



**PEAK
RESOURCES**
ENABLING LOW CARBON TECHNOLOGIES

Neodymium and Praseodymium 'NdPr' Biggest Blind Spot in the Global Commodity Market

32.24

the number
you need to remember



PRESENTATION 8th NOVEMBER 2018

Metal Events 15th int. Rare Earth Conference HK 2018 November

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Compliance Statement

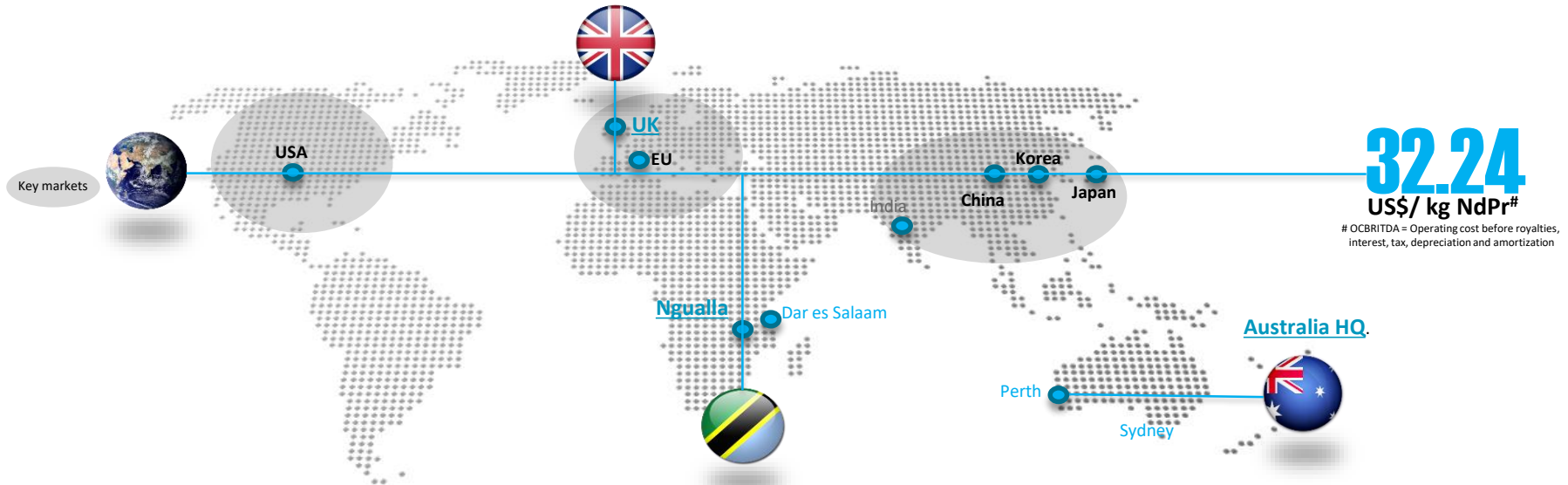
Information relating to Infrastructure, project execution, cost estimating, metallurgical test work, exploration results, Mineral Resource estimates and Ore Reserve estimates is extracted from the report entitled “Lower price deck delivers similar BFS results for Ngualla” created on the 12th of October 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 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 LOM.



UK Tees Valley the location of Peak's Rare Earth Refinery

- **Capex:** US\$ 165 million incl. 15% contingency plus 5% owners costs **Opex:** US\$ 40million p.a.
- **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 = 12,095tpa** = 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%

*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 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

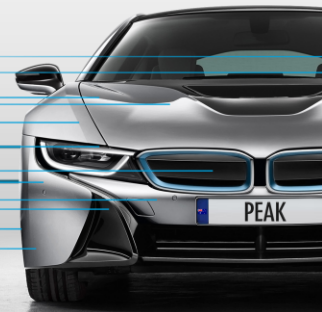


BEHIND EACH BATTERY IS A MOTOR

*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 new energy electric vehicle (48v mild Hybrid, HEV, PHEV, BEV)



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

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 PM motors/ generators



- China:**
 - NEV quota = 10% and 12% for 2019+2020; max points with +350km reach
 - By 2020 OEM's need to meet 5l/100km
 - Biggest single car market 2017 with 25.8m (EMEA 21m & NA=20.9m)
 - **Target 5m NEV stock by 2020.**
 - **Target 20%** of production + sales in 2025 = ~ 5-7m p.a.
 - ICE ban pending
- 10th October 2018:** EU Countries - EU commission (-15%/-35% based on 2021 values) and the EU Parliament (-20%/-40%) are in discussions to determine the new standards for 2025 and 2030. **VW CEO Mr. Dies commented:** In case the 40% target get implemented 50% of the new vehicle sales needs to be electrified by 2030.
- Japan:** County goal 30% NEVs of sales in 2030;
- US:** 8 states have set targets = 3.3m cars by 2025;

- India:** Only sales of NEV by 2030
- Ireland:** Sales ban of ICE by 2030
- Netherlands:** Sales ban of ICE by 2030
- Slovenia:** Sales ban of ICE by 2030
- Norway:** Sales ban of ICE by 2030
- Scotland:** Sales ban of ICE by 2032
- France:** Sales ban of ICE by 2040
- UK:** Sales ban of ICE by 2040
- Sri Lanka:** Fleet w/o ICEs by 2040
- Sweden:** Fleet w/o ICEs by 2045

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

Source: ICTT; national industry bodies, transportenvironment.org, [Mckinsey](#), Gov. announcements



- **China leads the way** with their quota system & 2025 target = 20% electrification
 - Followed by **EU, establishing an indirect EV quota** with 2025/ 2030 legislation
 - **2025 EU** - Emission targets translate to **~15-20% electrification**
 - **2030 EU** - Emission target translates **~30-40% electrification**
-
- **Best in class technology! NdFeB magnet motors** offer **greater torque** than competing technologies, the **same values of current and voltage** and **more power by weight**
 - **~90%** of all electric vehicles **have a NdFeB permanent magnet motor**
 - **Each electric vehicle** represents approx. **1 kg incremental NdPr demand**

Automotive - NdFeB Permanent Magnet Motor - Best in class!

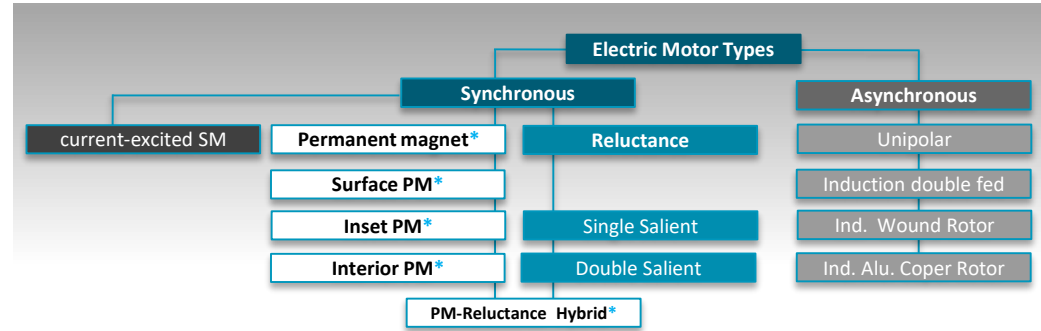
Synchronous Permanent Magnet Motors (PMM) - Best in class!

Technology: Enabling OEMs to design a more **cost optimized**, lightweight (up to 20% smaller and lighter) **vehicle and more efficient powertrain solutions** with a **15-20% smaller battery** at the same driving reach. The **battery** represent **~30% of a BEV vehicle manufacturing cost!**

Price sensitivity: Rare earth minerals represent between **0.23%* - 0.47%** of the total **vehicle** (42k US\$) cost or **8%* - 15%** of total **Driveline** (1200 US\$) cost or **12%* - 25%** of the total **electric motor** (800 US\$) cost
 *NdPr oxide 42 US\$/kg & Dy 180 US\$/kg

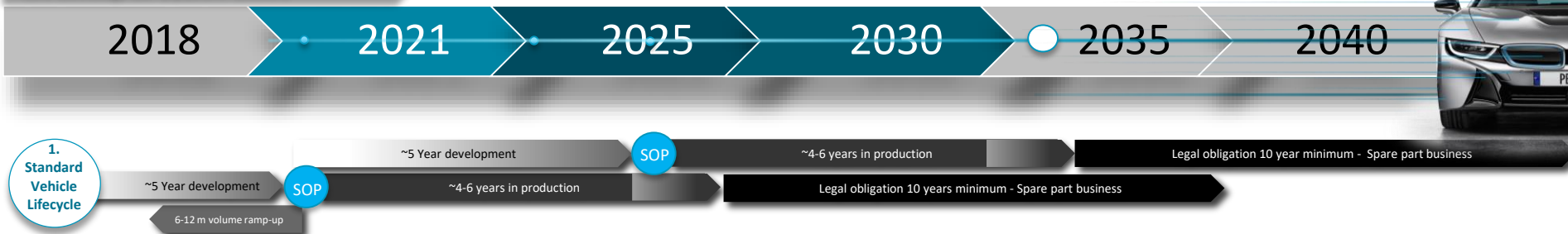
Market share: **~90%** of all EVs (PHEV, BEV, HV) have a PMM today

NdPr demand: Each NEV represents approx. **0.5-1 kg incremental NdPr demand**



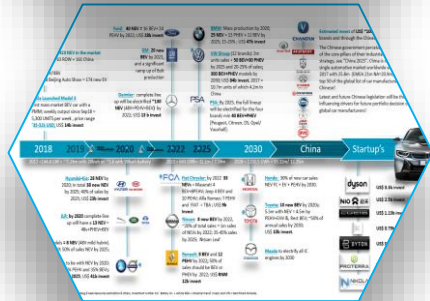
* Contain NdPr / NdFeB magnets

Core technology dev. & platform decisions

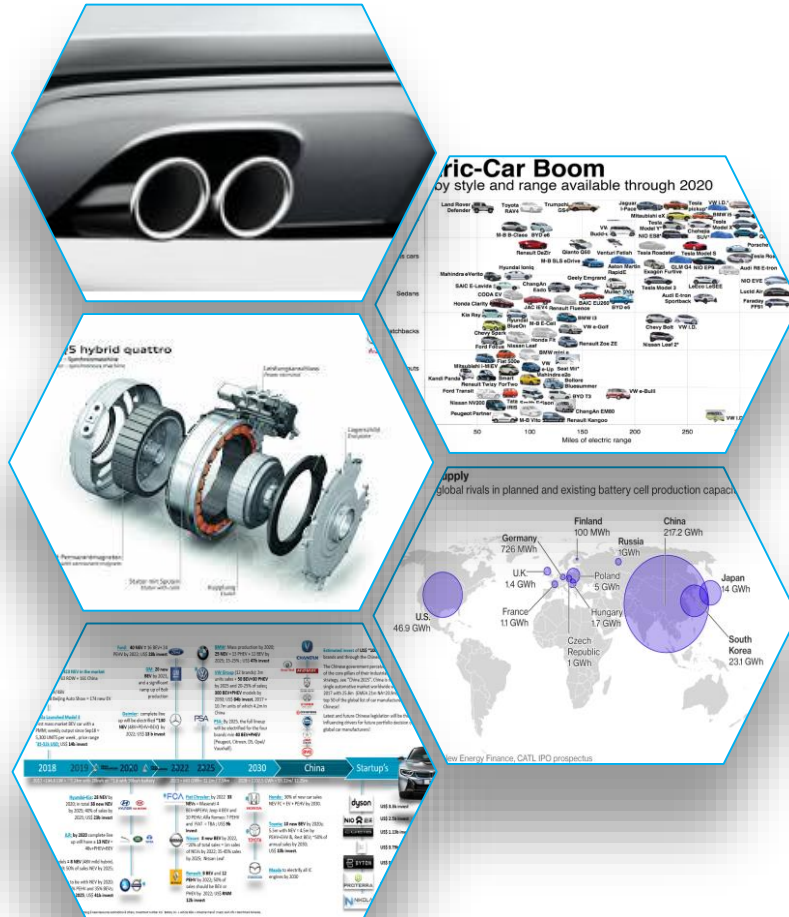


Source: Mckinsey + others; image Pm & Ind Image Courtesy of New Energy and Fuel.com





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 - **2030 EU** - Emission target translates **~40% electrification**
-
- **NdFeB magnet motors** offer **greater torque** than competing technologies, the **same values of current and voltage** and **more power by weight**
 - **~90%** of all electric vehicles **have a NdFeB permanent magnet motor**
 - **Each electric vehicle** represents approx. **1 kg incremental NdPr demand**
-
- The global **automotive industry committed ~ 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.



Car manufacturers have announced **200 new EV model launches by 2019*** and **~700** by 2030**

*Source [McKinsey & Company](#) ** car manufacturer and market announcements

Available industrial lithium battery manufacturing capacity:

YEAR	Installed Industrial capacity	PHEV with 20kWh	Or BEV with 100KWh
2020	~350GWh	17.5 million	3.5 million
2022	~500GWh	25 million	5 million
2025	~800GWh	40 million	8 million

Source: Industry information + individual company announcements

Automotive - US\$ ~400b Invest* & ~700 New NEV 2018-30

YTD Oct. 2018: 423 NEV in the market

- 224 BEV = 63 ROW + 161 China
- 68 PHV
- 131 HV/48v
- 2018 Beijing Auto Show = 174 new EV

Tesla Launched Model 3
First mass market BEV car with a PMM; weekly output since Sep18 = 5,300 UNITS per week, price range **35-52k USD**; US\$ **14b invest**

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

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**

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

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

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 with market 2017 with 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!



Hyundai-Kia: 28 NEV by 2020; in total 38 new NEV by 2025; 40% of sales by 2025; US\$ **23b 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 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**

FCA Fiat Chrysler: by 2022 33 NEVs = Maserati 4 BEV+8 PHEV; Jeep 4 BEV and 10 PHEV; Alfa Romeo: 7 PHEV and FIAT = TBA; US\$ **9b invest**



Nissan: 8 new BEV by 2022, ~20% 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.



Toyota: 10 new BEV by 2020; 5.5m with NEV = 4.5m by PHEV+EHV &, Rest BEV; ~50% of annual sales by 2030; US\$ **10b invest**.



Mazda: to electrify all IC engines by 2030



US\$ 3.3b invest



US\$ 2.5b invest



US\$ 1.13b invest



US\$ 0.79b invest



US\$ 0.7b invest



US\$ 0.6b invest



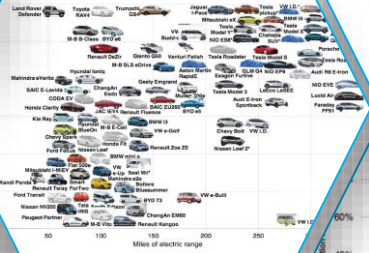
US\$ 0.2b invest

Source: Individual company announcements, Bloomberg & Peak Resources estimations & others, Investment number incl. Battery inv. + vehicle R&D + industrial manuf. invest





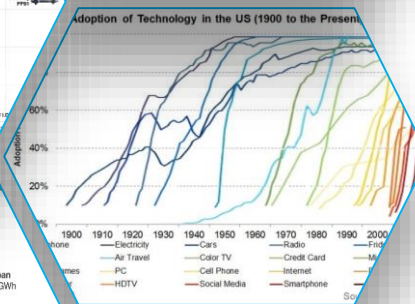
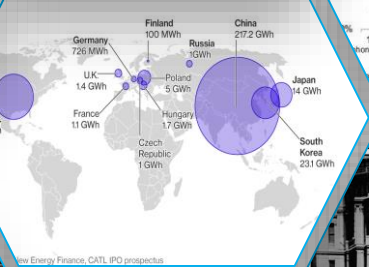
Electric-Car Boom
by style and range available through 2020



For the **Model 3**, Tesla made the decision to use a **NdFeB Permanent Magnet Motor** representing sales of 500k per year, an annual incremental demand of **500-600 tpa NdPr**.



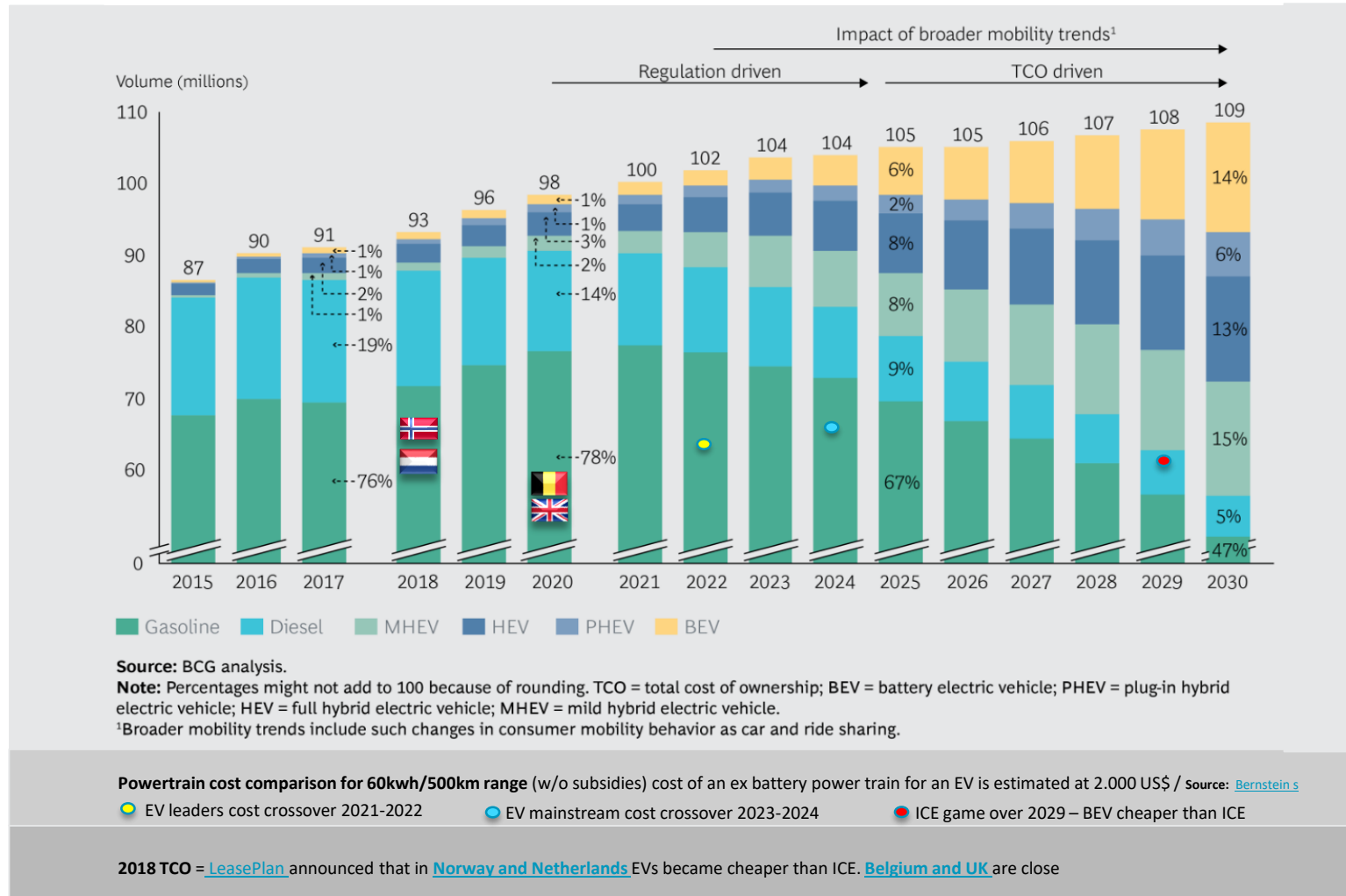
Apply
Global rivals in planned and existing battery cell production capacity



Adoption curves are accelerating year by year outpacing all expectations.



We believe the automotive landscape will **transform fundamentally in the next 5 years** starting with the urban areas.



Lithium battery manufacturing capacity

2020 = 350GWh
2023 = 500GWh
2025 = 800GWh

NEV Model announcements

2020 = ~+59 NEV*
2022 = ~+271 NEV*
2025 = ~+365 NEV*

Market share

~90%
NdFeB motors - No1 leading technology

NdPr oxide incremental demand

1 NEV = 1kg
1m NEVs = 1000t
27m NEVs = 27,000t =
25% of 105m vehicles p.a.

2017 global legal NdPr production

27,000 tpa NdPr#

All these facts indicate that the NdPr **supply risk** increases as electric vehicle sales rise!

NEVs are just one of the NdFeB megatrends – Just think what happens when you factor in developments in wind energy, mobile robotic solutions, Drones + E-planes, E-bikes, E- bicycles and consumer electronics etc.

*New Models numbers without Chinese's OEM except Geely; PEAK estimate +30% on global numbers for China

#2017 = China 105k quota = 21k NdPr + Lynas '17 = 5,223 tpa NdPr; Peak estimation incl. Illegal production = 45kt pa

Learn more about the market and the individual dynamics and enablers.
Download our recently published **white paper of 115 Pages**:

“NdPr: The Biggest Blind Spot in the Global Commodity Market”

<http://www.peakresources.com.au/whitepaper/>

The Right Investment Proposition

One of the Highest Grade, Lowest Cost NdPr Projects Globally

- Significant potential investment upside with a clear strategy to become a near term fully integrated NdPr producer
- Total Opex/kg NdPr = US \$32.24
- CAPEX of US \$365m; OPEX of US \$91m pa
- NdPr Oxide production 2,810 tpa
- Post-tax NPV8 of US \$612m
- IRR 22% at NdPr price of US \$77.50/kg
- BFS completed
- UK+ Tanzanian Environmental permits received



The Right Market

Considerable leverage to forecast increase NdPr prices resulting from EV revolution and transition to sustainable energy

- NdPr is a key ingredient in NdFeB Permanent Magnet Motors which are widely used in electric vehicle motors and direct drive wind turbines
- The market is projected to double in volume by 2025 with approximately 50% price increase over the same period

The Right Team

Experienced Board and Management with track record of delivery. 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 Solvay/Rhodia Catalysis
- **Peter Meurer** (Chairman), current Non-Executive Chairman of Nomura Australia and former Vice Chairman of Citi and Merrill Lynch

The Right Assets

Tanzania Ngualla - Simple Geology and Mining

- JORC Reserve: 18.5 mt, high grade 4.8% = 887,000 t REO; 21.3% NdPr, 22% of the Resource
- Life of Mine 26 years (only Reserve)
- Soft bastnasite ore body, open pit, strip ratio 1.77:1

Peak's UK refinery is a key differentiator

- The BFS covers a SX-Refinery to assure that Peak will be becoming a fully integrated producer from Mine to NdPr oxide outside of China. Enabling Peak to capture the full value of the material compared to other developers its peers who aim for concentrate/ mix carbonate only sales operation

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



CAPEX = Capital Expenditure
OPEX = Operation Expenditure
REO = Rare Earth Oxide
p.a. = per annum/ per year
NdPr = Neodymium Praseodymium oxide

ICV = Internal Combustion Vehicle
ICE = Internal Combustion Engine
EV = Electric Vehicle
HEV = Hybrid Electric Vehicle
PHEV = Plug-in Electric Vehicle
BEV = Battery Electric Vehicle
48v = 48v or MHEV = mild hybrid electric vehicle
NEV = New Energy Electric Vehicle (48v/MHEV,HEV,PHEV,BEV)

SOP = Start Of Production of a new vehicle model
NdFeB = Neodymium-Iron-Boron permanent magnets
PM = Permanent Magnet
PMM = Permanent Magnet Motor

kg = Kilogram
tpa = tonnes per annum/ per year
b = Billion
km = Kilometre
m = Million
K = Thousands
US\$ = United States Dollar

EU = European Union
ROW = Rest of the World
NA = North America
EMEA = Europe Middle East Africa

g = Gram
w/o = without
TCO = Total Cost Of Ownership
KWh = Kilowatt hour
GWh = Gigawatt hour

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



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