Neodymium and Praseodymium ‘NdPr’
Biggest Blind Spot in the Global Commodity Market
Peak Resources - Becoming one of world's lowest cost fully integrated NdPr producers

BEHIND EACH BATTERY IS A MOTOR
Over 90% of all new energy vehicles will be equipped with an NdFeB permanent magnet motor.
0.5-1kg per is the incremental demand for neodymium (Nd) and praseodymium (Pr)
for each internal combustion vehicle (ICV) which gets replaced by an electric vehicle (BEV,PHEV,HEV).
Disclaimer

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Certain statements contained in this document constitute “forward-looking statements” within the meaning of the United States Private Securities Litigation Reform Act of 1995 and forward looking information under the provisions of Canadian provincial securities laws. When used in this document, the words “anticipate”, “expect”, “estimate”, “forecast”, “will”, “planned”, and similar expressions are intended to identify forward-looking statements or information. Such statements include without limitation: statements regarding timing and amounts of capital expenditures and other assumptions; estimates of future reserves, resources, mineral production, optimization efforts and sales; estimates of mine life; estimates of future internal rates of return, mining costs, cash costs, mine site costs and other expenses; estimates of future capital expenditures and other cash needs, and expectations as to the funding thereof; statements and information as to the projected development of certain ore deposits, including estimates of exploration, development and production and other capital costs, and estimates of the timing of such exploration, development and production or decisions with respect to such exploration, development and production; estimates of reserves and resources, and statements and information regarding anticipated future exploration; the anticipated timing of events with respect to the Company’s mine sites and statements and information regarding the sufficiency of the Company’s cash resources. Such statements and information reflect the Company’s views as at the date of this document and are subject to certain risks, uncertainties and assumptions, and undue reliance should not be placed on such statements and information. Many factors, known and unknown could cause the actual results to be materially different from those expressed or implied by such forward looking statements and information. Such risks include, but are not limited to: the volatility of prices of gold and other metals; uncertainty of mineral reserves, mineral resources, mineral grades and mineral recovery estimates; uncertainty of future production, capital expenditures, and other costs; currency fluctuations; financing of additional capital requirements; cost of exploration and development programs; mining risks; community protests; risks associated with foreign operations; governmental and environmental regulation; the volatility of the Company’s stock price; and risks associated with the Company’s by-product metal derivative strategies. For a more detailed discussion of such risks and other factors that may affect the Company’s ability to achieve the expectations set forth in the forward looking statements contained in this document, see the Company’s Annual Report for the year ended 30 June 2019, as well as the Company’s other filings with the Australian Securities Exchange. The Company does not intend, and does not assume any obligation, to update these forward-looking statements and information.

Compliance Statement

Information relating to Infrastructure, project execution, cost estimating, metallurgical test work, exploration results, Mineral Resource estimates and Ore Reserve estimates is extracted from the report entitled “Lower price deck delivers similar BFS results for Ngualla” created on the 12th of October 2017 and is available to view on http://www.peakresources.com.au/asx-announcements/. The company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcement and, in the case of estimates of Mineral Resources or Ore Reserves, that all material assumptions and technical parameters underpinning the estimates in the relevant market announcement continue to apply and have not materially changed. The company confirms that the form and context in which the Competent Person’s findings are presented have not been materially modified from the original market announcement.
Peak Resources Limited (ASX:PEK) is focused on developing one of the world’s largest, highest grade and lowest cost Neodymium (Nd) and Praseodymium (Pr) (NdPr) rare earth projects.

NdPr is a key ingredient in NdFeB Permanent Magnet Motors (PPMs) which are widely used in electric vehicle (EV) motors and direct drive wind turbines.

The Ngualla Project, located in Tanzania, has existing JORC Compliant Reserves of 18.5 mt at 4.8% Rare Earth Oxide (REO) equating to 887,000t contained REO. Peak holds a 75% interest in the Ngualla Project alongside Appian Natural Resources Fund (20%) and International Finance Corporation (5%).

Peak is looking to become the second fully integrated producer of NdPr Oxide outside of China with its Tees Valley Refinery to be constructed at the UK’s third largest port, close to existing infrastructure and supplies of low-cost chemical reagents whilst providing access to European and Asian markets.

The NdPr price outlook is decidedly bullish with increased demand being driven by the adoption of EV and wind energy technologies. China’s historic supply dominance of rare earths, ~90% of the global supply, is undergoing structural changes due to environmental and supply side reforms which will reduce the overall volumes and availability of spot material in the market.
Investment Highlights

- **One of the Highest Grade, Lowest Cost NdPr Projects Globally:** Estimated US $32.24/kg neodymium & praseodymium (NdPr) breakeven point for positive cash flows assuming no other sales revenues from other rare earth material except NdPr, total pre-production CAPEX of US $365m and OPEX of US $91m p.a. over a 26 year LOM with a post-tax NPV of US $612m and IRR 22% at NdPr price of US $77.50/kg.

- **Simple Geology and Mining:** Large, high grade 4.8%, soft bastnasite ore body with mineralisation from surface allowing low cost free-dig open pit operation with a low strip ratio of 1.77:1.

- **The Right Team:** Extensive industry experience with Rocky Smith (CEO) ex-MD of Molycorp’s Mountain Pass Rare Earth Complex, Michael Prassas (GM Sales), ex-Global Sales Account Manager Catalysis and Peter Meurer (Chairman), former Chairman of Nomura Australia and former Vice Chairman of Citi and Merrill Lynch.

- **Advanced Project:** BFS completed, Tanzanian environmental certificates received, Teesside Refinery fully permitted - environmental certificate and Planning Permission received, further Project optimisation completed and mining licence application pending.

- **Proven processing capabilities:** Fully proven piloted process, Mineralogy which is low in reagent consumption, High Grade 45% REO, low mass concentrate, Selective leach process, Low strength acids- no acid roast, use of conventional construction material e.g. Modular plastic tanks

- **Exposure to Forecast Increases in NdPr Price:** Peak offers excellent leverage to the favourable NdPr price outlook with 90% of revenue to be generated from NdPr.

- **Tight Capital Structure:** Circa 1,305m shares on issue with 51% held by top 10 including Appian Natural Resource Fund (33.36%) and International Finance Corp/World Bank (7.27%).

- **Compelling Valuation:** With an EV of circa A $48m, Peak offers a compelling value proposition against its ASX listed peers.
Corporate Snapshot

Capital Structure (as at 31 December 2019)

- Share Price (ASX:PEK) 3.9¢
- Shares on Issue (Undiluted) 1,305.3m
- 52 Week Range 2.0¢/6.6¢
- Market Capital A $50.9m
- Cash As At 31 December 2019 Peak Resources A $2.9m
- Enterprise Value $48.0m

- Listed Options (Exercisable at $0.06 expiring 14 June 2020) 61.1m
- Unlisted Options Outstanding (Exercise Price A$0.035- A$0.15) 160.8m
- Unlisted Performance Rights 10m
- 1 Month Liquidity 20.5m shares for ~$0.8m
- 6 Month Liquidity 185m shares for ~$8.1m
- 12 Month Liquidity 430m shares for ~$19.6m

*ASX Volumes only

12 Month Share Price Performance

Top Shareholders

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<thead>
<tr>
<th>Shareholder Name</th>
<th>Shares</th>
<th>Percentage</th>
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<tr>
<td>Appian Pinnacle Holdco Limited</td>
<td>435,488,554</td>
<td>33.36%</td>
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<tr>
<td>International Finance Corporation</td>
<td>94,870,449</td>
<td>7.27%</td>
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<td>J P Morgan Nominees Australia Limited</td>
<td>47,476,639</td>
<td>3.64%</td>
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<td>Sambold Pty Ltd</td>
<td>16,325,000</td>
<td>1.25%</td>
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<tr>
<td>CRX Securities Pty Ltd</td>
<td>14,500,000</td>
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<tr>
<td>Directors and Management</td>
<td>8,845,104</td>
<td>0.68%</td>
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The Team

Experienced Management Team

Rocky Smith
Chief Executive Officer
Chemist with over 35 years’ operations and senior management experience in the mineral processing and chemical engineering sectors. Previously Managing Director of Molycorp’s Mountain Pass Rare Earth Complex.

Graeme Scott
Chief Financial Officer/ Company Secretary
Fellow of the Association of Chartered Certified Accountants (UK)
More than 20 years’ experience in professional and corporate roles in both Australia and the UK.

Michael Prassas
General Manager- Sales, Marketing & Business Dev
Over 15 years’ experience in sales marketing and business development. Former Global Account Manager Automotive Catalysis /Sales Manager of Rare Earth Systems for Solvay/ Rhodia.

Lucas Stanfield
General Manager Development
Mining Engineer with over 15 years mining and project management experience in Australia, Africa and the United Kingdom. Experienced in managing new projects, mine expansions and development studies.

Experienced Directors & Advisors

Peter Meurer
Non-Executive Chairman
Distinguished career of over 40 years in the Corporate Finance sector and is former Non-Executive Chairman of Nomura Australia.

Jonathan Murray
Non-Executive Director
Partner at independent corporate law firm Steinepreis Paganin Specialising in equity capital raisings and acquisitions

Robert Sennitt
Non-Executive Director
Senior Advisor for Appian Capital Advisory in Australia and South East Asia. Previous Managing Director of Mineral Deposits Limited & RBC Capital Markets

Tony Pearson
Non-Executive Director
Former Managing Director HSBC Australia with over 15 year’s banking experience, covering the Asia Pacific natural resources industry.
The Market – The Fundamentals

- **The Current Market** – The global market is currently approximately 35kt to 45kt of NdPr Oxide per annum across all applications incl. non-NdFeB applications and is currently valued at US $1.75bn to US $2.25b assuming a price of US $50kg/NdPr.

- **The Market Outlook** – The market is projected to double in volume by 2025 with approximately 50% price increase over the same period. Permanent magnets market including NdFeB magnets represents 70%-80% of the total rare earth oxide market in value.

- **EV Adoption Driving NdPr Demand** – approx. annual sales of 25-30m new energy vehicles (BEV/PHEV/HEV) represent approximately ~100% incremental NdPr demand from NdFeB permanent magnets.

- **Tesla Adopts PPM Technology** – With Tesla’s move to adopt the permanent magnet motor (PMM) technology for it’s Tesla Model 3, PMM has reached close to +90% market share confirming PMM technology as the leading engine technology and industry standard.

- **Change of the Chinese Policies will Impact Todays Rare Earth Supply Chain** – China currently accounts for circa 80-90% of the global NdPr supply and is undergoing structural changes due to environmental and supply side reforms, which will reduce the overall availability of material in the market (e.g. Made IN CHINA 2025) and raise cost (Beautiful China Policy e.g. Environmental Protection tax law). This trend is also supported by the published goals of the 5 Year Rare Earth Industry Plan by China’s Ministry of Industry and Information Technology in October 2016. This offers the opportunity for new supply sources supported by an increasing NdPr price over the coming years.

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Source: EV-Volumes.com
Key Enabler - Governmental Legislation Underpins NdPr Demand

**What does this mean? Required powertrain portfolios:**

- **World of today** – above 100g CO₂/km
  - a portfolio of ICE, mild-hybrids and less than 10% electrification can meet the target

- **Mix of powertrains** – below 100g CO₂/km
  - a “portfolio game” with equal importance of ICE, PHEV & BEV & 48v mild hybrids can meet the requirements

- **EV World** – below 50g CO₂/km
  - achieving the target only possible with a portfolio mainly consisting of EV’s and PHEVs

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**Major vehicle markets CO₂ emission regulation**

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<td>Japan:</td>
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**Energy efficiency regulation worldwide for electric motor and generators**

According to a recent IEA study electric motors are responsible for 53% of global electricity use. Industry standards IE1-IE4/IE5 + further alignment on test procedures will support the continuous growth of PM motors/generators.

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**What does this mean? Required powertrain portfolios:**

- **World of today** – above 100g CO₂/km
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- **Mix of powertrains** – below 100g CO₂/km
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- **EV World** – below 50g CO₂/km
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**Fossil Free Street Declaration**

Auckland, Barcelona, Cape Town, Copenhagen, London, Los Angeles, Mexico City, Milan, Oxford, Paris, Quito, Seattle, Vancouver,

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**Source:** ICCT; national industry bodies, transport/environment.org, Mckinsey, Gov. announcements
Analyst projections are all aligned! The question is not if, the question is when NEV will establish +25% market share.

Analysts from Bloomberg, Exxon, IEA, OPEC and BP have revised their Electric Mobility Vehicle sales forecast multiple times. All of them are agreeing on the fact that the electric vehicles will take over the market in the coming decade. China leads the way with their quota system & the 2025 target = 20% electrification (sales 2017 = 25.8m), followed by EU, establishing an indirect EV quota with its introduction of its new legislation and emission target for 2021/2025 & 2030 (sales 2017 = 21m). Furthermore, the EU has announced it will introduce penalties for car manufacturers in 2021 if they do not comply with the new regulation.

Global Automotive industry will invest more than US$ 400 billion

The global automotive industry committed to a ~ US $400 b investment in EVs. E-mobility represents a total new, incremental demand source for NdPr operating in a multi million unit sales mass market.

Toyota Motor Corp recently announced to accelerate its Electric vehicle strategy.

Toyota aims to get half of its global sales from electrified vehicles by 2025. This is five years ahead of schedule, leveraging Chinese battery makers to meet the accelerated global shift to electricity-powered cars.
The Market – Macroeconomic Issues

- **July 2019 - Global macroeconomic issues** have put the Rare Earth Industry back into the global spotlight. The world was reminded that those Rare Earth metals are essential for future technological megatrends. The general awareness of the importance of Rare Earth metals increased. This is due to the Chinese media and governmental officials publicly discussing the pro’s and con’s of using Rare Earth’s and it’s downstream products as a potential countermeasure in the ongoing trade dispute with the USA.

- **Nov 2019 - Australia, United States Sign Critical Minerals Agreement** Matt Canavan, Australia’s Minister for Resources “Growing global demand for critical minerals means there is huge scope for Australia to develop secure and stable supply chains to meet the growing demand for critical minerals in key economies such as the US,”

  US Secretary of the Interior said in a release that the formalization of the agreement was “an important milestone in reducing the (United States’) susceptibility to critical mineral supply disruptions.”
The recent trade tensions between United States and China has shown the vulnerability of the Industry. Whether or not China chooses to use rare earths in its trade war dispute with the United States, it is simply not sustainable for the downstream industry to rely on a single supplier for 80% of an key critical raw material.

We believe it is imperative for the industry and the supply chain of the electric vehicle manufacturers to act today and to diversify their supply chain before the S-curve and high volumes in the electric vehicle market kick in.
1 Megawatt from 200 kg NdPr Oxide

Each direct drive wind turbine uses a permanent magnet motor that generates between 2-6 MW of performance. Each megawatt requires approx. 200kg pure neodymium and praseodymium.
The supply demand balance of NdPr is set to be disrupted by the electrification of our society initiated by electric cars, buses and trucks becoming mainstream applications.

**Facts That Matter - Upcoming Supply Demand Disruption**

**E-mobility**
- Spearheaded by passenger cars
- Followed by trucks, buses & trains

And on top of the 2 mainstream applications above all these other applications will require NdPr as well!
Peak Resources - Who We Are

Peak to become one of the world’s lowest cost rare earth producers. With a CAPEX of only US$ 365 million incl. 15% contingency, OPEX of US$ 91 million p.a. and a 26 year Life of Mine.

**UK Tees Valley** the location of Peak’s Rare Earth Refinery
- **Capex:** US$ 165 million incl. 15% contingency plus 5% owners costs
- **Location:** Top logistics infrastructure + skilled labour + sustainable waste management facilities
- **Annual Production:** 9,290 tpa of oxide equivalent = Oxide 2,810 tpa NdPr 2N; Carbonate = 12,095 tpa = 7,995 tpa La; 3,475 tpa Ce & 625 tpa SEG/HRE
- **32.24 US$/kg NdPr** - The breakeven point for positive cash flow considering total OPEX divided with only the 2,810 tpa NdPr oxide production

**Tanzania** Ngualla Project, one of the largest and highest grade undeveloped NdPr deposits worldwide
- **Ore Resource:** 214.4 mt at 2.15% REO; **Ore Reserve:** 18.5 mt at 4.8% REO; 22% of the total Mineral Resource, approx. 887,000 t REO
- **Capex:** US$ 200 million incl. 15% contingency plus 5% owners costs; **OPEX:** US$ 51 million; **Life of mine:** 26 year; **Mill feed rate:** 711,000 tpa; **Strip ratio:** 1.77; **Rare earth concentrate:** 32,700 tpa of 45%

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*See ASX Announcement “Higher grade Resource for Ngualla nearly 1 m EoP" and ASX Announcement “Ngualla Rare Earth Project – Updated Ore Reserve” as of 12 April 2017 and “BFS positions Ngualla one of worlds lowest cost RE Projects” as of 12 April 2017 and “BFS Update - Lower price deck delivers similar BFS results for Ngualla” as of October 2017.*

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**Nd/Pr**

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**ENABLING LOW CARBON TECHNOLOGIES**
## The Ngualla Project, Tanzania

<table>
<thead>
<tr>
<th>Location:</th>
<th>Tanzania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geology:</td>
<td>Weathered carbonatite with a high grade bastnasite- rich zone, low in phosphate and carbonate</td>
</tr>
<tr>
<td>Ore Resource:</td>
<td>214.4 mt at 2.15% REO, initially developing only 22% of the total resource</td>
</tr>
<tr>
<td>Ore Reserve:</td>
<td>18.5 mt at 4.80% REO = 887,000 t REO; 21.3% NdPr, 38,800m of drilling (649 holes), 40 x 50 meter spacing, depth of 120 meter</td>
</tr>
<tr>
<td>Mining:</td>
<td>Low strip ratio 1.77:1 &amp; open-pit</td>
</tr>
<tr>
<td>Mill feed rate:</td>
<td>711,000 tpa dry ore</td>
</tr>
<tr>
<td>RE Concentrate:</td>
<td>32,700 tpa at 45% REO Bastnaesite</td>
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<tr>
<td>Environmental Certificate:</td>
<td>Received March 2017</td>
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<tr>
<td>Mining licence:</td>
<td>SML pending</td>
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<tr>
<td>Estimated Capex:</td>
<td>US $200m incl. 15% contingency and 5% owners costs</td>
</tr>
<tr>
<td>Estimated Opex:</td>
<td>US $51m p.a.</td>
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<td>Life of Mine:</td>
<td>26 years (considering only the official Reserve)</td>
</tr>
<tr>
<td>Location:</td>
<td>~1000 KM west of Dar es Salaam close to Mbeya</td>
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</table>

The material assumptions underpinning Ore Reserve, production target, capital and operating costs are disclosed in the ASX Announcement dated 12 April 2017. The positions Ngualla as one of the world’s lowest cost rare earth projects continue to apply and have not materially changed. # See ASX Announcement “Higher grade Resource for Ngualla nearly 1 million” and ASX Announcement “Ngualla Rare Earth Project – Updated Ore Reserve” as of 12 April 2017.
Peak’s refinery will be located at Wilton International’s Teeside Industrial Zone located in Tees Valley, North East England.

Teeside benefits from existing fully integrated site infrastructure located within a major UK exporting region which is home to existing heavy industries including mineral processing, automotive and advanced manufacturing.

Existing infrastructure includes road, rail, air and sea connections providing access to European and Asian markets.

Tees Valley is located alongside the UK’s 3rd largest port by volume within close proximity to competitively priced chemicals, water disposal and treatment facilities required for the refining process.

Power is generated on-site and is also connected to the UK National Grid providing power security whilst avoiding the need for significant capital outlay.

Teeside benefits from an available skilled workforce and local government and community support.

CAPEX: US $165m incl. 15% contingency plus %5 owners costs

Opex: US $40m p.a.
US $32.24 is the breakeven point for positive cash flow only from the projected 2,810 t p.a. NdPr sales; OCBRITDA = Operating cost before royalties, interest, tax, depreciation and amortisation.

*See ASX Announcement: “Lower price deck delivers similar BFS results for Ngualla” dated 12 October 2017

# See ASX Announcement: Process optimisation study boosts Ngualla’s operating margin” dated 28 August 2017

BFS Price deck: NdPr Mixed Oxide 2N Min 75% Nd2O3 US $77.50/kg; Cerium* US $02.20/kg; Lanthanum* US $03.70/kg; SEG & Mixed Heavy*US $08.00/kg
Peak has one of the lowest OPEX as a fully integrated producer per kg of NdPr among 58 development projects worldwide*3

Peak has one of the lowest CAPEX as a fully integrated producer per kg of NdPr Oxide LoM among 58 development projects worldwide*3

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*NdPr = Nd2O3 /Pr6O11 Mixed Oxide 2N – min 75% Nd2O3  *1 Benchmarking data provided by: Adamas Intelligence
*2 US $32.24 is the breakeven point for positive cash flow only from the projected 2,810 t.p.a. NdPr sales; OCBRITDA = Operating cost before royalties, interest, tax, depreciation and amortisation. See ASX Announcement: “BFS positions Ngualla one of worlds lowest cost RE Projects” dated 12 April 2017 and ASX Announcement: “Process optimisation study boosts Ngualla’s operating margin” dated 28 August 2017
Track Record of Delivery and Upcoming Catalysts

- Appointment of AMEC FW as BFS lead Engineering firm
- Beneficiation pilot plant
- Advancement of ESIA
- BFS Drilling Program
- AUD $23.4m investment from Appian and IFC
- Optimisation studies:
  - Location of downstream plant
  - Stockpiling of Cerium
  - Beneficiation improvement
- Results from pilot plant test work complete
- New mineral resource estimate
- Project economics updated
- Advance engineering
- Advance Environmental Permitting
- Bankable Feasibility Study completed delivering a US $35m p.a or 30% saving in operating costs compared to Pre Feasibility Study
- Tanzanian Environmental Certificate received
- Project Optimisation delivered similar financial results with a lower price deck. NdPr price has been reduced from US $85kg to US $77.50kg
- Special Mining Licence Application submitted
- Planning Permission for Teesside Refinery Granted
- Environmental Certificate for the UK Refinery Granted
- Ramp up discussions with potential offtake partners with special focus on magnet manufacturers
- Grant of Special Mining Licence in Tanzania - application lodged - grant pending
- Seek strategic partner and/or project finance to fund development of Ngualla and Teesside
## Why Peak?

### NGUALLA ORE BODY
- High grade 4.80% REO
- Large deposit
- Bastnaesite mineralogy
- Mineralisation from surface
- Very low U and Th (15 and 53 ppm)
- Thick blanket morphology
- Low in reagent consuming minerals

### NGUALLA MINE AND PROCESS PLANT
- Soft, free dig Ore
- Simple, small open pit mine
- Low waste: Ore strip ratio (1.77)
- Zero offsite discharge + water recycle
- High Grade (45% REO), low mass concentrate
- Proven piloted process

### TEES VALLEY REFINERY
- Selective leach process
- Low strength acids- no acid roast
- Modular plastic tanks
- Small SX separation plant
- Bulk, low-cost reagents available
- Pre-existing utilities
- Existing waste management facilities

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**NGUALLA RARE EARTH PROJECT: UNDERSTOOD – DE-RISKED – COMPETETIVE – MANAGABLE – READY TO BE DELIVERED**

See ASX Announcement: "BFS positions Ngualla one of worlds lowest cost RE Projects" dated 12 April 2017 and ASX Announcement: "Process optimisation study boosts Ngualla’s operating margin" dated 28 August 2017
The Right Company

- **The Right Team** – Experienced Board and Management with a track record of delivery

- **The Right Asset** – World class asset with low CAPEX ($365m) and OPEX ($91m p.a.) requirements relative to other rare earth projects

- **The Right Market** – considerable leverage to forecast increase NdPr prices resulting from EV revolution and transition to sustainable energy

- **The Right Investment Proposition** – Significant relative value compared to ASX listed peers with clear strategy to become a near term fully integrated NdPr producer

NGUALLA RARE EARTH PROJECT: UNDERSTOOD – DE-RISKED – COMPETITIVE – MANAGABLE – READY TO BE DELIVERED
Peak Resources Limited
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PO Box 603, West Perth 6872.
ASX: PEK ACN 112 546 700
Contact details:
Telephone: +61 8 9200 5360
info@peakresources.com.au

Chief Executive Officer:
Rocky Smith

Company Secretary:
Graeme Scott

Non-Executive Chairman:
Peter Meurer

Non-Executive Directors:
Jonathan Murray, Tony Pearson, Robert Sennitt
Automotive - US$ ~500b Invest* & ~700 New NEV 2018-30

Tesla Launched Model 3
First mass market BEV car with a PMM; weekly output since Sep18 = 5,300 UNITS per week, price range US$35-52k USD;

GM: 20 new BEV by 2023, and a significant ramp up of Bolt production

Daimler: complete line up will be electrified ~130 NEV (48V+PHEV+BEV) by 2022; US$ 13 b invest

VW Group: (12 brands): 3m units sales + 50 BEV+30 PHEV by 2025 and 20-25% of sales; 300 BEV+PHEV models by 2030; US$ 84b invest. 2017 = 10.7m units of which 4.2m in China

BMW: Mass production by 2020; 25 NEV = 13 PHEV + 12 BEV by 2025; 15-25% ; US$ 47b invest

Ford: 40 NEV = 16 BEV+ 24 PHEV by 2022; US$ 28b invest

PSA: By 2025, the full lineup will be electrified for the four brands min 40 BEV+PHEV [Peugeot, Citroen, DS, Opel/Vauxhall].

Toyota: 10 new BEV by 2020s; 5.5m with NEV = 4.5m by PHEV+EHV, Rest BEV; ~50% of annual sales by 2025; US$ 10b invest.

Hyundai-Kia: 28 NEV by 2020; in total 44 new NEV by 2025; ~40% of sales by 2025; US$ 87b invest

JLR by 2020 complete line up will have a 13 NEV = 48V+PHEV+BEV

Volvo: All new models = 8 NEV (48v mild hybrid, PHEV + BEV) by 2019; 50% of sales by NEV by 2025;

Gelly: 90% of sales to be with NEV by 2020; 65% PHEV and 35% BEVs; Target to launch 30 NEV by 2025; US$ 41b invest

Fiat Chrysler: by 2022 33 NEVs = Maserati 4 BEV+4 PHEV; Jeep A BEV and 10 PHEV; Alfa Romeo: 7 PHEV and FIAT = TBA; US$ 9b Invest

Nissan: 8 new BEV by 2022, ~23% of total sales = 1m sales of NEVs by 2022; 35-45% sales by 2025; Nissan Leaf

Renault: 8 BEV and 12 PHEV by 2022; 50% of sales should be BEV or PHEV by 2022; US$ RNM 12b invest

Honda: 30% of new car sales NEV FC + EV + PHEV by 2030.

Mazda: to electrify all IC engines by 2030

Estimated invest of US$ ~100b across all Chinese brands and through the Chinese supply chain. The Chinese government perceives E-mobility as one of the core pillars of their industrial transformation strategy, see “China 2025”. China is now the biggest single automotive market worldwide (2017= China 25.8m, EMEA 21m, NA 20.9m).

Within the top 50 of the global list of car manufacturers 24 are Chinese!
Latest and future Chinese legislation will be the key influencing drivers for future portfolio decision of all global car manufacturers!

Source: Individual company announcements, Bloomberg & Peak Resources estimations & others, Investment number incl. Battery inv. + vehicle R&D + industrial manuf. invest
Automotive - Forecast, Cost prediction & TCO impact

2018 TCO = LeasePlan announced that in Norway and Netherlands EVs became cheaper than ICE. Belgium and UK are close.

Source: LeasePlan

Powertrain cost comparison for 60kwh/500km range (w/o subsidies) cost of an ex battery power train for an EV is estimated at 2,000 US$ / Source: Bernstein

EV leaders cost crossover 2021-2022

EV mainstream cost crossover 2023-2024

ICE game over 2029 – BEV cheaper than ICE

Note: Percentages might not add to 100 because of rounding. TCO = total cost of ownership; BEV = battery electric vehicle; PHEV = plug-in hybrid electric vehicle; HEV = full hybrid electric vehicle; MHEV = mild hybrid electric vehicle.

Supply chain disruption anticipated

Source: BCG analysis.

Impact of broader mobility trends

Regulation driven

TCO driven


Volume (millions)

Gasoline Diesel MHEV HEV PHEV BEV

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EV mainstream cost crossover 2023-2024

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Next Generation Of Direct Drive Wind Turbines Depend On NdPr

HALIADE-X 12 MW

GE Renewable Energy is developing Halide-X 12 MW, the biggest offshore wind turbine in the world, with 220-meter rotor, 107-meter blade, leading capacity factor (63%), and digital capabilities, that will help our customers find success in an increasingly competitive environment.

One Halide-X 12 MW can generate 67 GWh annually, which is 45% more annual energy production (AEP) than most powerful machines on the market today, and twice as much as the Halide-150-6MW.

The Halide-X 12 MW turbine will generate enough clean power for up to 16,000 European households per turbine, and up to 1 million European households in a 750 MW configuration windfarm.

1MW = 200kg of NdPr Oxide

https://www.windpoweroffshore.com/