: Estimation of variable vs fixed costs (2022 BFS)



Source: Peak.

Figure 34: Operating cost breakdown (real 2022 $) (2022 BFS)

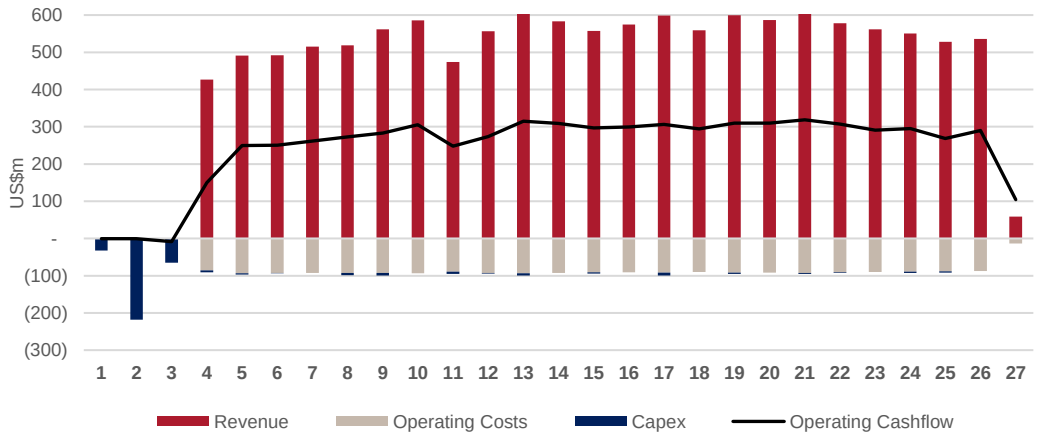
Item	Cost (A$m)			% of total
	US$m pa	US$/kg TREO	US$/t mill feed	
Power plant (BOO charge)	21.9	1.4	27.6	23.5%
Reagents	17.6	1.1	22.1	18.9%
Shipping to customers	14.2	0.9	17.9	15.2%
Trucking to Dar es Salaam Port	10.1	0.6	12.7	10.8%
Mining	8.5	0.5	10.7	9.1%
Plant labour (excluding mining)	7.3	0.5	9.2	7.8%
Fees and expenses	4.5	0.03	5.7	4.8%
Maintenance	2.2	0.1	2.8	2.4%
Other	7	0.4	8.8	7.5%
Total operating costs	**93.3**	**5.8**	**117.4**	**100.0%**

Source: Peak.

Financial evaluation (BFS)

A summary of the financial outputs across the LOM are presented in Figure 35. These cashflows assume the Adamas base-case scenario pricing as shown in Figure 37. Financial outputs are displayed net of the Tanzanian Government's distributions, factoring in their 16% free carry interest (FCI) in the project, which includes corporate taxes, royalties, and FCI-related dividends.

Figure 35: Lifetime operating cashflow vs capex (2022 BFS)



Source: Peak.

The key financial metrics from the BFS, using base-case pricing, are presented in Figure 36.

Figure 36: Ngualla Project financial analysis summary (base case) (2022 BFS)

Financial metrics	Unit	Value
Average annual revenue	US$m pa	538
Net operating cash flow (post tax) - LOM	US$m	6,597
Average annual operating cash flow (post tax)	US$m pa	276
Average annual EBITDA	US$m pa	448
Peak NPV8 (post tax, royalties and FCI)	US$m	1,483
Peak NPV10 (post tax, royalties and FCI)	US$m	1,156
IRR (post tax, royalties and FCI)	%	37.3%
Equity payback period	years	4
Commodity price assumptions	**Unit**	**Value**
NdPr oxide (LOM average)	US$/kg	231.88
Net payability	%	60.9%
Fiscal assumptions	**Unit**	**Value**
Royalties (% on total gross revenue)	%	6
Clearing fee and local levy (% on total gross revenue)	%	1.3
Withholding tax rate	%	10
Corporate tax rate	%	30
Government free-carried interest (FCI)	%	16

Source: Peak.

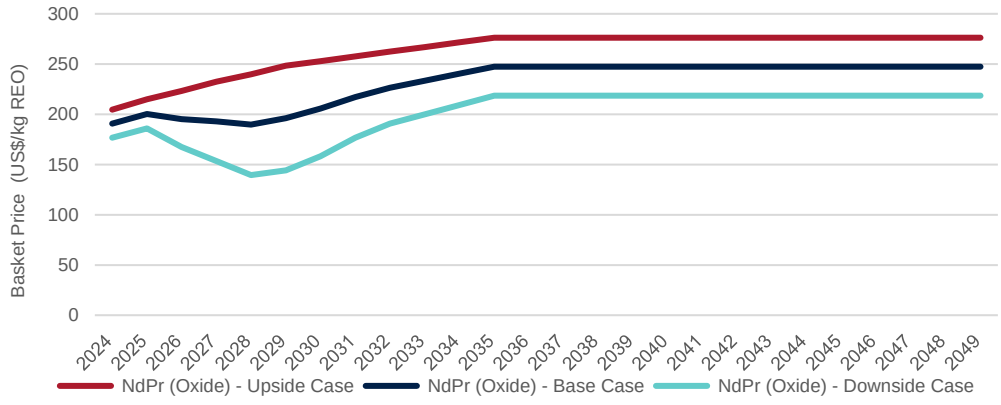
Rare earth elements pricing (BFS)

The product is sold as a concentrate with approximately 45% TREO grading. The price of the concentrate is broken down into 4 product streams:

1. NdPr oxide
2. cerium carbonate
3. lanthanum carbonates
4. a combined medium and heavy rare earth product.

In 2022, Peak engaged Adamas to conduct a rare earths market review to establish pricing assumptions. Based on its base-case pricing model, Adamas forecasts the NdPr oxide price will reach US$200/kg by 2025 and increase to US$247/kg by 2035, attributed to the growing demand from EVs, direct drive wind turbines, and a widening market deficit in NdPr oxide.

Figure 37: Adamas price forecast for NdPr oxide: upside, base, and downside case (US$/kg)

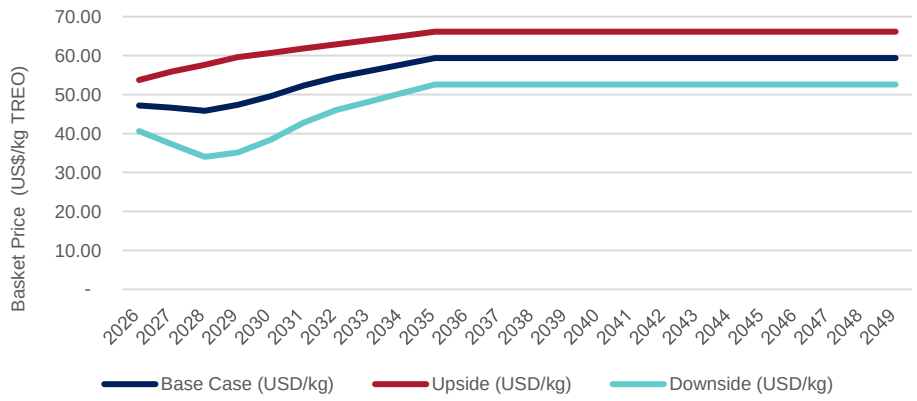


Source: Peak.

The Ngualla concentrate's value is primarily influenced by the NdPr oxide price, which constitutes over 97% of its basket value. Figure 38 shows price forecast for Ngualla Project basket of concentrate (TREO of 45%).

Historical NdPr oxide prices are shown in Figure 44. Prices peaked in March 2022 at ~US$154/kg (ex-VAT) and have averaged US$84/kg (ex-VAT) over the last 3 years.

Figure 38: Peak's price forecast for Ngualla Project basket of concentrate (TREO of 45%)



Source: Peak.

Project funding strategy

Based on the 2022 BFS, Peak will need funding to cover pre-production capital of ~US$321m, as well as a combination of capitalised interest, working capital, debt service reserves and working capital.

Peak's non-binding MOU with Shenghe supports an integrated development and funding solution. Shenghe will arrange a fixed-price, turnkey EPC solution, and is tasked with sourcing a funding solution for Ngualla with terms that both Peak and Shenghe find acceptable. The Offtake Agreement stipulates a termination clause should financial close not occur within 6 months of a FEED study being finalised.

Both Peak and Shenghe are working to minimise capex and opex, expedite construction, and enhance the Ngualla Project. It is noteworthy that Shenghe might acquire a significant non-controlling equity stake in the project through a Peak-owned subsidiary, considerably reducing Peak's capital requirements.

Peak's funding strategy for Ngualla aims to reduce equity dilution. Shenghe is prepared to offer a blend of primary and supplementary funding, including a significant asset-level investment without gaining a controlling stake. If additional capital is needed, options include a prepayment for concentrate sales, a loan provision, or leveraging Chinese banking channels. This strategy benefits Peak shareholders by reducing dilution, utilising Shenghe's fiscal capabilities, and lessening dependence on third-party funding.

Marketing and Offtake Strategy

Current strategy: key relationship with Shenghe

Binding offtake with Shenghe: project significantly de-risked

On 8 August 2023, Peak executed a binding offtake agreement with Shenghe Resources, a leading global producer of vertically integrated rare earth oxides. Shenghe has agreed to purchase 100% of the rare earth concentrate produced at Ngualla (minimum of 50% of intermediate and final rare earth products). The agreement is conditional (including subject to Peak shareholder approval) and for an initial term of 7 years. This binding offtake agreement significantly de-risks the Ngualla Project.

Figure 39: Key terms of Peak–Shenghe offtake agreement

Aspect	Details
Products	All rare earth concentrate, with the possibility of at least 50% of intermediate products (e.g., future Mixed Rare Earth Carbonate) or final separated oxides, contingent upon subsequent agreements.
Take-or-pay	Shenghe Singapore must purchase and accept delivery of all products agreed upon.
Pricing	Market-based pricing formula derived from the value of contained rare earth oxides (as listed on Asianmetal.com) minus deductions for VAT, trading fees, refining recoveries, charges, and margins.
Term	Initial 7-year period, extendable by mutual consent.
Shipping	Concentrate sales employ a Cost, Insurance and Freight (CIF) model to specified Chinese ports.
Invoicing	Peak can choose between two payment options: • 90% of the Provisional Invoice paid via a Letter of Credit before shipment loading. • 80% of the Provisional Invoice paid by Telegraphic Transfer within five days after receiving shipping documents. The remaining balance is due within 30 days post Chinese customs clearance.
Conditions precedent	The agreement is conditional upon: • approval from at least 50% of Peak shareholders • consents from Shenghe's board and/or shareholders • Mamba Minerals Corporation Limited and Mamba Refinery Corporation Limited Board approvals • novation of the Offtake Agreement to Mamba Minerals Corporation Limited and Mamba Refinery Corporation Limited • a performance guarantee from Shenghe • achieving Financial Close for project funding • Tanzanian Mining Commission's endorsement.
Termination	The agreement can be terminated if: • a default event remains unaddressed for 30 days • Financial Close isn't reached within 6 months after finalising the FEED study (currently scheduled to be completed in November 2023).

Source: Peak.

Who are Shenghe Resources?

-Listed in Shanghai: market cap US$3.1 bn

-China's leading importer of rare earth concentrate

-Operations: mining, beneficiation, refining, trading, alloy and metal production + large, integrated titanium business

-Rare earth portfolio: rare earth oxide, rare earth salts, rare earth metals, metal catalysts and molecular sieves

-Shenghe Singapore has a 19.8% Peak stake; added Non-Executive Director to Peak's Board in Nov 2022

Peak and Shenghe have also entered into a non-binding Memorandum of Understanding (MOU) for engineering, procurement, and construction (EPC) as well as funding for Ngualla. Given Shenghe's status as a rare earth specialist, we see its involvement in the project development as pivotal to achieving operational excellence. Its expertise spans mining, metallurgy, supply chains, and more, which could significantly reduce the risks associated with the project.

The non-binding MOU also includes the potential for Shenghe to become a non-controlling partner in the project by contributing equity capital. This would reduce Peak's dependence on financing from equity capital markets and high-interest debt financing, further de-risking the project.

Future strategic opportunity: filling the void left by MP Materials

MP Materials transitioning downstream…

MP Materials (NYSE:MP – market capitalisation nearing US$4 bn) operates the Mountain Pass mine in California – globally recognised as the second-largest rare earth mine. MP sells bastnaesite mineral concentrate, exporting approximately 40ktpa TREO to Shenghe. Shenghe has a 7.75% interest in MP, and has consistently supported MP through offtake agreements, technical collaborations, and funding.

As part of its strategic expansion, MP is transitioning downstream to produce NdPr oxide and magnets. This strategic integration downstream will effectively remove approximately 15% of the global rare earth concentrate supply, thereby creating a supply gap in Shenghe's procurement.

…creating an opportunity for the Ngualla Project

The mineralogy of Ngualla's bastnaesite deposit, combined with its high-grade concentrate, contained NdPr, and low levels of deleterious elements, positions it strongly to supplant MP Materials as Shenghe's primary concentrate supplier.

MP Materials provides the perfect roadmap for Peak and its staged development approach. MP restarted the Mountain Pass Mine as a concentrate-only operation, much like Peak aims to do. Following the optimisation of MP's project, which has entailed expanding production and improving concentrate grades and recovery, MP is now moving further downstream into the production of NdPr oxide and high-strength permanent magnets.

Exploration: The Hidden Upsides of the Ngualla Deposit

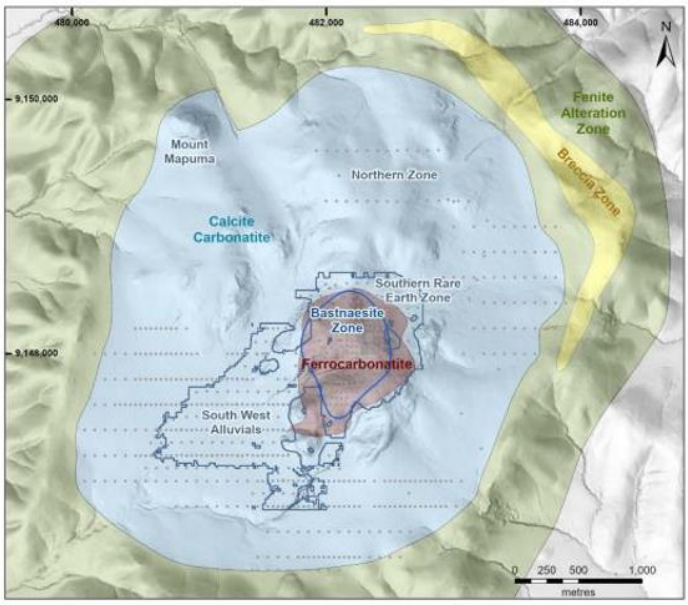
In addition to light rare earths, the Ngualla deposit is highly prospective for several other elements, including heavy rare earths (DyTb), fluorspar, niobium, and phosphate.

Exploration overview

Peak has allocated approximately $1.5m towards a new exploration program at its Ngualla deposit. The program's primary focus is the Northern Zone and the Breccia Zone, both rich in critical minerals such as heavy rare earths, monazite-hosted rare earths, niobium, phosphate, and fluorspar. The exploration strategy includes a 4,000-metre RC drilling campaign to further delineate these zones. A formal tender for this drilling contract is in progress and is set to wrap up in the coming weeks. In addition, Peak has collaborated with SRK Consulting to develop a conceptual model for the Northern Zone, aiming to spotlight potential mineralisation and refine drilling targets.

Figure 40: Exploration targets the Northern and Breccia Zones, rich in critical minerals

1. Northern Zone	2. Breccia Zone
a) Phosphate	a) Fluorspar (Fluorite)
b) Niobium	b) Monazite
c) Monazite	c) Other Commodities?
d) Heavy Rare Earths	



Source: Peak.

Numerous samples from prior trenching in the Breccia Zone have been discovered during the quarter. These samples are now enroute to Perth for assaying and in-depth analysis. It is worth noting that the Breccia Zone is particularly promising for fluorite, a critical mineral gaining traction in various EV technologies and applications.

Potential upside

The potential upside for Peak is significant. If these explorations activities confirm substantial deposits of these critical minerals, Peak stands to not only diversify and strengthen its resource portfolio but also to capitalise on the growing global demand for these minerals, especially in the tech and EV sectors. This could translate to increased market valuation, enhanced investor interest, and potential new partnerships or contracts, ensuring a robust and sustainable growth trajectory for the company.

Tanzania: Attractive Jurisdiction

Growing economy is attracting multinational corporations, fuelling growth

The United Republic of Tanzania (which includes the island of Zanzibar) is an East African country bordering the Indian Ocean. Tanzania is a former British colony that gained independence in 1961 and became a republic within the Commonwealth of Nations a year later. As of 2021, Tanzania's population was estimated at 63.6m.

Tanzania has generally been considered politically stable, with peaceful transitions of power and limited instances of civil unrest. It is a one-party dominant state, with the Chama Cha Mapinduzi (CCM) in power since 1961.

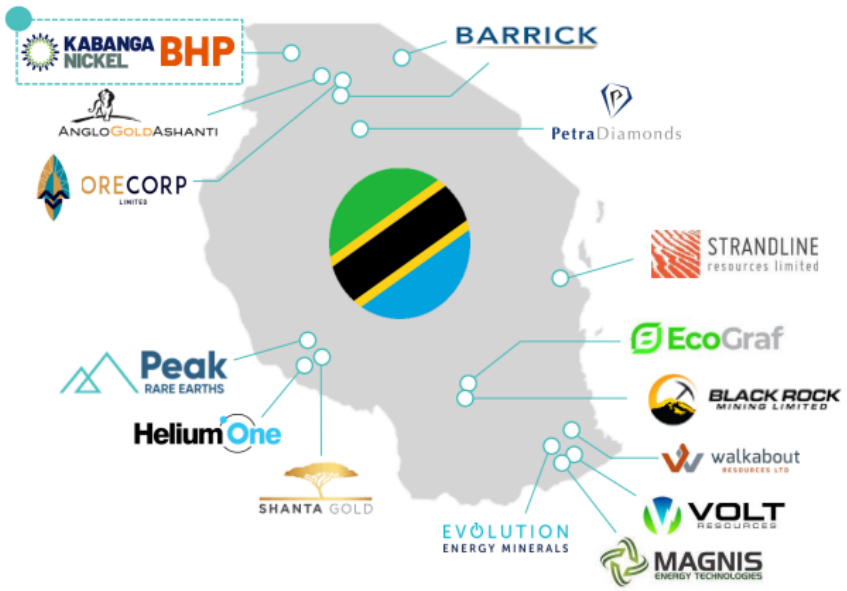
Over the past decade, Tanzania has achieved relatively strong economic growth and declining poverty rates. Inflation has fallen to low single digits, and economic growth is buoyant, averaging 7.6% per year in the 10 years prior to the pandemic. Poverty, while still widespread, is falling. Exports are booming, public finances are sound, debt ratios are low, and foreign exchange reserves are ample.

Furthermore, in March 2023, the Vice President of the United States, Kamala Harris, completed a three-day state visit to Tanzania. One of the major initiatives announced during the trip included a Memorandum of Understanding between Tanzania and the Export-Import Bank of the United States to facilitate US$500m of export financing. Other funding initiatives included support for economic development, broadband coverage, biodiversity, agriculture and health.

Rapidly expanding mining sector

Tanzania's already established mining sector is undergoing rapid growth and transformation. The Government of Tanzania is prioritising the development of the mining sector with an aim of increasing its GDP contribution to 10% by 2025. A total of 8 mining-related Framework Agreements have now been executed under the oversight of President Samia Suluhu Hassan.

Figure 41: Tanzanian mining and development projects



Source: Peak.

Moody's positive credit rating for Tanzania – improved country risk

In 2023, Tanzania has seen increased political stability and an enhanced business climate, leading to an upgraded B2 Positive credit rating from Moody's. This improvement is attributed to decreased political risks, structural reforms, and a surge in foreign direct investments, particularly in the mining and hydrocarbons sectors. Moody's indicates potential for a further upgrade if Tanzania consistently promotes investor-friendly policies and ensures regulatory steadiness.

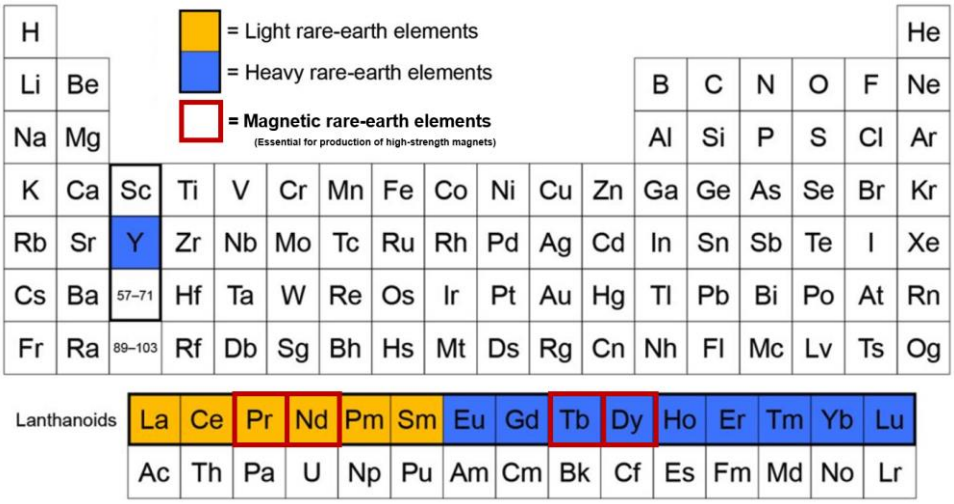
Product Understanding: Unpacking Rare Earths

Rare earth elements (REEs), often dubbed as 'industrial vitamins', have – despite their small volume[5] - a crucial role in multiple industrial procedures and are indispensable in facilitating a wide range of modern materials and technologies. The majority of high-value heavy rare earths originate from China, a fact that is propelling initiatives to broaden the supply chain for these vital elements.

Definition of rare earths

There are 17 specific chemical elements as REEs or rare earth metals (REMs) (Figure 42). . While all 17 of these elements share similar chemical properties, they possess distinct physical and magnetic characteristics.

Figure 42: Rare earth elements (REEs) in the periodic table



Source: Peak.

Classification and terminology

REEs are often classified into two main categories: light rare earth elements/oxides (LREEs or LREOs) and heavy rare earth elements/oxides (HREEs or HREOs). This classification is largely determined by their atomic weights and electron configurations. Within these classifications, a subset referred to as the magnetic rare earth elements (MREEs) has unique magnetic properties. Each of these categories, marked by their unique characteristics, has significant applications across diverse fields including electronics, defence, renewable energy, and transportation.

Total rare earth oxides (TREOs)

This term represents the total concentration of rare earth oxides present in a material or deposit. It is a crucial metric in the assessment of the economic viability of a rare earth project, as it helps determine the quantity of recoverable rare earths.

Light rare earth oxides (LREOs)

Due to their higher abundance in the Earth's crust, LREOs make up over 90% of the TREO content typically found in a rare earth deposit. Consequently, they constitute the vast majority of the world's annual TREO production.

Heavy rare earth oxides (HREOs)

HREOs, on the other hand, are present in the Earth's crust in substantially lower concentrations than LREOs and as such make up a relatively small portion of the world's TREO output each year. HREOs have critical roles in high-tech and green applications, including advanced electronics, high efficiency lighting, and permanent magnets used in electric vehicles (EVs) and wind turbines.

Magnetic rare earth oxides (MREOs)

This category refers to the rare earth elements that are particularly important in the production of strong permanent magnets. The main MREEs are neodymium (Nd), praseodymium (Pr), and dysprosium (Dy), and terbium (Tb). MREEs are critical for a range of technologies, including EVs, wind turbines, hard disk

[5] Only ~45kt per annum for the NdPr market

drives, and various other electronics and clean energy applications. NdPr are critical elements in the strongest type of permanent magnets, while DyTb enhance the high-temperature resistance of these magnets.

Understanding how REEs are priced

Since REEs are largely a niche commodity with bespoke products and end uses, most commercial terms for pricing and sale are negotiated between producers and downstream consumers. In China, the price is more tightly controlled by the few large producers, with annual mining quotas used a tool to increase or constrain supply in the market (where possible). The product is predominantly sold as:

- rare earth mineral concentrates (REMCs)
- mixed rare earth carbonate (MREC)
- separated product – rare earth oxide (REO)

Various pricing references are available for REOs and metals, usually in US dollars per kilogram. Prices can be sourced from industry publications like Asian Metal, Metal-Pages, Shanghai Metals Market, and Industrial Minerals, or consulting firms including Adamas Intelligence, Argus Metals, Project Blue, CRU, and Wood Mackenzie.

Following the sale formats of REEs, it's crucial to understand the term "payability." Simply put, payability is the percentage of a product's value that a producer gets paid. In the REEs market, this can vary based on whether the product is sold as REMCs, MREC, REO, or REMs. As the product undergoes further refinement, its payability typically increases, getting closer to 100%, reflecting the higher value of more purified forms.

Figure 43: Rare earth oxide spot prices as of 31/08/23

	Rare Earth Oxide	REO spot price (US$/kg)
Light REO	Lanthanum	0.60
	Cerium	0.61
	Praseodymium	70.60
	Neodymium	71.01
	Samarium	2.09
Heavy REO	Europium	27.15
	Gadolinium	41.43
	Terbium	1,120.92
	Dysprosium	344.63
	Holmium	87.03
	Erbium	38.57
	Thulium	0.00
	Ytterbium	13.92
	Lutetium	772.81
Other	Yttrium	6.27

Source: SMM metals

Figure 44: Historical NdPr oxide prices (US$/kg, VAT excluded)

Source: SMM Spot Metal Prices.

Market Review: Many Uses and Growing Demand as Supply Gap Looks Set to Grow

Exploring the multiple end-uses of REEs

REEs have a wide range of uses. Figure 45 shows their primary applications.

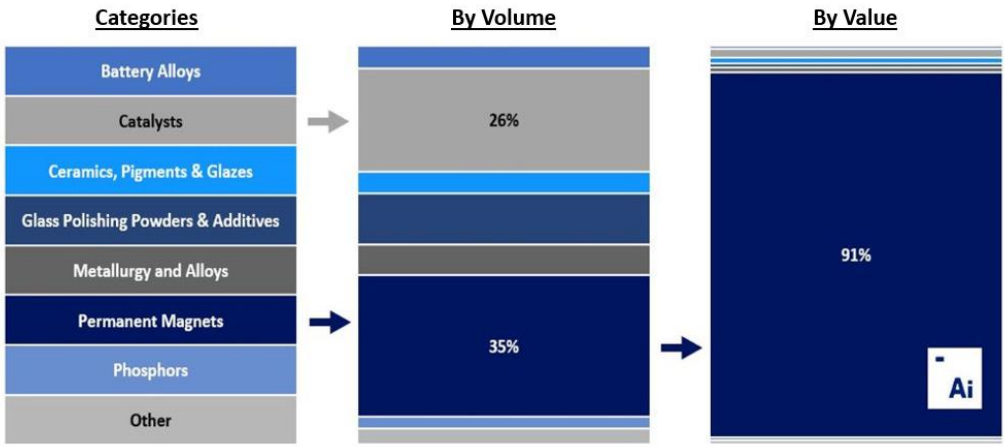
Figure 45: Rare earth applications overview

End-Use Category	Elements	Description
1. Permanent Magnets	Nd, Pr, Dy, Tb, Sm	Used in the production of high-strength permanent magnets found in mobile phones, laptops, energy-efficient electric motors and generators, etc.
2. Catalysts	La, Ce	Utilized in catalytic converters for gasoline- and diesel-powered vehicles, as well as in fuel cracking catalysts and additives used by oil refiners.
3. Battery Alloys	La, Ce, Pr, Nd	Used in the production of anode materials for nickel-metal hydride (NiMH) batteries, which are found in hybrid vehicles, consumer electronics, cordless tools, and more.
4. Metallurgy and Alloys	La, Ce, Ho, Gd, Y	Rare earth mischmetal is used in steel production and ductile iron making, as well as in the creation of various alloys.
5. Ceramics, Pigments and Glazes	La, Ce, Pr, Nd, Y	Essential in the creation of various ceramics used in applications such as jet engine coatings, dental crowns, ceramic capacitors, ceramic tiles, etc.
6. Phosphors	Ce, La, Y, Tb, Eu	Used in phosphors for energy efficient lamps, display screens and avionics, and as an anti-counterfeit measure in some fiat currencies.
7. Glass Polishing Powders and Additives	Ce, La, Er, Gd, Y	Used for polishing optical glass, hard disk drive platters, LCD display screens, and gemstones. Additionally, cerium is used as an additive in UV-filtering glass and container glass.
8. Other	La, Ce, Nd, Dy, Tb, Gd, Lu, Tm	Used in various other applications in defense, medicine, health, wellness, aerospace, agriculture, high-tech, and chemical industries.

Source: MST, based on data from The Global Rare Earth Industry Association (https://www.global-reia.org/about-rare-earth/)

In 2021, over 65% of global TREO volume was consumed by permanent magnets (PMs) and catalysts. PMs accounted for 95% of TREO's global value. Given the rising demand for elements like neodymium and praseodymium, this percentage is expected to grow in the coming years. Historically utilised in electronics, the shift towards a green economy has surged the demand for REEs in EVs and wind turbines. As a result, with PMs representing 46% of 2021's TREO volume, their demand and market value are anticipated to rise further.

Figure 46: Permanent magnets the largest demand drivers of rare earth elements



Source: The global rare earth industry association (https://www.global-reia.org/about-rare-earth/), original chart via Adamas.

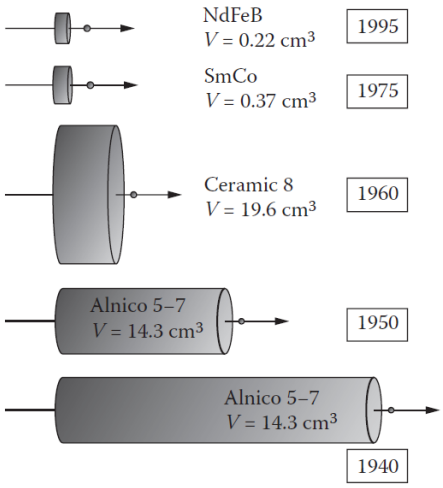
A quick look at permanent magnets – NdFeB

NdFeB magnets have dominated the PM market since their development in the 1980s, replacing older magnet types such as ceramic, AlNiCo, and SmCo magnets.

Their composition is primarily a $Nd_2Fe_{14}B$ tetragonal crystalline structure consisting of neodymium, iron, and boron. Additionally, they often contain trace amounts of praseodymium, dysprosium, terbium, copper, cobalt, niobium, and other metals tailored for specific applications.

NdFeB magnets have a superior magnetic strength per volume (Figure 47), allowing for compact, high-performance designs. This strength-to-weight advantage is vital for reducing electric motor sizes.

Figure 47: Relative magnet volume for the same magnet energy

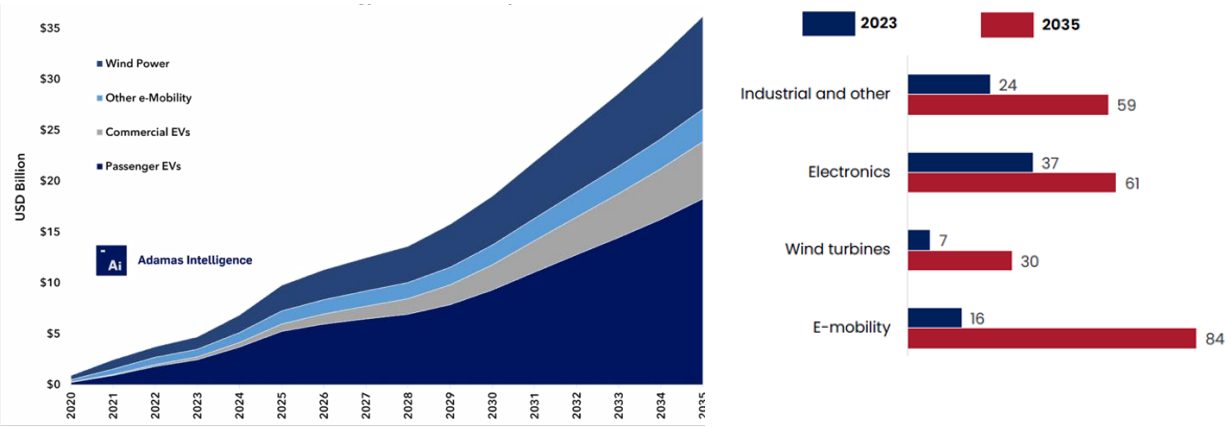


Source: Extractive Metallurgy of Rare Earths, 2nd edition.

Demand: growth in EVs and wind turbines

In 2022, energy-transition applications such as EV motors and wind generators consumed magnet rare earth oxides (NdPr, Dy, and Tb) worth $3.8 bn, as reported by Adamas Intelligence. Adamas predicts this value will grow at a 19.1% CAGR, reaching $36.2 bn by 2035, with this growth predominantly driven by passenger EV traction motors and boosted by wind power generators (see **Error! Reference source not found.**).

Figure 48: Surging value of rare earths in energy transition to 2035 (LHS); Key NdPr oxide demand drivers (ktpa) (RHS)

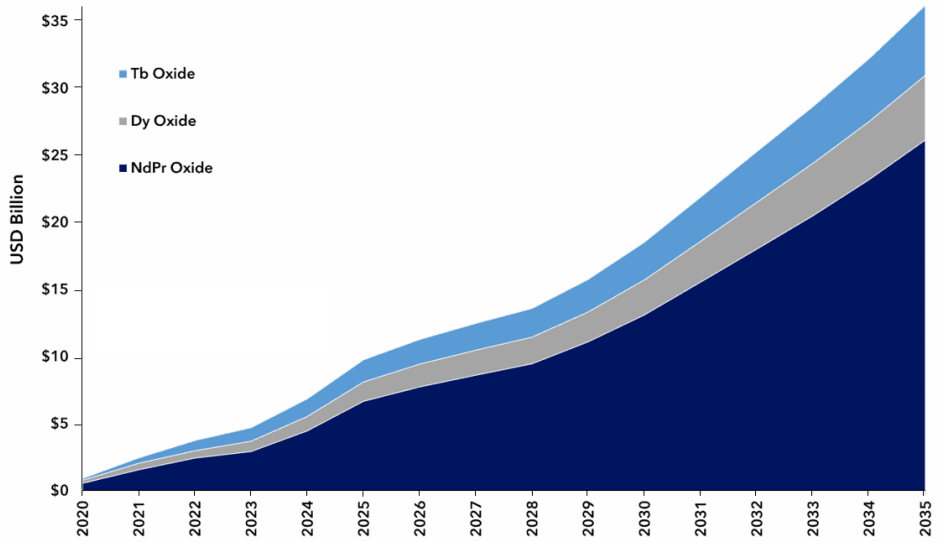


Source: Adamas Intelligence (https://www.adamasintel.com/value-of-rare-earths-used-in-energy-transition/) (LHS); Peak, sourced from Adamas Intelligence – Rare Earth Magnet Outlook to 2040, Q2 2023 (RHS).

NdPr oxides to see substantial benefit

The consumption value of NdPr oxide is projected to see the highest increase by 2035, anticipated to rise 11-fold by 2035 (Figure 49). This is due to strong demand growth across all applications, rising prices, and a shift towards using more NdPr in high-grade NdFeB magnets.

Figure 49: NdPr oxides to benefit most, but the rising tide will lift all boats

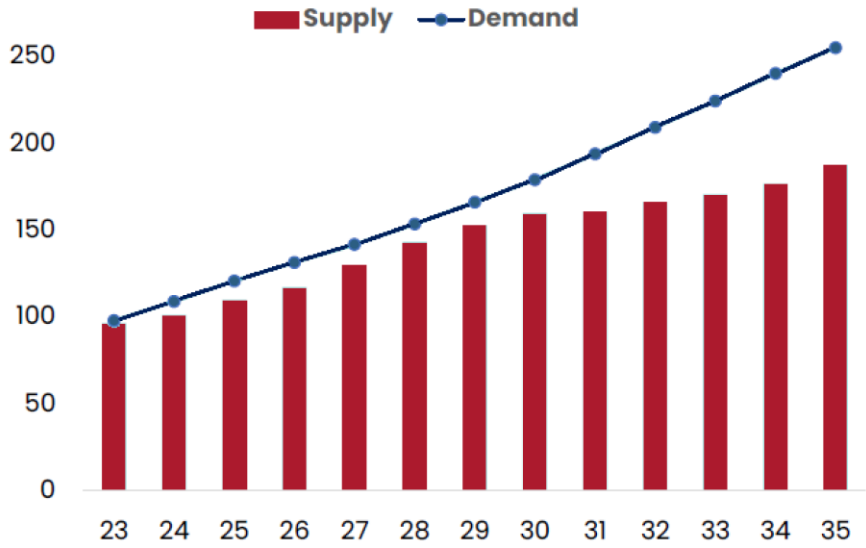


Source: Adamas Intelligence (https://www.adamasintel.com/value-of-rare-earths-used-in-energy-transition/)

Supply: a growing deficit

Figure 50 shows that supply deficits of NdPr oxides are expected to commence in 2024 and continue to increase, ultimately creating significant shortages of these critical magnet materials by 2035.

Figure 50: Forecasted NdPr oxide supply–demand balance (ktpa)



Source: Peak, sourced from Adamas Intelligence – Rare Earth Magnet Outlook to 2040, Q2 2023.

Valuation: A$1.13 base case valuation, A$2.65 Upside Case if Project Selldown Proceeds

Our base-case risked NPV-based valuation for Peak is A$1.13/share on a fully diluted basis. However, we see significant upside in the valuation if Peak complete a sell down of the Project, as detailed in the subsequent section.

Base-case valuation: risked NPV implies almost 2.5x potential upside

Our financial analysis of the flagship Ngualla Project (86% ownership) values Peak at A$1.13 per share, fully diluted, while the un-risked valuation is A$1.52/share. This valuation implies upside of 150% to the current share price. We summarise our valuation in Figure 51. The analysis was conducted using a discount rate of 10% and a probability risk weighting of 75%.

Furthermore, we have attributed a net asset value (NAV) of A$776m compared with the current market value of ~A$120m. In our valuation, we assume that US$200m (A$286) in equity will be raised at A$0.62 per share, leading to a 179% increase in the total number of shares.

The valuation excludes potential upside from exploration and added potential for additional critical minerals and does not consider ant potential sell down of the project to Shenghe. We believe NdPr is under-appreciated with strong structural tailwinds, and we see the potential for tight medium-term fundamentals in the NdPr market.

Figure 51: Base-case valuation summary, showing potential upside of 150%

PEK (MSTe)					Jun-23
	Discount rate	US$mn	Risk weighting	AUD$mn	AUD$/sh
Ngualla (100%)	10.0%	778	75.0%	833	1.13
Total operating assets				**833**	**1.13**
Corporate/SG&A				(30)	(0.04)
Net cash/(debt) ($AUD)				25	0.03
Net Asset Value				**829**	**1.13**
Current Share Price					0.45
Upside					150%

Source: MST estimates.

Key assumptions

Our base-case NPV valuation is built upon a mine plan which aligns with the recently published BFS. Critical assumptions are shown in Figure 52.

We have used a 10% discount rate (real) and assumed US$401m (versus US$321m in the BFS) in initial development capital. Our basket price (avg. initial 10 years) of US$47/kg is conservative relative to industry forecasts. We assume project construction commences in CY2025, with first production in CY2028 after a ~36-month construction period.

We assume the project will be funded by 50%/50% debt/equity (at a 62c issue price). Importantly, our valuation does not incorporate the benefit of any additional potential project expansions.

Figure 52: Base-case valuation assumptions

Assumptions	PEKe	MSTe
Construction commencement time (Year)	2024	2025
Construction period (years)	2	3
Average Mill Feed (ktpa)	802	802
Development Capex (US$m) (Real 2023 $)	321	401
Total Sustaining Capex (US$m) (Real 2023 $)	65.5	81.9
Closure Cost (US$m) (Real 2023 $)	12.7	20.3
Avg. Annual C1 Cash Costs (US$m) (Real 2023 $)	91.2	107.6
Avg. Annual Unit Operating Costs - AISC (US$/kg)	4.4	4.8
Avg. NdPr Price (Real 2023) (US$/kg)	234	210
Realised Avg. Basket Price (US$/kg) - Real 2023	34	29

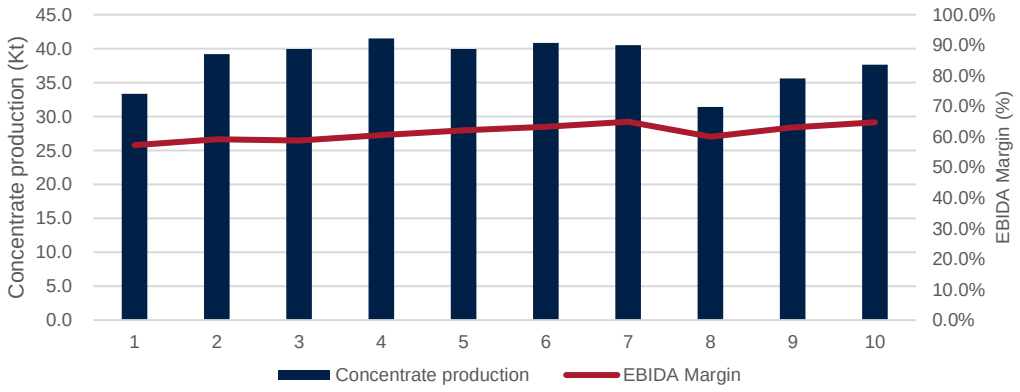
Source: MST estimates.

Our production and EBITDA margin forecasts

Our production and EBITDA margin forecasts are shown in Figure 53.

For modelling purposes, we have used the same production profile as Peak's scoping study for the first 11 years and then assumed an additional 9 years with an average production of 3,935t of REEs p.a.

Figure 53: Concentrate produced vs EBIDA margin: first 10 years

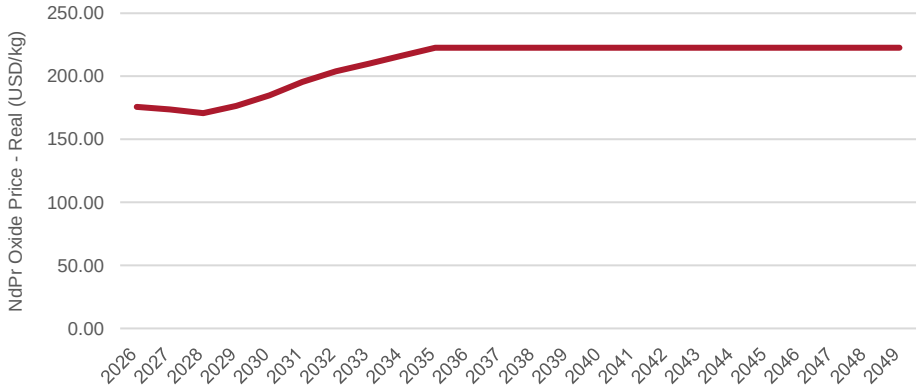


Source: MST *estimates.*

Our NdPr pricing forecasts

Our NdPr pricing assumptions for the Ngualla Project are shown in Figure 54. Peak could see significant upside from higher prices.

Figure 54: Forecasted NdPr oxide price – real 2023 $ (assuming 100% payability)



Source: MST estimates.

Figure 55 shows our forecasted sale price (in US$/kg of dry concentrate) for Ngualla concentrate versus the BFS forecasted sale price.

Figure 55: Concentrate pricing assumptions for the Ngualla Project

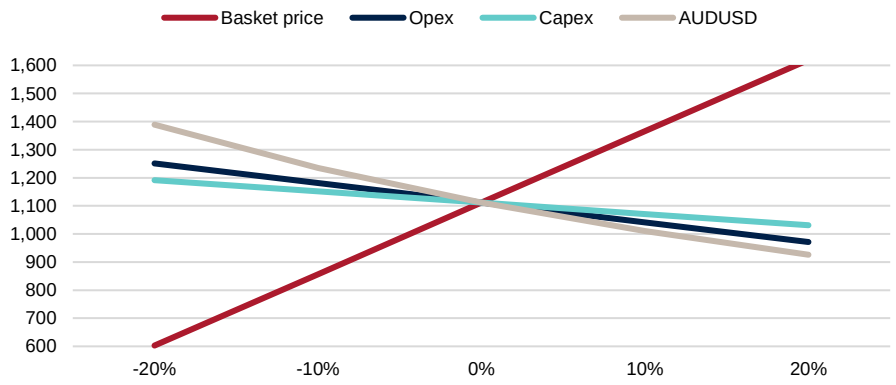
US$/KG (dry)	Year									
	26	27	28	29	30	31	32	33	34	35
BFS Model	13.0	12.5	12.3	12.7	13.4	14.2	14.9	15.4	15.9	16.4
MSTe	8.0	7.8	7.6	7.4	7.7	7.4	7.6	7.8	7.5	7.3

Source: Peak and MSTe

Key sensitivities

As shown in Figure 56, our valuation is most sensitive to assumptions on the NdPr oxide price and to a lesser extent the AUD/USD exchange rate and capital costs.

Figure 56: Key project sensitivities



Source: MST.

Capex (our estimates)

We have taken a conservative approach in forecasting pre-development capital costs. While Peak's BFS anticipates a figure of US$321m, we have projected US$401m (see Figure 57).

Figure 57: MST vs Peak's estimated project pre-development capex for Ngualla Project

Development capital cost breakdown	PEKe (US$)	MSTe (US$)
Plant	95.7	119.6
Services	35	43.8
Accommodation camp	25	31.3
Tailings	18.2	22.8
Mining	16.5	20.6
Regional roads and infrastructure	11.4	14.3
Access roads	11	13.8
Earthworks	9.3	11.6
Airstrip	5.7	7.1
Other	12.6	15.8
Direct cost subtotal	**240.4**	**300.5**
EPCM	32.6	40.8
Owners cost	14.3	17.9
Contingency	33.4	41.8
Total upfront cost	**320.7**	**400.9**

Source: Peak, MST.

Opex (our estimates)

We show our estimated operating cost summary for the Ngualla Project's first 10 years in Figure 58, with a C1 cost of US$2.87/kg. We've made a slight increase in the C1 cost compared to Peak's BFS, resulting in a calculated US$4.56/kg.

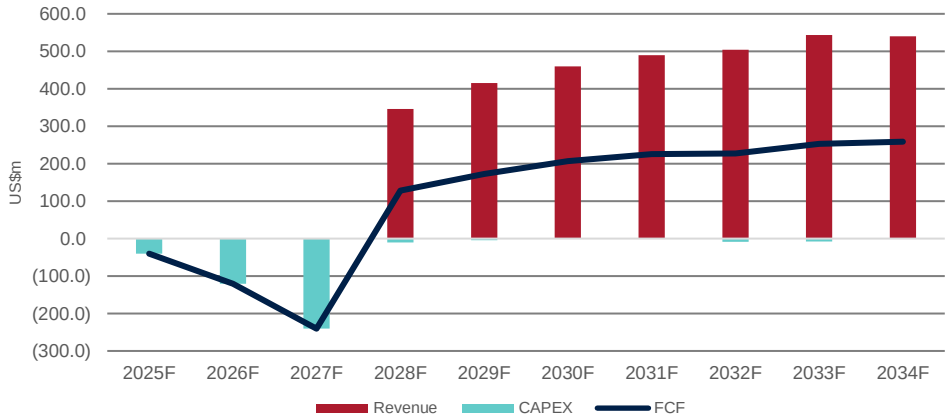
Figure 58: Operating cost: Peak estimate vs MST assumption

Operating cost breakdown	PEKe (US$/kg)	MSTe (US$/kg)
Mining	0.23	0.28
Processing	1.96	2.36
General & admin	0.23	0.23
C1 cash costs	**2.43**	**2.87**
Royalties	1.01	0.91
Transport & shipping	0.64	0.77
TOTAL	**4.08**	**4.56**

Source: MST.

Revenue, capex and free cash flow (our estimates)

Figure 59: MST forecast revenue, capex and free cash flow



Source: MST.

Cash position: maintaining good capital management

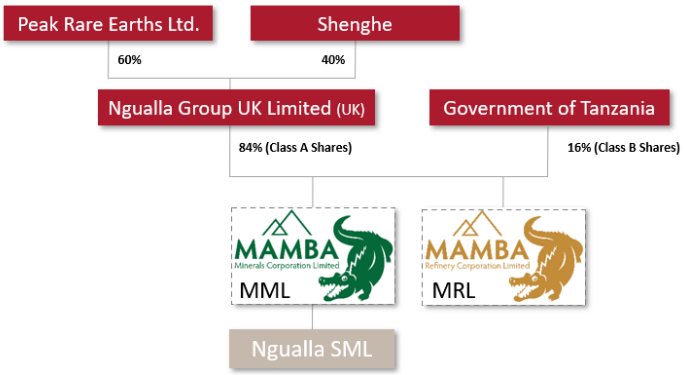
As of 30 June 2023, Peak had cash reserves of A$25.852m. With a current burn of approximately A$1.5m/month, Peak is well-funded to move forward with its CY23 and CY24 strategy.

Scenario Analysis: Non-controlling equity interest in the Project, provides a significant uplift

As highlighted in PEK's announcement from 9 August 2023, a funding MOU for Ngualla has been signed with Shenghe. This entails Shenghe acquiring a notable non-controlling stake in the Ngualla Project significantly reducing Peak's funding needs. We've analysed a scenario where 40% of Ngualla UK is sold to Shenghe for a turnkey project funding and Engineering, Procurement, and Construction (EPC) solution.

This assumes Peak holds an effective 50.4% stake in the Project (60% of 84%), while Shenghe secures 33.6% (40% of 84%) in exchange for the EPC solution, encompassing the project's construction.

Figure 60: Corporate structure, Shenghe holding non-controlling equity interest in the Project



Source: MST estimates.

In our analysis, we value Peak at A$2.65 per share on a fully diluted basis, as detailed in Figure 61.

Figure 61: Asset sell down valuation summary, showing potential upside of 255%

PEK (MSTe Sale of Asset)					Jun-23
	Discount rate	US$mn	Risk weighting	AUD$mn	AUD$/sh
Ngualla (100%)	10.0%	656	75.0%	703	2.66
Total operating assets				**703**	**2.66**
Corporate/SG&A				(30)	(0.04)
Net cash/(debt) ($AUD)				25	0.03
Net Asset Value				**698**	**2.65**
Current Share Price					0.45
Upside					490%

Source: MST estimates.

The additional valuation in this scenario is attributed to:

- No initial cash outlay by Peak at the project's inception.
- No equity dilution as there's no issuance of shares.
- Absence of debt-related costs.

Key assumptions

Assumptions for this scenario are shown in Figure 62. We have used a 10% discount rate (real) and assumed a zero pre-development capital, on the basis that Shenge fund the Project. We assume no pre-development capex and that Peak receives 50.4% of the free cash flow, with all other assumptions consistent with the base case scenario. Importantly, our scenario valuation assumes no dilution.

Figure 62: Scenario valuation assumptions

Assumptions	PEKe	MSTe (Sell Down)
Project Ownership (%)	84%	50.4%
Construction commencement time (Year)	2024	2024
Construction period (years)	2	2
Development Capex (US$m) (Real 2023 $)	321	0
Total Sustaining Capex (US$m) (Real 2023 $)	65.5	81.9
Closure Cost (US$m) (Real 2023 $)	12.7	20.3
Debt to equity	50:50	Zero debt
Avg. Annual C1 Cash Costs (US$m) (Real 2023 $)	91.2	103.8
Avg. Annual Unit Operating Costs - AISC (US$/kg)	4.4	4.9
Avg. NdPr Price (Real 2023) (US$/kg)	234	210
Realised Avg. Basket Price Price (US$/kg) - Real 2023	34	29

Source: MST estimates.

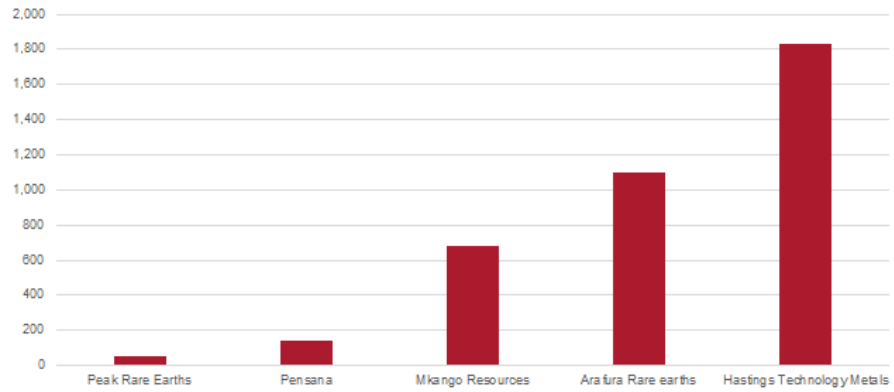
Comparables analysis: suggesting A$2.02/share, fully diluted

A common tool used to assess the value of mining companies in their pre-production phase is to compare the enterprise value (EV) to the resource base to see what value the market places on the company's resource and its potential. While the typical comparable analysis for such projects is the EV/Resource multiple, we specifically use the EV/contained NdPr metric for valuing PEK's Ngualla Project, given that most of its value derives from NdPr.

Figure 63 presents a comparative analysis of the EV/contained NdPr for similar companies. As shown, Peak's valuation multiple stands at a modest 51x, in contrast to the average of 941x.

Applying our EV/ contained NdPr multiple values PEK's contained NdPr at A$2.02 per share, fully diluted.

Figure 63: Comparables analysis of EV/contained NdPr (LHS); Valuation using comps analysis (RHS)



Contained NdPr Comps Analysis	
Ngualla's Contained NdPr (Kt)	2,328.4
Average peer EV/NdPr (x)	940.7
Ownership (%)	84%
Risk weighting (%)	75%
Valuation (A$m)	1,379.9
Valuation per share (A$/share)	2.02

Source: MSTe

Positive catalysts for share price and valuation

Funding of project: Securing capex for major resource developments is a challenge for small companies; thus, a competitive funding package would significantly de-risk the project.

Exploration upside: Discovering economical deposits of heavy rare earths, fluorspar, niobium, or phosphate at Ngualla could greatly enhance its value. Such discoveries would diversify revenue and position the project favourably in a high-demand market, ensuring strong returns for investors.

Asset Sell-Down: Selling a stake in the project to finance its development will mitigate construction risks and minimise dilution. By partnering with an experienced company, such as Shenghe, Peak can potentially lower costs and shorten the construction timeline.

Metallurgical improvements: Advancements in metallurgical efficiencies, whether through enhanced recoveries or superior grades, can significantly boost the project's valuation. Given Shenghe's involvement, such advancements are not only plausible but anticipated, further solidifying the potential for a favourable impact on share price.

Other potential share price catalysts:

- Resource growth: Drilling at Ngualla is being undertaken. An increase in resource would be positive.
- NdPr price increase: The valuation is highly sensitive to NdPr prices. Increases in the price of NdPr oxide would positively affect the valuation.
- USD depreciation: The valuation is highly sensitive to the USD/AUD. USD depreciation would have a positive effect on the valuation.

Risks to share price and valuation

We outline the key risks to the share price and valuation below, noting that early-stage mining projects have various critical risks.

Company-and project-specific risks:

- **Access to funding**: The availability of funding for the project is not guaranteed. A lack of sufficient funding could have a negative impact on the stock.
- **Delays to development**: Any delays in moving into construction, post-funding, would be a negative for the stock and would gradually make the information from the BFS less current and thus less reliable.
- **Key person dependence**: Individuals, including the CEO, may have relationships and experience critical to advancing the project. The loss of such personnel may significantly compromise Peak's ability to advance the project.
- **Cost inflation** is a global theme and is particularly concerning in the mining industry. If operational or capital costs increase without a corresponding increase in the commodity price, the project's margins will be reduced, which could impact the economics and viability.
- **Shenghe funding solution falls through**: If Shenghe does not proceed with its potential subscription for a significant non-controlling equity interest in the Ngualla Project, Peak's funding requirements could substantially increase.
- **Supplying to China**: Tensions between China and other countries could lead to trade embargoes or other restrictions, potentially impacting the Peak's ability to sell its refined products internationally.

Macro risks:

- Rare earth oxide price – this is the key valuation sensitivity
- Foreign exchange rates
- Increasing interest rates and the potential impact on the cost of debt finance

Country-specific risks: The Ngualla Project, operating in Tanzania, may face several country-specific risks.

- Political instability: Any changes to government policies or leadership could impact the project, as they could adversely change laws, taxes or other regulations, increasing costs or decreasing revenues.
- Regulatory environment: Regulatory or legal changes could adversely impact the project's success.

ESG: Building a Strong Culture of Sustainability

Peak aims to deliver the Ngualla Project while advancing its commitment to long-term sustainability, as well as its five stated core values of integrity, safety, health and wellbeing, accountability, sustainability, and a progressive mindset. The company's positive approach toward environmental, social and governance (ESG) issues is evident in its project planning and development, with its progress to date as well as its long-term objectives reflecting this responsible approach.

Environment

Tailings management

Peaks' tailings strategy for the Ngualla flotation offers significant environmental benefits. Notably, the tailings from Ngualla will exhibit reduced radioactivity levels, as the majority of thorium and uranium, are largely eliminated from the tailings. Additionally, Peaks integrates the Global Industry Standard on Tailings Management (GISTM) for environmentally sound design and operations.

Radiation management

The Ngualla ore presents notably low levels of thorium (Th) and uranium (U) relative to other rare earth deposits. The life-of-mine (LOM) average concentrations for the weathered bastnasite ore are 54 ppm (Th) and 15 ppm (U).

Further, the concentrate will feature an LOM average of 415 ppm (Th) and 106 ppm (U). Importantly, with a specific radioactivity of 3.0 Bq/g, the concentrate is not classified as a Class 7 Hazardous Goods Radioactive Substance (for specific radioactivities exceeding 10 Bq/g). This means the concentrate can be transported as General Cargo and will not need to be labelled as radioactive goods. Peak has committed to regularly monitoring radioactivity levels of the concentrate to ensure that concentrate cargoes are appropriately permitted.

Closure and remediation

In accordance with Peak's closure planning, the project aims to ensure disturbed areas are rehabilitated, safe, stable, non-contaminating, and suitable for agreed-upon post-mining uses. This initiative minimises liabilities to stakeholders and environmental rehabilitation remains an ongoing priority throughout the project's lifespan.

During decommissioning, Peak plans to dismantle buildings and infrastructure that cannot be transferred to the local community; rehabilitate haul roads and hard stand areas; ensure access to the void left from open pit mining is restricted; reprofile slopes and top surfaces of waste rock dumps, stockpiles and TSF to ensure stable landforms; and revegetate previously disturbed areas with indigenous vegetation.

Social

Social investment

Since it began exploration in the Ngualla area in September 2009, Peak has been actively involved in many community development projects as part of its Social Investment Plan. The plan's primary aim is to collaborate with the community to ensure sustainable social development of Ngwala Village and the wider region, even after Peak's area operations have ceased.

Peak acknowledges its responsibility to improve the wellbeing of communities in which it operates by providing employment, engaging local contractors and suppliers, and giving financial assistance to or becoming directly involved in community projects. The vital infrastructure initiatives that Peak has implemented so far have directly enhanced the quality of life in the Ngwala Village, benefited local primary and secondary schools, and improved the broader district.

Recent community initiatives

Peak has engaged in a substantial way with the local community, through funding, assistance, and donations to numerous projects, highlighting its commitment to positively impacting the communities within which it operates. Initiatives have included:

- Running a School Development Program (building 2 new and refurbishing 5 existing classrooms; donating new school desks, beds, mattresses, textbooks, stationery, sports equipment, and cement for the Kapalala Laboratory).
- Building 4 duplex teacher houses at Ngwala, Itiziro, and Ngwala Magereza Primary Schools, and refurbishing a teacher house at Ngwala Primary School, providing accommodation for 9 teachers and their families.
- Implementing community programs at Ngwala Ward, including donating new football kits and equipment, supporting official visits, providing emergency medical transport, and arranging delegate transport for official meetings.

- Maintaining and repairing the village water supply.
- Conducting major refurbishment and remediation of a 46-km stretch of the Ngwala–Kininga Road, significantly improving accessibility (reducing Ngwala–Mbeya travel time from 2 days to ~6 hours) and paving the way for the Tanzanian Government's plan to connect Ngwala Village to the national power grid.
- Assisting with the preparation, maintenance, and licensing of a local airstrip.
- Sponsoring the annual Ngwala Ward football league and the Farmers' Day (Nanenane) tournament.

Governance

ASX Corporate Governance Principles and Recommendations

Peak has embraced the Corporate Governance Principles and Recommendations as issued by the ASX Corporate Governance Council, demonstrating its commitment to effective corporate governance. Key aspects include:

- The ASX Corporate Governance Council Principles and Recommendations have been applied across the company's operations.
- The Board is composed 6 members, each with qualifications well-suited to the business.
- A remuneration structure, risk assessment protocol, and policies that align predominantly with market practices have been adopted.
- The Board has established separate committees for risk, nomination, remuneration, and audit, to ensure robust and transparent governance.

Board of Directors

The Board is responsible for Peak's corporate governance. The Board develops strategies for Peak, reviews strategic objectives and monitors performance against those activities. The specific goals and responsibilities of the Board are outlined in Peak's Corporate Governance Statement.

The six members of Peak's diverse Board have many years of experience in the minerals industry and a strong complementary range of technical, financial, managerial and directorship skills. The Board plans to maintain a Board Skills Matrix to ensure it has the skills to discharge its obligations effectively.

Figure 64: Board experience and skill matrix

Experience Skills and Attributes	Directors					
	R. Scrimshaw	I. Chambers	S. Lu	A. Mwinyi	N. Bowen	H. Badenach
Professional and Tertiary Skills						
Geology	✓				✓	
Engineering	✓			✓	✓	
Commerce and Business	✓	✓	✓	✓	✓	✓
Law				✓		
Financial/Accounting and Governance	✓	✓	✓			
Member of professional body in field of expertise				✓	✓	
Industry Experience:						
Resource industry (resources, mining, exploration)	✓	✓	✓	✓	✓	✓
Risk management and compliance	✓	✓	✓	✓	✓	✓
Corporate Governance	✓	✓	✓	✓	✓	✓
Capital raising	✓	✓	✓	✓	✓	✓
Financial acumen	✓	✓	✓	✓	✓	✓
Safety, environment and community relations	✓	✓	✓	✓	✓	✓
Strategy	✓	✓	✓	✓	✓	✓
Leadership	✓	✓	✓	✓	✓	✓

Source: MST

Of the six Board members, five are independent, and one is the CEO – therefore the Board meets ASX guidelines for at least 50% independent members.

Appendix 1: Board of Directors and Management

Board of Directors

Russel Scrimshaw AM – Executive Chairman is a well-known corporate executive and company director, with experience in large-scale mining project development and operations, product marketing, finance, business development and technology. He was a founding director of Fortescue Metals Group, serving in executive roles including Deputy CEO and Executive Director, and was a key part of the management team that developed Fortescue's mining, port and rail operations. He was instrumental in establishing Fortescue's strong relationships with large steel mill groups across a vast Asian customer base. More recently, Mr Scrimshaw was Chairman of UK-listed Sirius Minerals PLC (acquired by Anglo American in 2020), which is developing a large polyhalite fertiliser project in North Yorkshire, close to Peak's Teesside refinery site. He has also held senior executive positions at the Commonwealth Bank and Optus. He is currently Chairman of the Garvan Research Foundation, a non-Executive Director of the Garvan Institute of Medical Research and Vice Chairman of Ignition Wealth.

Ian Chambers – Non-Executive Director is an experienced executive and company director who has worked for 35 years in international financial markets including institutional securities, wealth management and capital markets. He spent about 24 years with Morgan Stanley Australia where he was Managing Director, Head of Institutional Equities and Head of Wealth Management Australia. Mr Chambers has a proven record in organisational development, governance, operational management and financial performance. He is a member of ASIC's Financial Services Credit Panel and Markets Disciplinary Panel and was inducted into the Australian Stockbrokers Foundation Hall of Fame in 2015.

Shasha Lu – Non-Executive Director has been Managing Director of Shenghe Resources Overseas Development since 2014, where she leads overseas investment, cross-border corporate management, international trade and the building of a complete rare earth/monazite supply chain. She was previously Executive Director & CEO at Hong Kong East China Non-Ferrous Mineral Resources Co. & Sino-Australia International Mineral Resources, responsible for overseas investment, scientific research and management. Ms Lu has previous experience as a director of ASX-listed companies; she was an Executive Director of Arafura Resources Limited (ASX:ARU) and an Executive Director and Vice President of Globe Metals and Mining Corporation (ASX:GBE). She holds a Bachelor and a Masters of Medical Science from Nanjing University, a Doctorate of Medical Science (PhD) from Tianjin Medical University and Karolinska Institute, a Post-Doctorate of Medical Science from Karolinska Institute, and an Executive MBA from Nanjing University. Ms Lu is also a graduate of the Australian Institute of Company Directors (GAICD).

Hon. Abdullah Mwinyi – Non-Executive Director has been a member of the Tanzanian Parliament since 2007, and was also a Member of the East African Legislative Assembly (2007–2017), where he was Chair of the Legal, Privileges and Rules Committee and the Regional Affairs and Conflict Resolution Committee. He is also Chair of Swala Oil and Gas (Tanzania) plc. He is a lawyer by profession and, in 2007, established Asyla Attorneys, where he specialises in corporate, commercial, labour and employment law.

Nick Bowen – Non-Executive Director has extensive experience in the construction, development and operation of international mining projects. He has spent over 35 years with ASX-listed construction and contract mining companies operating in both Australia and overseas, including Africa. Previous roles include 12 years as Managing Director of Macmahon Holdings, 2 years as Executive Global Head of Mining Services with Orica and 9 years as Managing Director of mining contractor Eltin Limited. He was head executive at the Lubambe Copper Mine in Zambia and the Shishen Iron Ore Mine in South Africa. Mr Bowen is a Life Member of the Western Australian Chamber of Minerals and Energy, Member of the Australian Institute of Mining and Energy and Fellow of the Australian Institute of Company Directors.

Hannah Badenach – Non-Executive Director, a seasoned executive and company director, has over 20 years' global experience in resources, supply chain management, and business development. Currently Executive Director of Metals & Mongolia for Noble Resources, she has managed its global ore and metals trading divisions and established its operations in Mongolia. With considerable experience in Africa and China, she has developed and operated numerous metal supply chains and built an extensive sales and marketing network. She holds a Bachelor of Arts/Law (Hons) from the University of Tasmania and is a GAICD. She has been a director at Aspire Mining (ASX:AKM) and Xanadu Mines (ASX:XAM).

Management Team

Bardin Davis – Chief Executive Officer has over 25 years of investment banking and corporate experience in mining and energy. He began his career with diversified mining group North Limited before moving into investment banking and has also worked in renewable energy. Previous roles include CFO of UPC/AC Renewables (now ACEN Australia); Head of the Resources & Energy Group – Asia Pacific; Deputy Head of Corporates – Asia Pacific and Head of Advisory – Australia for HSBC; and Head of Metals & Mining Asia for Macquarie Capital. He has significant emerging markets experience and has worked on a broad range of international advisory, capital markets and financing transactions.

Philip Rundell – Company Secretary & Chief Financial Officer is a former Partner at Coopers & Lybrand (now PwC) and a Director at Ferrier Hodgson. He is now a sole practitioner Chartered Accountant, providing company secretarial, compliance, accounting and reconstruction services.

Ismail Diwani – Country Manager, Tanzania previously worked as the Business Manager and then Managing Director of the Warthog Safari Tanzania in Iringa. He joined Peak in 2015 as a Regulatory Liaison Officer, responsible for administering compliance with Tanzanian laws and regulations and managing government communications. He was then appointed as Commercial Manager before being promoted to Country Manager, Tanzania.

Lello Galassi – Head of Development and Operations has been a project manager and developer for 14 international mining and infrastructure projects since 1998. With a strong track record in delivering greenfield projects, he excels in cost control, meeting schedule targets, ensuring safety, environmental compliance, and community outcomes. He has worked across Africa, South America, Europe, Australia and Canada. Notable roles include Vice President Project Development & Construction at Sabina Gold & Silver Corporation and various project director and manager roles at ICL, Guyana Goldfields, Rio Tinto, Freeport McMoran, and Phelps Dodge.

Andrea Cornwell - Head of Marketing, EMBA, Bachelor of International Business Relations

With over 28 years in international resources marketing, Andrea has held senior roles in major firms including South32, BHP, Vale, Anglo American, and Shell. Her experience spans leading international marketing strategies, customer relationship management, logistics oversight, and structuring long-term agreements. Recent roles include VP Marketing at South32 and Head of Coal Marketing at Vale. She's a co-founder of Women in Mining & Resources and was recognised among the Top 100 Inspirational Women in Global Mining in 2016. Andrea holds a Bachelor's degree in International Business Relations and an MBA.

Mary Duncan Mwaiswelo – Community Liaison Officer is a community development professional with 9 years of expertise in community affairs. After serving as a Community Development tutor at St. John's University, Tanzania, she joined Peak in 2015.

Appendix 2: History of REEs and How China Became the Largest Producer

The beginnings of the REE industry

The term *rare earth* was coined when an unusual black rock was unearthed by a miner in Ytterby, Sweden, in 1788. The rare earth industry began to grow in the early 1960s, when it was discovered that the element europium (Eu) gave an intense red luminescence when exited by electrons – a discovery quickly implemented in the development of colour TVs.

How China became the dominant player in rare earths

Deng Xiaoping was the architect behind China's dominance of rare earth mining and processing. In a 1992 speech, he said: 'The Middle East has oil. China has rare earth metals.'

In the 1980s, China started to develop innovative programs in science and technology. This resulted in two programs which would accelerate the country's high-tech development. In March 1986, China's leader Deng Xiaoping approved Program 863: The National High Technology Research and Development Program. Program 863 focuses on biotechnology, space technology, information technology, laser technology, automation, energy technology, and on new materials. A very important researcher was Professor Xu Guangxian (1920–2015), who is called 'the father of rare earths in China' (*Peking University News*) and who is credited with paving the way for the country to become the world's primary exporter of REEs. Xu Guangxian applied his previous research in extracting isotopes of uranium to rare-earth extraction and succeeded in developing cutting-edge extraction technologies for REEs – the perfect materials to give China high profits and geopolitical influence. Therefore, in the 1980s and 1990s, China decided it wanted to become a world leader in the production of REEs. In 1978–1989, China increased production of REEs by an average of 40% per year (Hurst 2010).

While in the USA environmental regulations were very strict and labour costs relatively high, Chinese companies profited from a combination of low labour costs and lax environmental regulations. In the 1990s, China's export of REEs grew, causing a significant world-wide drop in prices. The Mountain Pass mine, which was the largest rare earth mine in the world, struggled to remain competitive and hence slowly began to curtail production.

The REE crisis

A trade war between China and the USA in 2009–2013 may hint at what potentially lies ahead if the West fails to allocate capital to the REE industry. China limited the export of rare earths in 2007, as they wanted to retain them for their own market. This was achieved by raising export duties. Export duties were originally 10%, but rose from 15 to 25% in 2011. In 2011, China subjected the export of ferro-alloys, containing more than 10% of REEs, to taxes of 25%. Overall this resulted in a large drop in China's export of rare earths and hence a strong rise of prices of REEs. Neodymium, a rare earth necessary for a range of products including headphones and EVs, climbed from $42/kg in 2009 to $283/kg in 2011.

China's monopoly on the REE industry persists. China's intellectual property in the separation and processing of REEs is highly valuable given the global lack of understanding, as rare earths have contributed minimally to local economies for around 30 years. Western economies are keen to regain a foothold in the market due to the critical role of separated rare earths in decarbonisation and defence sectors. Lynas, with a separations facility in Malaysia, leads the industry, followed by Iluka, constructing a refining facility in Western Australia. Mountain Pass, under MP Materials since 2017, is now producing a concentrate shipped to China for further processing. MP Materials plans to develop a refining plant for separated REOs, a difficult processing step currently overlooked by the market.

Significant capital investment is required to establish a strong Western presence in the market. Competing with China, which controls supply and prices and has few environmental restrictions, is challenging for newcomers. Recent significant capex blowouts in new projects, as exemplified by Hastings Technology Metals' +40% revision of its Yangibana project's capex budget (A$948m), underline these challenges. Raising capital will likely remain difficult due to China's market dominance, but government interventions offering cheap debt to prospective projects may occur, recognising the risks of a concentrated rare earths supply.

Appendix 3: Understanding Deposit Types and Difficulties of Processing

Deposit types

REEs are mainly associated with four geological environments: alkaline igneous rocks, carbonatites, placer deposits with monazite-xenotime mineralisation and ion-adsorption clay deposits (Figure 65).

Figure 65: Geological environment and the main rare earth elements found in each

Geological Environment	Main REEs	Notable Example	Advantages	Disadvantages
Alkaline Igneous Rocks	Neodymium (Nd), Praseodymium (Pr)	Mount Weld (Lynas Corporation)	High concentration of REEs; Can be relatively easy to extract	Often contain radioactive elements; High energy required for processing
Carbonatites	Lanthanum (La), Cerium (Ce)	Cummins Range Rare Earths Project	REEs can be more easily leached and concentrated	Rare globally; Often contain radioactive elements
Placer Deposits (Monazite-Xenotime)	Neodymium (Nd), Dysprosium (Dy)	Mineral sands mining (Iluka Resources)	Easy to mine due to surface location; Low environmental impact	Lower concentration of REEs; Can be limited by availability of deposits
Ion-Adsorption Clay Deposits	Dysprosium (Dy), Terbium (Tb)	Makuutu deposit (Uganda)	Low-cost extraction; High concentration of heavy REEs	Mostly located in China; Environmental concerns due to leaching extraction method

Source: MST.

Rare earth minerals

While over 250 rare earth minerals are identified, around 95% of the global rare-earth resources are found in just three: bastnasite, monazite, and xenotime. Details of these minerals are shown in Figure 66.

Figure 66: Major rare earth minerals

Minerals	Chemical formula	REO%	Average density (g/cm^3)	Colour
Bastnaesite	(Ce,La,Pr)(CO3)F	74.8	4.97	Yellow, reddish brown
Monazite	(Ce,La…)PO_4	65.1	5.15	Brown, colourless, greenish, grey, white, yellow
Xenotime	Y(PO_4)	62	4.75	Yellowish brown, greenish brown, grey, reddish brown, brown

Source: Separation Hydrometallurgy of Rare Earth Elements, Jack Zhang & Baodong Zhao

Not actually so rare, but difficult to process

Despite their name, REEs are not actually rare: they are present in nearly all types of rock. However, the economic viability of extracting these elements is the real challenge, with the costs often outweighing potential profits since REEs are rarely found in large, concentrated deposits. The term ‘rare’ refers to the infrequency of these economically feasible, concentrated deposits, rather than the abundance of the elements themselves.

Separating REEs from one another is challenging due to a number of factors:

- **Chemical similarities**: REEs share a similar size, charge, and chemical behaviour, which makes their separation based on chemical properties difficult.
- **Low concentrations**: The relatively small amounts of REEs in ores require large-scale processing, leading to higher costs and environmental concerns.
- **Radioactive byproducts**: REE ores often contain radioactive elements, such as thorium and uranium, which require careful handling during extraction and refining to protect workers and the environment.
- **Slow, costly and non-scalable process**: Solvent extraction is slow, energy-intensive, and hard to optimise. Each REE deposit is unique, making it challenging to streamline the extraction process.

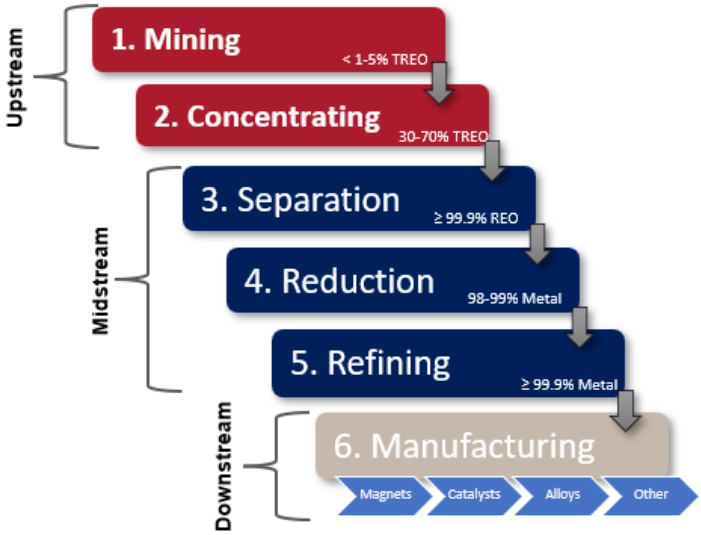
Appendix 4: Stages of REE Value Chain: from mining to end-user products

REEs go through several stages, from being mined as raw ores to becoming integral components of sophisticated end-user products. Each of these stages results in a specific product type, which can be independently sold, thus adding a layer of complexity to the REEs market.

Rare earth processing is challenging due to the similarities among the 17 REEs, which often coexist in ores and are difficult to separate due to their similar physical and chemical properties. The task is complicated by the physical resemblance between the valuable rare earth minerals and the unwanted gangue materials, making their separation in mineral processing relatively complex.

Every stage in the intricate rare earth supply chain contributes to value addition. Characteristically directed by end-users, this supply chain sees the peak of value addition, and consequently, economic viability, during the final stages.

Figure 67: Stage of the rare earths supply chain



Source: MST.

Mining: Different mining techniques are employed based on the nature of the deposit. Currently bastnaesite, monazite, xenotime minerals, and ion-adsorbing type rare earth clays are the major sources of rare earth production.

Concentration: To ensure the economic viability of a rare earth project, numerous ore beneficiation techniques are applied to concentrate the rare earth minerals. Predominantly, the methods used for this process include gravity separation, flotation, and magnetic separation.

Separation: The separation process for rare earths is quite complex. Rare earth extraction involves mineral decomposition and subsequent leaching of elements. Tailored to the mineral type and target product, processes include acid roasting, caustic cracking, and chlorination. The procedure chemically transforms mineral concentrate into an end or intermediate product, employing reagents to break down minerals and extract the elements. Subsequent separation techniques yield either mixed or individual rare earth oxides.

Reduction: Converting rare earth oxides into metals typically involves high-temperature treatments of concentrated REO to yield metal products. This is achieved using metallothermic pyrometallurgy, a heat-based metallurgical process that extracts and refines metals from oxides. The procedure facilitates a chemical reaction that removes oxygen, fluorine, or chlorine from the metal.

Refining: Reduced rare earth metals typically achieve 98–99.5% purity. Various processes can further refine these metals to reach up to 99.99% purity. The choice of refining technique depends on the impurity type and concentration, as well as the desired final purity level. Electrorefining and zone refining are the most common techniques.

Manufacturing: The refined REEs are utilised to fabricate components, such as powerful Nd-Pr magnets for electric motors. These components are then incorporated into diverse final products, ranging from EVs and wind turbines to smartphones and military lasers.

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