Peak Rare Earths

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Ngualla Just Got Better

NEED TO KNOW

- FEED study enhances world-class Ngualla project
- Capex and opex reduced materially
- FID targeted by 30 June 2024

FEED study enhances an already robust project: Peak has just completed a Front-End Engineering and Design (FEED) study for the Ngualla Rare Earth Project in Tanzania. The study builds on the Bankable Feasibility Study (BFS) from October 2022 and includes further optimisation of the process plant, airstrip, road and Tailings Storage Facility (TSF), mining operations and power supply.

Capex and opex materially reduced: The FEED study has reduced capex assumptions (–10.6%) with a switch from owner-operator to contract mining, scope refinement for earthworks and roads, and reduction of the TSF to a single cell. Opex is also reduced (–17.8%) due to lower logistics and reagent costs as well as optimisation of the build-own-operate (BOO) power plant contract model.

Lower pricing assumptions still support a robust outcome: Peak has tested the project over a number of pricing ranges. The project generates positive margins under current weak spot prices and generates an US$982m after-tax NPV_8 based on the study's base-case pricing assumptions.

Investment Thesis

Ngualla ticks the boxes on scale, quality, margin: One of the world's largest and highest-grade undeveloped NdPr[1] oxide projects, Ngualla has an 18.5Mt ore reserve and an initial mine life of 24 years. The concentrate is rich in NdPr, with minimal impurities and radionuclides, making it a highly attractive product.

Peak 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 for 100% of Ngualla's concentrate and 50% of any future mixed rare earth carbonate (MREC). This fills a significant supply gap for Shenghe, replacing its current supplier, US-based MP Materials, which is moving further downstream to the production of NdPr oxide.

Progressing a de-risked development pathway: Peak's MOU with Shenghe provides a fixed-price EPC development and execution package, potential funding solution and non-controlling strategic stake in Ngualla and prioritises cost efficiency, accelerated construction, and minimal equity dilution. FID is targeted for 30 June 2024 with Peak also recently initiating a strategic partnering process that covers evaluation of other options to ensure maximum shareholder return.

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.

Valuation: A$1.29 ($3.54 with Project Selldown)

We have increased our base-case valuation to A$1.29/share, fully diluted. Our base-case valuation assumes Peak maintains its 84% ownership of the Ngualla Project and assume dilution for a A$236m equity raise to fund Peak's equity contribution to the project. 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$3.54 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 the departure of key people from the business.

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$1.29** ***(previous A$1.13)***
Current price	**A$0.32**
Market cap	**A$85m**
Cash on hand	**A$21.1m** ***(30 September 2023)***

Upcoming Catalysts and Newsflow

Period	
1HCY24	Project funding finalised
June 24	FID
2HCY24	Project construction commenced

Share Price (A$)

Source: FactSet, MST Access.

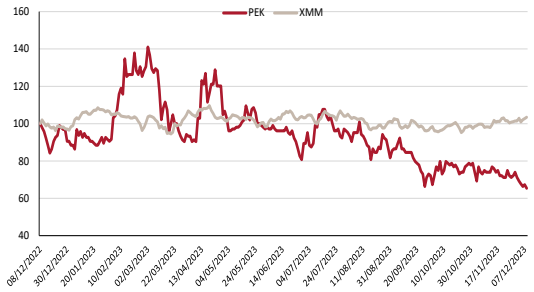
[1] Neodymium and praseodymium (NdPr) are among the most valuable rare earth elements and are utilised in magnet manufacturing.

PEK Limited — PEK.AX

Year end 30 June

MARKET DATA		
Share Price	A$/sh	0.32
52 Week Low	A$/sh	0.32
52 Week High	A$/sh	0.74
Market Cap (A$m)	A$m	85
Net Debt / (Cash) (A$m)	A$m	(4)
Enterprise Value (A$m)	A$m	81
Shares on Issue	m	265
Performance rights	m	15
Shares Issued during Capital Raise	m	554
Potential Diluted Shares on Issue	m	834

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



INVESTMENT FUNDAMENTALS		Jun-22	Jun-23	Jun-24e	Jun-25e	Jun-26e
Reported NPAT	A$m	(23)	(11)	(11)	(7)	(12)
Underlying NPAT	A$m	(23)	(11)	(11)	(7)	(12)
EPS Reported (undiluted)	¢ps	(11.7¢)	(5.5¢)	(5.4¢)	(1.4¢)	(1.6¢)
EPS Underlying (undiluted)	¢ps	(11.7¢)	(5.5¢)	(5.4¢)	(1.4¢)	(1.6¢)
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$	(0.06)	(0.05)	(0.05)	(0.01)	(0.02)
Price / Operating Cash Flow	x	n/m	n/m	n/m	n/m	n/m
Free Cash Flow / Share	A$	(0.06)	(0.05)	(0.05)	(0.63)	(0.02)
Price / Free Cash Flow	x	(5.4)	(5.8)	(5.9)	(0.5)	(19.1)
Free Cash Flow Yield	%	-18.6%	-17.1%	-17.0%	-196.0%	-5.2%
Book Value / Share	A$	0.34	0.42	0.37	0.40	0.39
Price / Book	x	0.94	0.75	0.86	0.80	0.83
NTA / Share	A$	0.34	0.42	0.37	0.40	0.39
Price / NTA	x	0.94	0.75	0.86	0.80	0.83
Year End Shares	m	207	208	208	762	762
Market Cap (spot)	A$m	66	67	67	244	244
Net Cash / (Debt)	A$m	9	25	14	(229)	(241)
Enterprise Value	A$m	57	41	53	473	485
EV / EBITDA	x	n/m	n/m	n/m	n/m	n/m
Net Debt / Enterprise Value		(0.1)	(0.3)	(0.2)	2.8	3.0

PRODUCTION AND PRICING	Jun-25e	Jun-26e	Jun-27e	Jun-28e	Jun-29e
Ore Mined (Kt)	-	-	186	1,800	1,521
Total Mill Feed (Kt)	-	-	-	723.0	804.0
Concentrate production at 45% TREO (Kt)	-	-	-	33.34	39.22
NdPr Price (US$/kg)	-	-	-	160.7	166.3
Realised Basket Price (US$/kg)	-	-	-	21.1	21.6

Profit & Loss (A$m)	Jun-22	Jun-23	Jun-24e	Jun-25e	Jun-26e
Revenue	-	-	-	-	-
Expenses	(15)	(11)	(11)	(12)	(12)
EBITDA	**(15)**	**(11)**	**(11)**	**(12)**	**(12)**
D&A	(0)	(0)	(0)	(0)	(0)
EBIT	**(15)**	**(12)**	**(12)**	**(12)**	**(12)**
Interest	(8)	0	0	5	0
Tax	-	-	-	-	-
Underlying NPAT	**(23)**	**(11)**	**(11)**	**(7)**	**(12)**
Exceptionals					
Reported Profit	**(23)**	**(11)**	**(11)**	**(7)**	**(12)**

Balance Sheet (A$m)	Jun-22	Jun-23	Jun-24e	Jun-25e	Jun-26e
Cash	9	25	14	17	4
Receivables	1	0	0	0	-
Inventory	-	-	-	-	-
PP&E	0	0	0	471	471
Exploration	59	60	60	60	60
Other	4	4	4	4	4
Assets	**74**	**90**	**78**	**552**	**539**
Creditors	2	1	1	1	-
Debt	-	-	-	246	246
Other	0	0	0	0	0
Liabilities	**3**	**1**	**1**	**247**	**246**
Shareholder's Equity	**71**	**88**	**77**	**306**	**294**

Cashflow (A$m)	Jun-22	Jun-23	Jun-24e	Jun-25e	Jun-26e
Receipts from Customers	-	-	-	-	0
Payments to suppliers and employees	(12)	(11)	(12)	(12)	(13)
Interest Received	0	0	0	5	0
Other					
Net Cash From Operations	**(12)**	**(11)**	**(11)**	**(7)**	**(13)**
Capex	(0)	(0)	-	(471)	-
Exploration	-	-	-	-	-
Other	0	-	-	-	-
Net Cash From Investing	**(0)**	**(0)**	**-**	**(471)**	**-**
Equity	33	28	-	236	-
Borrowings	-	-	-	246	-
Other	(14)	(0)	(0)	(0)	(0)
Net Cash From Financing	**19**	**27**	**(0)**	**481**	**(0)**
Effects of FX	(0)	(0)	-	-	-
Net Increase / (Decrease) in Cash	**7**	**16**	**(11)**	**3**	**(13)**

Source: PEK and MST Est.

Source: Company reports, MST Access.

Ngualla Just Got Better – FEED Study Enhances Already Robust Project

Peak has just completed a Front-End Engineering and Design (FEED) Study for the Ngualla Rare Earth Project in Tanzania. The study builds on the Bankable Feasibility Study (BFS) from October 2022 and includes further optimisation of the process plant, airstrip, road and Tailings Storage Facility (TSF), mining operations and power supply.

Overview – what did the FEED Study involve?

Peak stated that the purpose of the FEED Study was to 'investigate optimisation opportunities and further de-risk the project ahead of a targeted Final Investment Decision in June 2024 and the commencement of development activities'.

Key items in the scope of the study were:

- an assessment of contract mining
- process plant and flowsheet optimisation
- tailings optimisation
- scope refinement of key capital items
- budgetary updates of key costs including power, logistics, reagents and accommodation camp
- review of long-lead items
- review of pricing assumptions.

Key outcomes of the study – material capex and opex reductions

The FEED Study enhanced an already robust project by achieving material reductions in capex and opex.

Capex reduced 10.6%

The key capex reductions resulted from:

- adopting a contract mining model as opposed to owner operated substantially reducing the upfront cost of mining equipment
- refining the scope associated with the bulk earthworks, airstrip, camp and roads
- reducing service costs, which included reduced storage tank capacities and removal of overhead power lines which follows recent expansions of the national grid through the Ngwala Village.

Opex reduced 17.8%

The key opex reductions resulted from:

- extending the build-own-operate (BOO) contract for the power plant from 10 to 20 years
- lower reagent costs which follows engagement with a broad range of potential reagent vendors
- significantly reduced transportation costs to China coinciding with decreases in global shipping rates over the last year.

Review of pricing scenarios still supports a robust project

Peak developed 4 pricing scenarios for NdPr oxide in its FEED Study for the purposes of valuation and financial sensitivity analysis in deriving the after-tax NPV_8 and IRR outcomes:

- Base scenario (US$153/kg-US$201/kg) from the latest Adamas market study – see below
- Downside scenario (US$130/kg-US$171/kg) from the latest Adamas market study – see below
- Consensus scenario: a US$120/kg flat NdPr oxide price reflecting a consensus price from 16 brokers
- Downside scenario: a US$100/kg flat NdPr oxide price.

For the purposes of the first 2 scenarios above, Peak considered the latest market forecast from Adamas Intelligence (Adamas). Adamas has developed 4 pricing scenarios that have been derived from a supply-demand analysis based on differing global growth and EV uptake rates, with Peak adopting the 'Base' and 'Downside' scenarios for the purposes of its FEED Study. See p. 7 of this report for more details about these pricing scenarios.

A Look at the FEED Study Details – Capex and Opex Reduced

As noted above, the FEED Study achieved material capex and opex reductions. We detail these below.

Capex reduced by US$33.9m or 10.6%

Figure 1 gives a detailed analysis of the capex reductions achieved from the FEED Study compared to the BFS of 2022. Key contributors to these reductions are detailed below.

Figure 1: BFS capex (2022) vs. FEED Study revised capex (2023)

Capital cost element (US$m)	BFS Update	FEED Study	Delta	%
Roads & infrastructure	29.6	22.2	-7.3	-24.7%
Mine equipment	6.6	0.4	-6.3	-95.5%
Plant	69.2	67.6	-1.5	-2.2%
TSF	18.2	17.2	-1.0	-5.5%
Services	66.9	58.9	-7.9	-11.8%
Bulk earthworks	9.3	7.9	-1.4	-15.1%
Airstrip	5.7	4.1	-1.6	-28.1%
Escalation and FX adjustment	-	3.1	3.1	N/A
Total direct costs	**205.5**	**181.6**	**-24.0**	**-11.7%**
EPCM	32.6	29.5	-3.1	-9.5%
Accommodation camps	22.3	19.8	-2.5	-11.2%
Preliminaries and other indirect costs	12.6	12.7	0.0	0.0%
Owner's cost	14.3	13.6	-0.6	-4.2%
Contingency	33.4	29.7	-3.7	-11.1%
Total indirect costs	**115.2**	**105.3**	**-9.9**	**-8.6%**
Total upfront capex	**320.7**	**286.9**	**-33.9**	**-10.6%**

Source: PEK.

Services – savings of US$7.9m: A key saving has been in the area of services. Broadly, services include the ancillary items that feed into and are around the mine and plant, such as storage, tanks, and power transmission.

The major savings for services included reducing tank sizes for reagents and the removal of a power transmission line due to grid connection.

Roads and infrastructure – savings of US$7.3m: Savings were achieved by changing the scope for the 45km Southern Access Road (SAR) from a major reconstruction to a continuous care and maintenance model during the construction period and the Tanzanian Roads Authority improving road beds and replacing deficient bridges.

Mine equipment: switching to contractor mining – savings of US$6.3m: The BFS Update incorporated an owner-operator mining model with a leased fleet but also identified that contract mining could be a viable alternative.

The decision to switch from an owner-operator model has reduced mining equipment costs significantly removing upfront costs such as lease deposit, reduces the number of light vehicles to be purchased, removal of explosives magazine and the cost of a heavy vehicle workshop.

In addition, with a contract mining arrangement, the responsibility for fleet maintenance goes to the contractor.

EPCM (engineering, procurement and construction management) – savings of US$3.1m: The EPCM cost has been reduced which coincides with a lower direct cost for the project as well as additional optimisation of the EPCM package (including transfer of some engineering staff from Wood's Perth office to South Africa).

Accommodation camps – savings of US$2.5m: Further scope refinement of the fly camp and permanent accommodation camp which will be used for both construction and operation.

Contingency – savings of US$3.7m: Reductions in contingency coincide with a lower direct cost for the project as well as improved accuracy of capital cost estimates through the FEED Study.

Offset to savings: escalation and FX have increased by US$3.1m: Observations of 5-10% escalation of major capital items offset by FX savings from weaker native currencies as well as an adjustment for decreased logistics costs for landed capital items.

Opex reduced by US$16.6m or 18%

Figure 2 gives a detailed analysis of the opex reductions achieved from the FEED study compared to the BFS of 2022. Key contributions to these reductions are detailed below.

Figure 2: BFS capex (2022) vs. FEED Study revised capex (2023)

Operating cost - LOM (US$m	BFS Update	FEED Study	Delta	%
Mining cost	8.5	12.8	4.3	51%
Plant Labour	3.1	3.4	0.3	10%
Power	21.9	17.4	-4.5	-21%
Maintenance	2.2	2.2	0.0	0%
Reagents	17.6	12.2	-5.4	-31%
Consumables	1.9	1.9	0.0	0%
Miscellaneous	4.5	4.4	-0.1	-2%
General and administration	9.3	9.7	0.4	4%
Cost (mine site)	**69**	**64**	**-5.0**	**-7%**
Concentrate transport	24.3	12.7	-11.6	-48%
Cost (delivered to China)	**93.3**	**76.7**	**-16.6**	**-18%**

Source: PEK..

Shipping – savings of US$11.6m: The major saving in costs relates to shipping the concentrate to China. At the time of the BFS COVID had created historically high shipping costs which were adopted into the BFS cost model. Subsequent normalisation of shipping rates has led to a significant reduction of those costs.

Reagents – savings of US$5.4m: Reagents are a major cost utilised in the processing plant to enable necessary chemical processes to occur and make up ~20% of the operating cost base. As part of the FEED study, Peak conducted a global competitive process to achieve the lowest possible cost for reagents.

Power – savings of US$4.5m: The lower annual power costs are attributable to an extension of the build-own-operate power plant contract period from 10 years to 20 years, which allows for a longer amortisation period of the upfront costs. Peak also adopted a lower diesel price (US$1.17/L vs US$1.39/L in the BFS Update) on the back of detailed price forecast analysis for Tanzanian diesel price which also contributes to a lower power cost.

Offset to cost savings: adoption of contact mining increases costs by US$4.3m: A significant increase in the costs relates to the adoption of contract mining. A lower capex is achieved via a contract model however higher costs are a result as the contractor takes on the risks associated with labour costs, maintenance and equipment usage. It should be noted that the contractor does not take on diesel price risk as it is passed straight through, however Peak has adopted a lower long-term diesel price in the cost estimates which partially offsets the increase in annual mining cost.

The advantages of the contract model include that it:

- improves operational efficiency
- avoids the complexity of an equipment leasing structure
- supports greater local/regional content
- avoids recruiting and training mining operators
- shifts responsibility for fleet maintenance to the contractor.

Other key outcomes of the FEED Study

Plant optimisation

The FEED Study evaluated several initiatives aimed at improving the overall performance and operability of the two-stage flotation plant which formed the basis of the process plant design in the BFS Update.

Upfront capex related to the plant has been reduced by US$1.5m. This is supported by an optimised plant layout design which includes:

- a dedicated delivery corridor on the east side of the process plant to divert transport activities away from operating and maintenance areas
- relocation of the water services area, fire water area and demineralised water treatment equipment resulting in a reduction of earthworks and pipe rack lengths

- relocation of the bulk diesel storage area to be closer to major usage points to reduce diesel pipe lengths and road crossing requirements
- the development of a second reagent storage shed on the delivery corridor to support management of traffic through the main process plant area.

Tailings Storage Facility (TSF) optimisation

The review of the TSF achieved a capital savings of US$1.0m, as well as a number of efficiencies and improvements to the facility.

The TSF adopted as part of the BFS Update design allowed for separate storage of the 2 process waste streams (barite concentrate and rare earth tailings). It was concluded during the FEED Study that the reprocessing of either stream for additional revenue would be uneconomic.

The TSF design has been updated to a single cell. In addition the TSF has been improved by:

- updating the TSF design to adopt a high-density polyethylene liner rather than a conventional compacted clay liner
- completing a preliminary dam breach hazard assessment, which resulted in a shift of the planned location of some plant infrastructure
- retaining an emergency spillway to protect the main embankment from overtopping in the event of an extreme weather event
- increasing the embankment height of the TSF during the initial stages of operation to enable the deferral of a TSF decant water process.

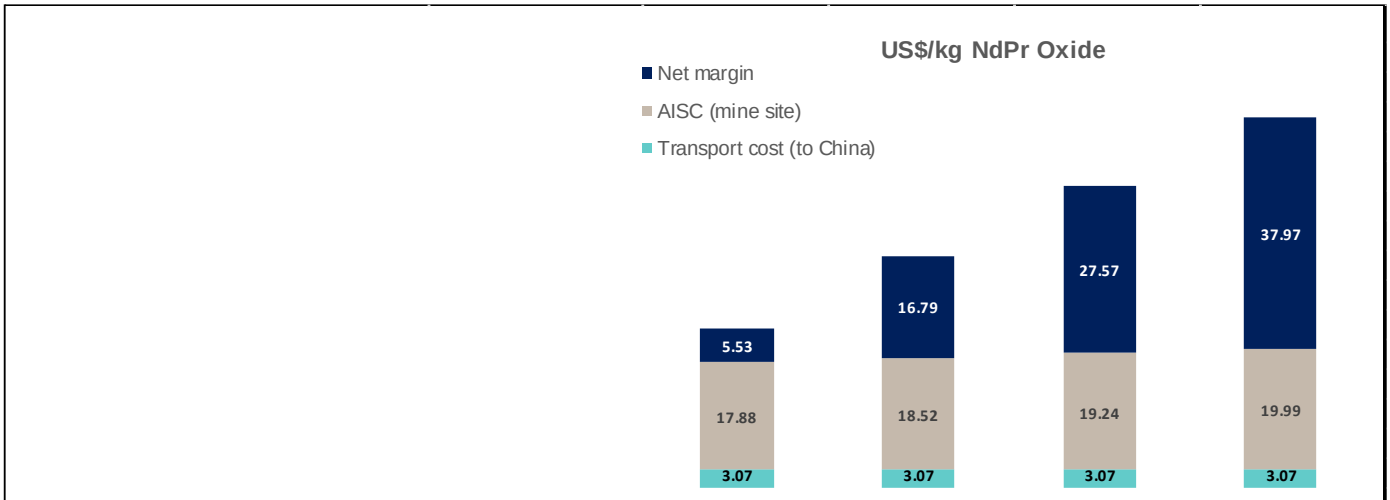
All in sustaining costs (AISC) – Ngualla maintains margins

AISC is an industry cost standard used to estimate the total costs including the cost of sustaining capital for the business and is defined as:

Cash costs (including by-product credits) + Sustaining capital + Exploration expenses + G&A expenses

Peak demonstrated that under the new cost assumptions the Ngualla Project sustains positive margins across a range of pricing scenarios. Figure 3 shows the positive margins across a number of scenarios including current spot pricing (US$60/kg).

Figure 3: Good margins across a number of pricing scenarios



Financial Metrics	Unit	NdPr Oxide price (US$/kg)			
		US$60/kg	US$80/kg	US$100/kg	US$120/kg
Payability (for concentrate)	%	44.1%	48.00%	49.90%	50.90%
Net price received for ct. NdPr	US%/kg NdPr	26.48	38.38	49.88	61.03
By-product credits	US%/kg NdPr	2.65	2.88	3	3.06
Operating cost	US%/kg NdPr	(17.5)	(17.47)	(17.47)	(17.47)
Royalty	US%/kg NdPr	(1.99)	(2.9)	(3.7)	(4.5)
Rehabilitation	US%/kg NdPr	(0.16)	(0.16)	(0.16)	(0.16)
Sustaining capital	US%/kg NdPr	(0.91)	(0.91)	(0.91)	(0.91)
Transport (to China)	US%/kg NdPr	(3.07)	(3.07)	(3.07)	(3.07)

Source: PEK..

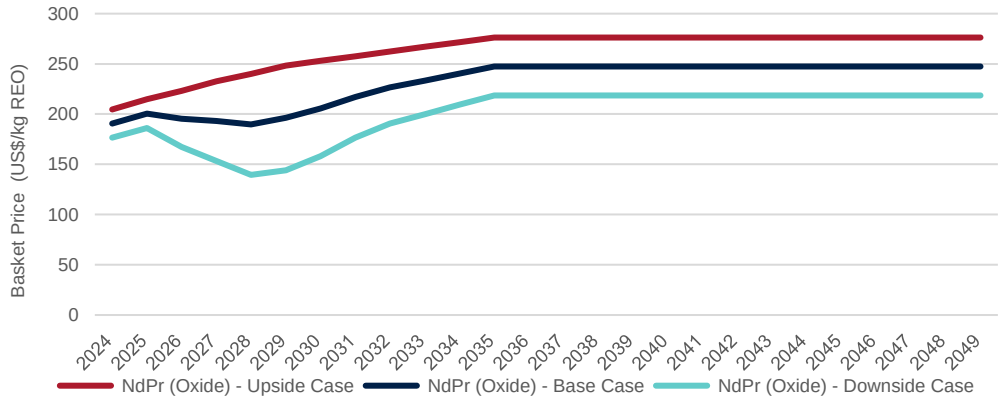
Pricing Scenarios – BFS vs. FEED Study

The Ngualla concentrate's value is primarily influenced by the NdPr oxide price, which constitutes over 92% of its basket value. For this reason, pricing assumptions around NdPr are critical for NPV calculations.

BFS (2022): pricing scenarios – NPV US$1.483b

In 2022, Peak engaged Adamas to conduct a rare earths market review to establish pricing assumptions. Based on its base-case pricing model, Adamas forecasted 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 4: Adamas price forecast for NdPr oxide: BFS (2022)



Source: PEK.

The average life-of-mine pricing adopted by the BFS was US$231.88/kg, with Peak receiving higher net payabilities as the price increases.

With this assumed price, the BFS calculated NPV_8 post tax was US$1,483m.

FEED Study (2023): pricing scenarios – base-case NPV of US$982m

Aa part of the FEED Study, Peak revisited the pricing assumptions for Ngualla and provided a range of outcomes across different assumptions. The company looked at 4 pricing scenarios:

- 'Base' and 'Downside' scenarios from the latest Adamas market study (3Q2023)
- US$120/kg flat NdPr oxide price (real), which reflects a consensus price from a range of 16 brokers
- Downside scenario at US$100/kg flat NdPr oxide price (real)

Figure 5 shows the outcomes of these scenarios.

Figure 5: Ngualla financial outcomes under different pricing scenarios

Financial Metrics	Unit	Pricing Scenarios			
		Adamas Base	Adamas Downside	US$120/kg (flat)	US$100/kg (flat)
NdPr price (2026 - 2030)	US$/kg	**153**	**130**	120	100
NdPr price (LOM)	US$/kg	**201**	**171**	120	100
Net payability (LOM)	%	**53.7%**	**52.6%**	50.8%	49.9%
Peak $NPV_{8\%, real}$	US$m	**982**	**724**	384	208
IRR	%	**33.8%**	**28.8%**	24.7%	18.8%

Source: PEK..

The base-case Adamas forms the base case scenario for the FEED study valuation and still shows a very robust project with an NPV_8 of US$982m (attributable to Peak and net of taxes and other distributions to the Government of Tanzania).

What's Next? FID Targeted for End-June 2024

Peak is now progressing the Ngualla Project towards FID at the end of June 2024, with first concentrate 24 months after FID is confirmed.

Finalising construction execution strategy – including Shenghe; decision planned for early 2024

The FEED study was based on an EPCM strategy. However, Peak will continue to assess an EPC strategy in parallel which follows the MOU with Shenghe for a funding and EPC development strategy. See Appendix 1 for a description of the difference between EPCM and EPC strategies.

Project and export financing

A final debt package is being finalised with the assistance of Peak's debt advisor, WaterBorne Capital. Peak continues to engage with a range of Africa-focused development and commercial banks.

Funding and potential partners

Peak continues to negotiate with Shenghe around a significant non-controlling interest in Ngualla as part of a broader funding solution for the project and follows the funding and EPC development MOU with Shenghe. Peak also recently appointed Macquarie Capital as its strategic advisor – in part to assist with discussions with Shenghe but also to evaluate other funding and development options for the project.

Exploration

Earlier in the year, Peak commenced an exploration program targeting the critical mineral potential of Ngualla which remains prospective for commodities such as niobium, fluorspar and phosphate. Peak has completed a ~4,000m RC drilling program on site and is awaiting assay results from this drilling.

Revisiting the Investment Thesis: Project in Launch Mode, High-Grade, De-risked

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

Peak Rare Earths is advancing the Tier-1 Ngualla Rare Earths Project in Tanzania. The project is 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[2], where valuable NdPr represents 1.02%, placing it as the second-highest NdPr[3] concentration in the world, only surpassed by Lynas (ASX:LYC). The NdPr oxide contributes to 92% 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

PEK, requiring funding for its ~US$287m 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 (see Appendix 2). 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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[2] '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.

[3] NdPr comprises neodymium and praseodymium, which 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

We project the price of rare earths, especially NdPr, 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

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 the 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 (2024)

- 1HCY24: Finalise construction strategy, confirm if Shenghe to construct or other option
- 1HCY24: Exploration and drilling results
- 1HCY24: Finalise funding and outcomes from strategic partnering process
- June 2024: Final Investment Decision; project funding finalised
- 2HCY24: Project construction commenced

Recent events (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
- November: completion of FEED study

Valuation: Base Case and Upside Case Both Get a Healthy Boost – We See Big Upside

Our base-case risked NPV-based valuation for Peak is A$1.29/share on a fully diluted basis (up from A$1.13/share previously). However, we see significant additional upside in the valuation if Peak completes a sell down of the Ngualla Project (with our upside case raised to A$3.54 from A$2.65 previously).

Base-case valuation: risked NPV implies almost 4x potential upside

Our financial analysis of the flagship Ngualla Project (84% ownership) values Peak at A$1.29 per share, fully diluted, while the un-risked valuation is A$1.63/share. We summarise our base-case valuation in Figure 6. Our analysis uses a discount rate of 10% and a probability risk weighting of 80%.

Furthermore, we have attributed a net asset value (NAV) of A$1,067m compared with the current market value of ~A$120m. In our valuation, we assume that A$236m 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 any potential selldown 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 6: Base-case valuation summary

PEK (MSTe)					Jun-24
	Discount rate	US$mn	Risk weighting	AUD$mn	AUD$/sh
Ngualla (84%)	10.0%	948	80.0%	1,083	1.31
Total operating assets				**1,083**	**1.31**
Corporate/SG&A				(30)	(0.04)
Net cash/(debt) ($AUD)				14	0.02
Net Asset Value				**1,067**	**1.29**
Current Share Price					0.320
Upside					304%

Source: MST estimates.

Base case raised to $1.29/share (up 15% from prior) – here's why

We have increased our valuation to A$1.29/share from A$1.13/share, driven by a number of factors:

- **a substantial decrease in capex.** Given Peak's strong reduction in capex we have reduced our capex numbers materially (see Figure 8). This has a material positive effect on the valuation. Our capex assumptions are now 15% above Peak's assumptions (previously 25% above Peak's prior assumptions).
- **a decrease in operating costs** to be in line with Peak's operating cost assumptions.
- **an increase in the risk probability rating** to 80% from 75%. We see Peak's FEED Study as a major de-risking event with the project now even more robust than it was previously.
- **lower required equity capital raising** due to the lower capex, reducing the dilution. This was offset by using a lower share price for the assumed raising.

These factors are partially offset by using a **lower price deck for the REO**.

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 7).

Figure 7: Base-case valuation assumptions (to be updated)

Financial Performance Summary	Unit	PEK	MSTe
Construction commencement year	Year	2024	2025
Construction period	Years	2	3
Avg. NdPr price (first 5 years)	US$/kg	153	172
Avg. NdPr price (LOM)	US$/kg	201	197
Upfront development capex	US$m	287	330
AISC at US$60/kg NdPr (inc. conc transport)	US$/kg	21.0	23.9
Avg. annual operating cost	US$m	77	80
Average annual EBITDA	US$m	281	314
NPV10 (Post-tax, ungeared, and after 16% free carr	US$m	747	948
IRR (Post-tax, ungeared, and after 16% free carry)	%	34%	41%

Source: PEK., MST estimates.

Capital Raising Assumptions

We have assumed a capital raising (50/50 debt to equity) of A$236m to fund the pre-production capex of US$330m for the project. We have assumed an issue price of 25% greater than the current share price (as we expect share price appreciation as PEK name any debt funding options). The share count increases by 554.1m as a result.

Capex (our estimates)

We have taken a conservative approach in forecasting pre-development capital costs. While Peak's FEED Study anticipates a figure of US$287m, we have projected US$329.7m (see Figure 8).

Figure 8: MST vs Peak's estimated project pre-development capex for Ngualla Project

Development Capital Cost Breakdown	PEKe	MSTe	BFS
Roads & infrastructure	22.2	25.5	29.6
Mine equipment	0.4	0.5	6.6
Plant	67.6	77.7	69.2
TSF	17.2	19.8	18.2
Services	58.9	67.7	66.9
Bulk earthw orks	7.9	9.1	9.3
Airstrip	4.1	4.7	5.7
Escalation and FX adjustment	3.1	3.6	-
Direct cost subtotal	**181.6**	**208.6**	**205.5**
EPCM	29.5	33.9	32.6
Accommodation camps	19.8	22.8	22.3
Preliminaries and other indirect costs	12.7	14.6	12.6
Ow ner's cost	13.6	15.6	14.3
Contingency	29.7	34.2	33.4
Total upfront cost	**286.9**	**329.7**	**320.7**

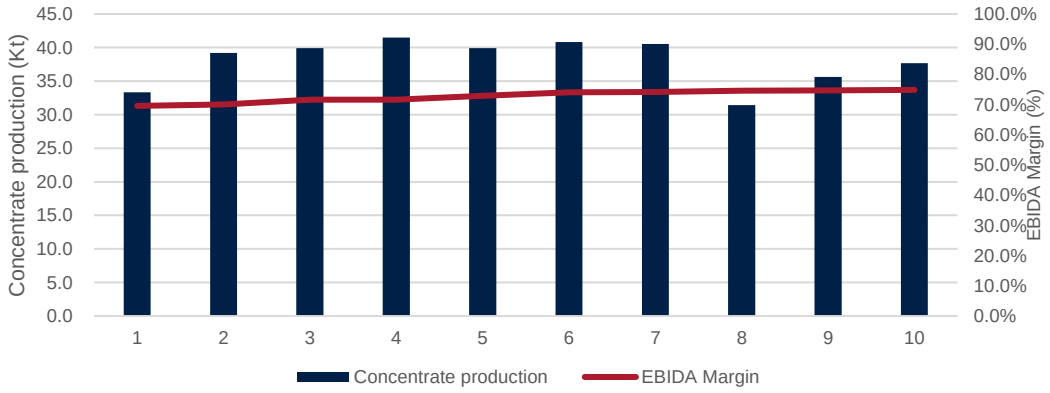
Source: PEK, MST *estimates.*

Production and EBITDA margin (our estimates)

Our production and EBITDA margin forecasts are shown in Figure 9.

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 9: Concentrate produced vs EBIDA margin: first 10 years

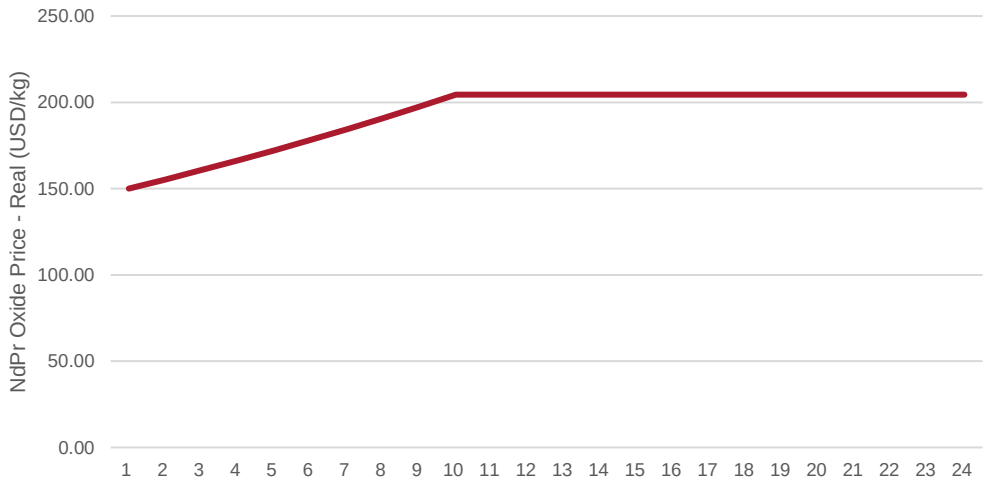


Source: MST *estimates.*

NdPr pricing (our estimates):

Our NdPr pricing assumptions for the Ngualla Project are shown in Figure 10. Peak could see significant upside from higher prices.

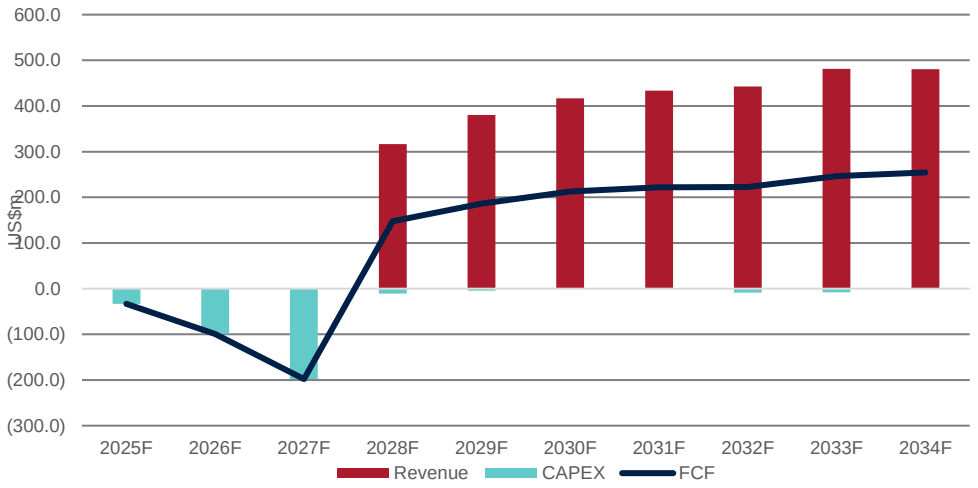
Figure 10: Forecasted NdPr oxide price – real 2023 $ (assuming 100% payability)



Source: MST estimates.

Revenue, capex and free cash flow (our estimates)

Figure 11: MST forecast revenue, capex and free cash flow

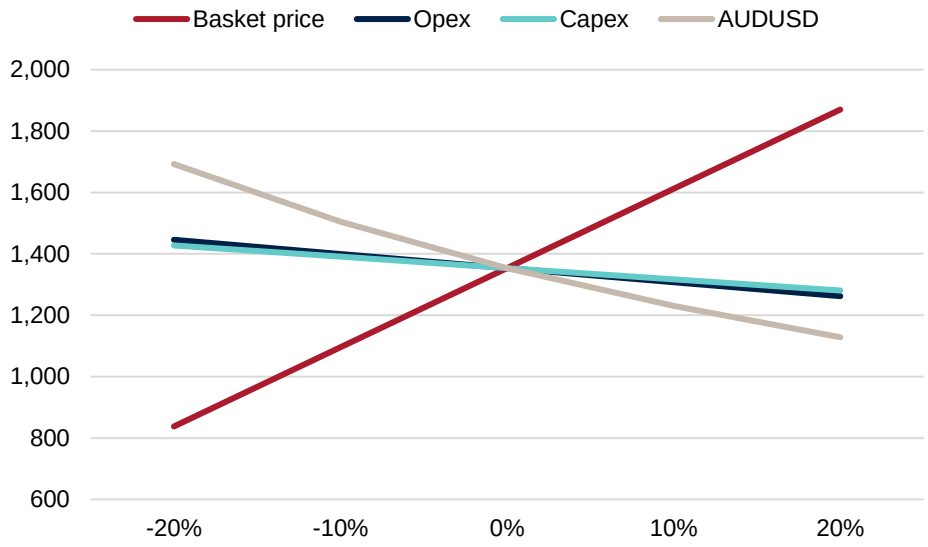


Source: MST *estimates.*.

Key sensitivities

As shown in Figure 12, our valuation is most sensitive to assumptions on the NdPr oxide price and to a lesser extent the AUD/USD exchange rate, opex and capex.

Figure 12: Key project sensitivities



Source: MST *estimates.*

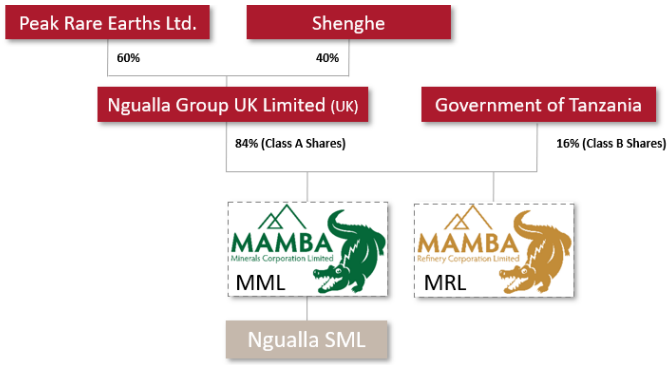
Scenario analysis: non-controlling equity interest – a significant uplift Valuation A$3.54

As announced on 9 August 2023, Peak has signed a funding MOU for Ngualla with Shenghe. This entails Shenghe acquiring a notable non-controlling stake in the Ngualla Project, significantly reducing Peak's funding needs. We have 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.

In this analysis, we value Peak at A$3.54 per share on a fully diluted basis (vs A$2.65 previously for this upside-case scenario), as detailed in Figure 14. 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 would be no issuance of shares)
- the absence of debt-related costs.

Figure 13: Corporate structure, Shenghe holding non-controlling equity interest in the project



Source: PEK

Figure 14: Asset selldown valuation summary, significant value creation

PEK (MSTe Sale of Asset)					Jun-24
	Discount rate	US$mn	Risk weighting	AUD$mn	AUD$/sh
Ngualla (50.4%)	10.0%	823	80.0%	941	3.56
Total operating assets				**941**	**3.56**
Corporate/SG&A				(30)	(0.04)
Net cash/(debt) ($AUD)				14	0.02
Net Asset Value				**925**	**3.54**
Current Share Price					0.320
Upside					1007%

Source: MST estimates.

Key assumptions

We have used a 10% discount rate (real) and assumed zero pre-development capex, on the basis that Shenge funds the project. We assume 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.

Cash position: maintaining good capital management:

As of 30 September 2023, Peak had cash reserves of A$21.148m.

With a current burn of approximately A$1.5m/month, Peak is well-funded to move forward with its CY24 strategy.

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.

Asset selldown: Selling a stake in the project to finance its development would 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.

Final Investment Decision: FID is the key to project commencement and represents a major milestone.

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.

Metallurgical improvements: Advancements in metallurgical efficiencies, whether through enhanced recoveries or superior grades, could 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 would 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 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.

Appendix 1: EPC v EPCM: a brief explanation

EPC (engineering, procurement, and construction) and EPCM (engineering, procurement, construction management) are both project delivery methods used in the construction and engineering industries. However, these methods differ with respect to the scope of services and the level of direct client involvement in construction. EPC provides a complete turnkey solution with a single entity taking full responsibility for the project, while EPCM involves a more collaborative approach, with the client playing a more active role in construction management. The choice between EPC and EPCM depends on factors such as the client's preferences, risk tolerance, and the specific requirements of the project.

EPC – a complete turnkey solution

Turnkey solution: EPC is often referred to as a turnkey solution because the EPC contractor takes full responsibility for the entire project, from design and engineering to procurement of materials and construction.

Single point of responsibility: In EPC contracts, the client typically contracts with a single entity, the EPC contractor, who manages and executes the entire project. This provides the client with a single point of responsibility and accountability.

Fixed price: EPC contracts often involve a fixed-price arrangement, where the contractor agrees to deliver the project for a predetermined and fixed cost.

EPCM – a more collaborative approach

Project management focus: In EPCM contracts, the emphasis is on engineering and project management services rather than direct construction. The EPCM contractor provides services related to design, engineering, and procurement but may not directly perform the construction work.

Client's direct involvement: Unlike EPC, in EPCM contracts, the client is usually responsible for procuring and managing the construction contracts separately. The EPCM contractor acts as an advisor, providing expertise and management services to the client.

Cost-plus or reimbursable contracts: EPCM contracts may involve cost-plus or reimbursable arrangements where the client pays for the actual costs incurred by the contractor plus an agreed-upon fee.

Appendix 2: 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.

Ray Anguelov – Head of Technical Services holds over 25 years' extensive international hands-on experience (UK, Africa, Canada and US, Middle East, Russia, Pakistan, and Middle East) in development, managing economical and efficient operations, commissioning and optimising metallurgical processes, establishing strong controls and procedures, designing, developing and implementing. Mr Anguelov's major achievements are the recent commissioning and optimisation of rare earth mines in Australia and Canada, a sulphuric acid plant and Pierce Smith Converters in Namibia, a vanadium refinery in Australia, the installation of a crushing plant in the UAE, and installation of a crushing circuit, on-line stream analyser and Outotec ceramic filter for copper-gold mine in Bulgaria.

Matthew Horgan – Head of Corporate Development and Investor Relations holds over 10 years of experience within the mining industry. Mr Horgan was most recently a senior associate within Azure Capital, a boutique investment bank based out of Perth, where he worked on several M&A transactions within the metals and mining space. Prior to his role at Azure, Mr Horgan spent over 9 years at aluminium company Alcoa, working across a number of roles spanning corporate development, strategy, market development and technical (chemical engineering). Prior to departing Alcoa, Mr Horgan was manager of global corporate development where he focused on business development initiatives across Southeast Asia.

Andrea Cornwell – Head of Marketing, EMBA, Bachelor of International Business Relations has over 28 years in international resources marketing. Ms Cornwell 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. Her recent roles include VP Marketing at South32 and Head of Coal Marketing at Vale. Ms Cornwell is a co-founder of Women in Mining & Resources and was recognised among the Top 100 Inspirational Women in Global Mining in 2016. She 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 3: 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 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, wanting to retain them for its own market. This was achieved by raising export duties on ferro-alloys containing more than 10% of REEs from 10% originally to 15% and then finally to 25% in 2011. 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 of 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 4: 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 15).

Figure 15: 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 16.

Figure 16: 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.

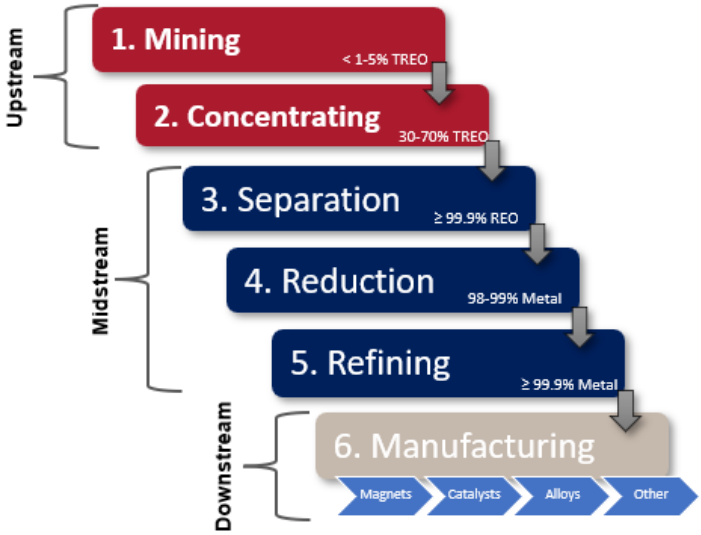
Appendix 5: Stages of REE Value Chain – From Mining to End-user Products

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 adds value. Characteristically directed by end-users, this supply chain sees the peak of value addition, and consequently, economic viability, during the final stages.

Figure 17: 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.

Methodology & Disclosures

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