



## Arafura Resources Limited

*Up and coming supplier of NdPr to permanent magnets used in the growing clean energy industry*

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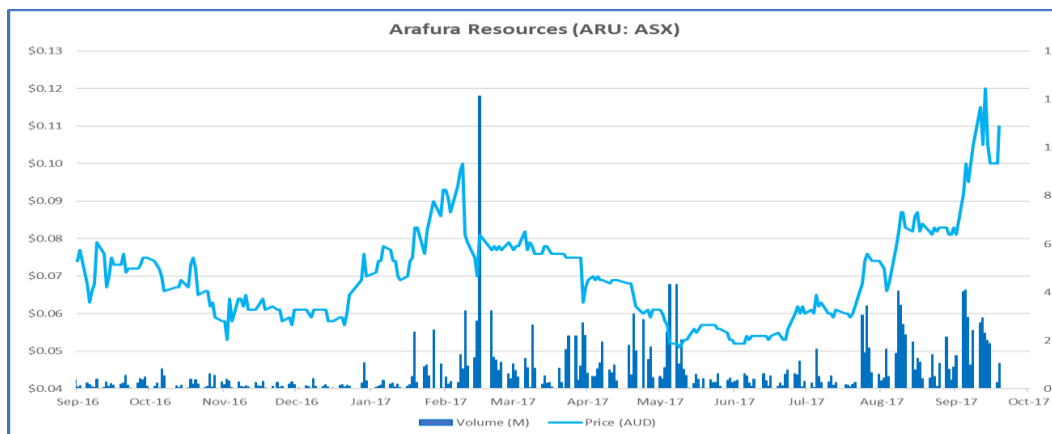
Mr Hussey is a full-time employee of Arafura Resources.

# Investment Highlights & Capital Structure

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- **Nolans Project** in the Northern Territory, **low geopolitical risk**, **30+ year** mining and chemical processing operation
- One of the **largest and richest deposits of Neodymium-Praseodymium (NdPr)** in the world.
- Forecast operating costs are in the **lowest quartile**
- Capability of meeting **5-10% of global demand for NdPr**
- Afforded **major project status** by NT and Australian governments
- Nolans is in **advanced feasibility and environmental assessment**
- **Final Investment Decision targeted end 2018**

ASX Code	ARU
Share Price (15-Nov-17)	A\$0.11
Issued Shares	575.8m
Market Cap	A\$63.3m
Cash (30-Sept-17) + Placement	A\$15.3m
Debt	Nil
Enterprise Value	A\$48.0m



## Top 5 Shareholders

JP Morgan Nominees	20.47%
ECE Nolans Investment Co	19.05%
HSBC Custody Nominees	2.59%
Citicorp Nominees	2.31%
BNP Paribas Nominees	0.85%

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# NdPr Market Update

# Overview

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## Secure Supplier of NdPr to Permanent Magnets Used in Clean Energy

- **NdPr is a key component** in the manufacture of high-strength NdFeB permanent magnets used in electric vehicles (EVs), wind turbines, portable electronic devices, and many industrial applications
- EVs use an additional **1 kg of NdPr per electric motor** over a standard vehicle's use of 0.7 kg
- NdPr accounts for 26.4% of Nolans rare earths composition by volume and **85% by value**
- China has generally controlled the production of NdPr but recently analysts are forecasting for **China to become a net importer**
- Structural changes are being implemented in China to **weed out illegal operators, close unsustainable operations**, and push bigger players to consolidate

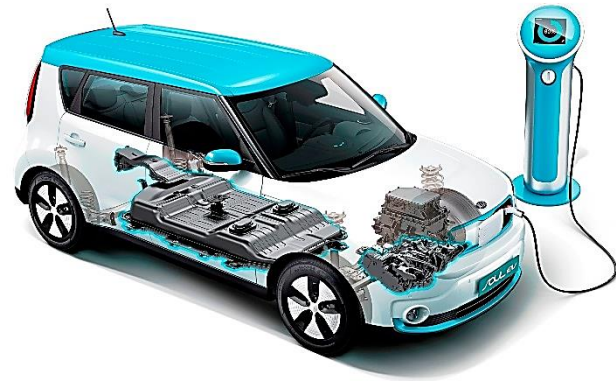
# NdPr Snapshot – Clean Energy Applications

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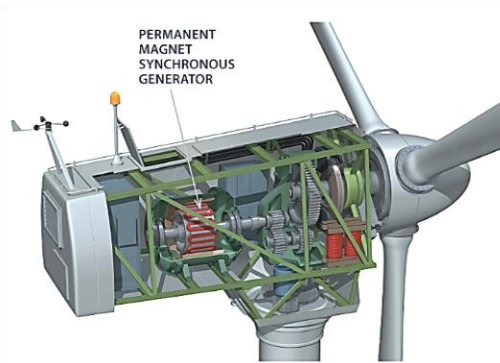
**EV Drivetrain:** 1 kg of NdPr



**Electric Vehicles:** 41 million by 2040 each containing 1.7 kg of NdPr



**Wind Turbines:** Up to 150 kg of NdPr per MW



**Electric Bicycles:** 30 million in 2017 each containing 0.1 kg of NdPr



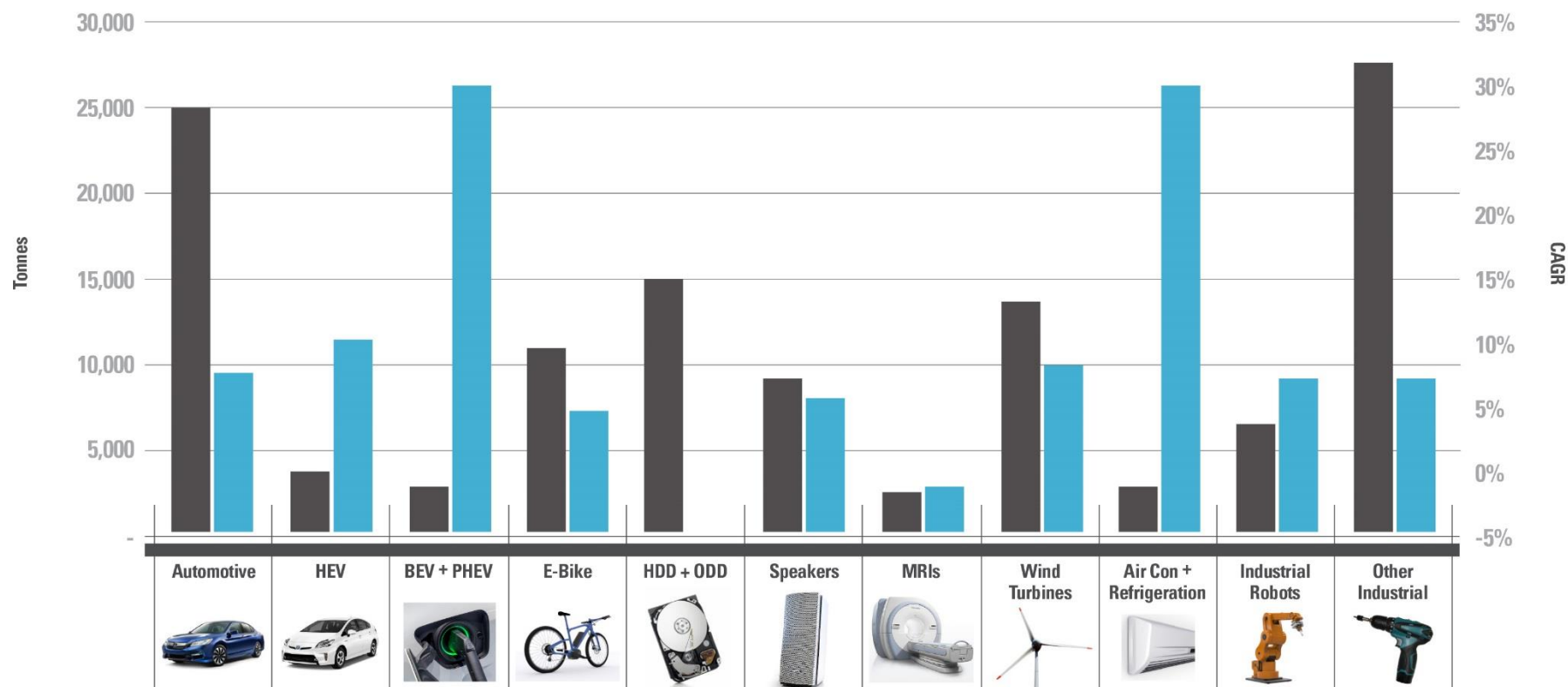
# Established Markets & Growing Applications

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## NdPr Magnet Volume & Forecast Growth

■ NdPr Magnet Tonnes 2016

■ Forecast CAGR% 2025



Source: Adamas Intelligence, Arnold Magnetic Technologies, Japanese industry participants, Roskill

# Automakers EV Growth Strategy

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Manufacturer	PMSM	AACIM	NOTES
Audi	✓		25% of US sales from EVs by 2025
BMW	✓		EV range to extend to Series 3 and X4 for next generation of models
BYD	✓		World's largest manufacturer of EVs
Ford	✓		40% EVs by 2020
General Motors	✓	✓	Alliance with Lyft to create an integrated network of on-demand autonomous vehicles. China accounts for one-third of GM's total production
Honda	✓		Targeted two-thirds of sales by 2020. Honda Daido Steel heavy Dy free magnets
Hyundai	✓		26 hybrid, plug-in, fuel cell and EV models by 2020
Mitsubishi	✓		Electric powered SUVs
Nissan/Renault	✓		10% EVs by 2020
Tesla X & S		✓	Independent manufacturer – disruptive technology?
Tesla 3	✓		Mass market affordable EV
Toyota	✓		Gasoline to hydrogen fuel by 2050
Volkswagen	✓		25% EVs by 2025

PMSM = Permanent Magnet Synchronous Motor

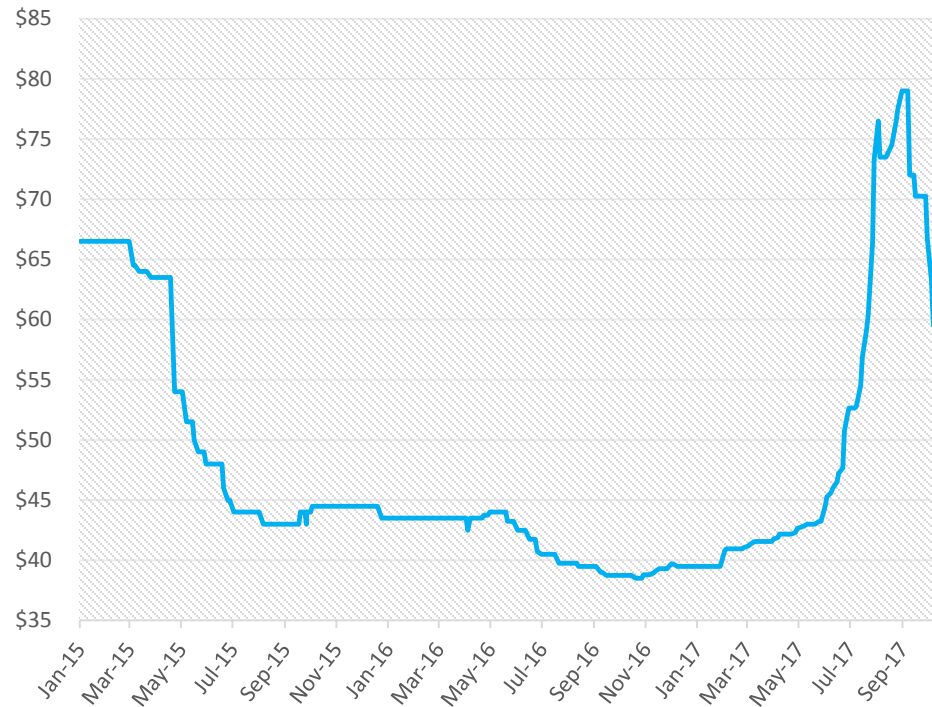
AACIM = Asynchronous AC Induction Motor



# NdPr Price – Supply & Environmental Reform

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**NdPr Oxide Pricing (US\$/kg) 2015-2017**



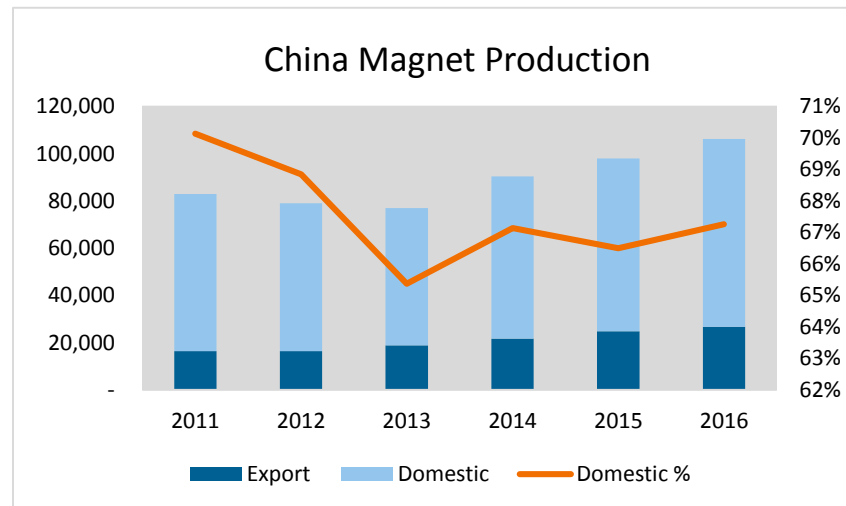
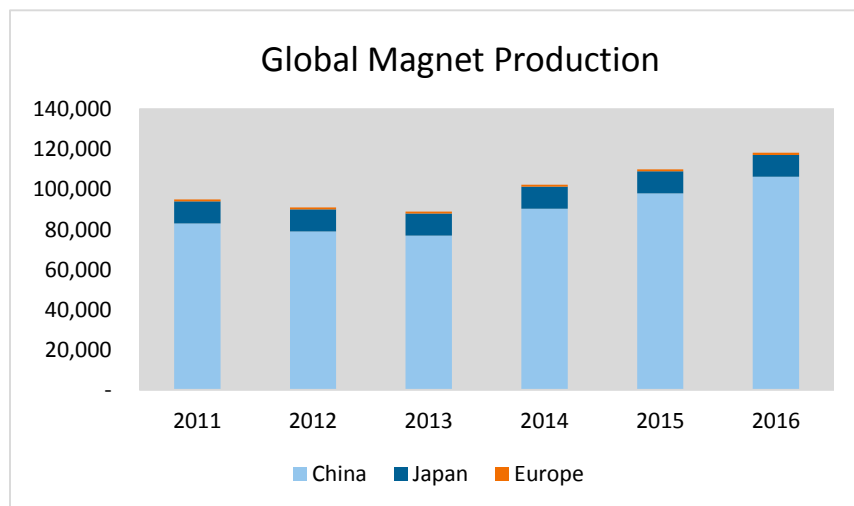
- Enforced closure of illegal and unsustainable mines and smelting
- China “big 6” consolidation creates a more sophisticated supply chain
- Improved chain of custody for NdPr supply
- China rehabilitation costs yet to be realised
- Supply initiatives have positively impacted NdPr price in 2017
- Emerging demand for NdFeB magnets may also impact demand-supply balance

Source: Independent price reporting agency

# Emerging Demand Dynamic – China 2025 Strategy

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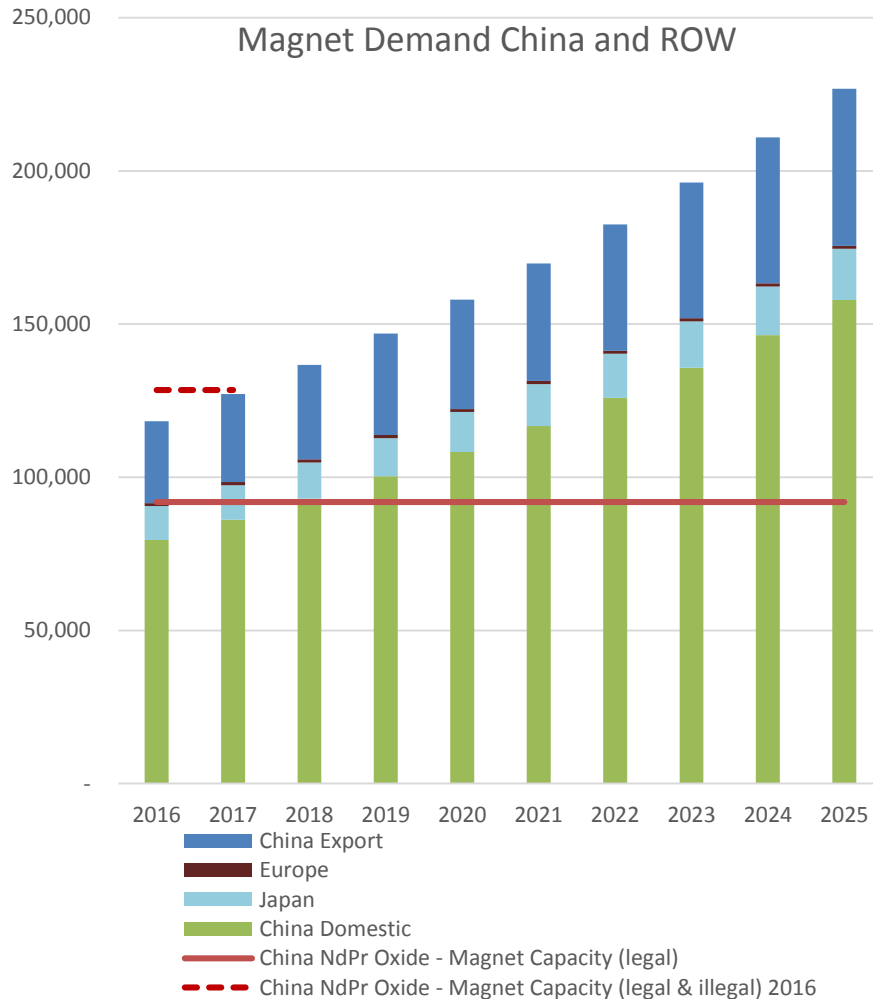
- Steady increases in global magnet production 2014 to 2016, NdPr price movement indicates **continued growth for 2017**
- **China's domestic consumption will increase** as it pursues clean energy objectives
- To maintain magnet production growth China will require **increased volumes of NdPr raw materials**, which conflicts with **currently constrained feedstock for local NdPr production**
- **By 2025 at current growth rates China will become an importer of NdPr – who will supply this?**



Source: ACREI, Argus Metals and industry sources

# Demand Growth – China a Net Importer?

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- China 2025 Strategy – integration and movement along the supply chain
- China pursuing global leadership in EV manufacture, as a priority
- Commercial activity and expansion of non-China NdPr supply
  - China RE producers are now looking to foreign assets to expand production (ASX:GGG; ASX:NTU)
  - China backed syndicate places winning bid to acquire Mountain Pass assets
  - Noble Resources acquires 14.5% of Mkango, a Malawi-focused RE development
  - Rainbow RE, Gakara project in Burundi – Thyssenkrupp mineral concentrate offtake
- Nolans has potential to provide meaningful NdPr oxide production in the **lowest cost quartile due to its high NdPr enrichment**, and advanced development status

Source: ACREI, Adamas Intelligence, corporate filings and presentations, IMCOA, rare earth end users, Roskill

# Non-China Supply Peer Comparison

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- Non-China NdPr supply will be constrained by the **sector's historical inability to attract capital**
- **Nolans is one of the world's largest and more advanced undeveloped NdPr projects which provides investors with a compelling investment opportunity in a low-risk jurisdiction**
- Nolans has the potential to provide meaningful NdPr production in the **lowest cost quartile due to its NdPr enrichment**, and advanced project development status

Asset	Nolans	Mount Weld/LAMP	Yangibana	Ngualla	Kvanefjeld
Owner	Arafura Resources	Lynas Corporation	Hastings Technology Metals	Peak Resources	Greenland Minerals and Energy
Country	Australia	Australia / Malaysia	Australia	Tanzania	Greenland
Status	Development	Production	Development	Development	Development
Contained NdPr (kt)	255	242	44	210	907
NdPr "enrichment" (%)	26.4%	23.3%	32.3%	21.2%	17.7%
Annual NdPr Production (kt)	3.6	5.2	2.8	2.8	5.3
OPEX (US\$/kg NdPr)	\$34.72	\$31.93	\$39.90	\$32.24	\$63.20
OPEX (US\$/kg NdPr) - after by-product credits	\$24.40	\$31.93	\$39.90	\$32.24	\$50.80

Source: Resource Capital Research Pty Ltd (AFSL 325340). See Appendix B for notes and assumptions used in the preparation of the Peer Comparison.

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# Project Delivery

# Pilot Scale Work Completed In 2017

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## PHASE 1

### Beneficiation



Beneficiation Pilot Plant



## PHASE 2

### Phosphate Extraction



Phosphoric Acid Regeneration Circuit



## PHASE 3

### Bulk Pre-Leach

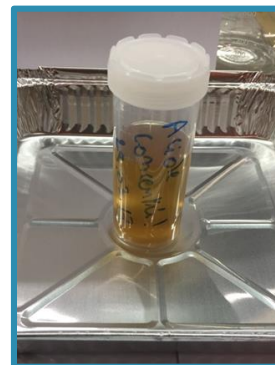
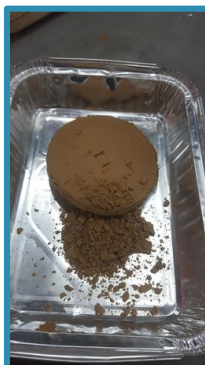


Bulk Pre-Leach Pilot Plant



TREO Grade	7.0%
TREO Recovery	>80%
NdPr Oxide Grade	1.8%
NdPr Oxide Recovery	>82%
P <sub>2</sub> O <sub>5</sub> Grade	29%
P <sub>2</sub> O <sub>5</sub> Recovery	>90%
Al <sub>2</sub> O <sub>3</sub> Grade	<3.2%
Fe <sub>2</sub> O <sub>3</sub> Grade	<1.9%
Mass Pull	55%

High-Phosphate Concentrate



Rare Earth & Phosphoric Acid Products



NdPr-Rich Pre-Leach Residue



# Remaining Piloting Activities 2017-18

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## Acid Bake Phase 4 Commenced



PLR and Acid Mixing



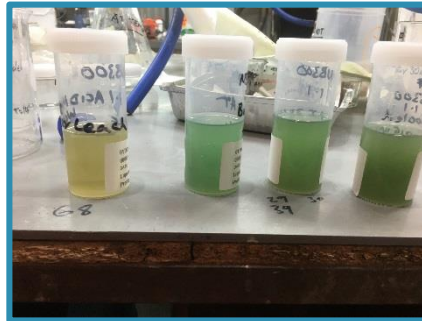
Baked Mixture Feeding



Acid Bake



Cooled Sulfated Product



Water Leach Liquor

## Phase 5,6,7 Planning

RE Purification and Precipitation pilot  
**Phase 5**

RE Dissolution and Crystallization pilot  
**Phase 6**

RE Separation pilot  
**Phase 7**

# Piloting & Final Feasibility

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## 2018 Targets

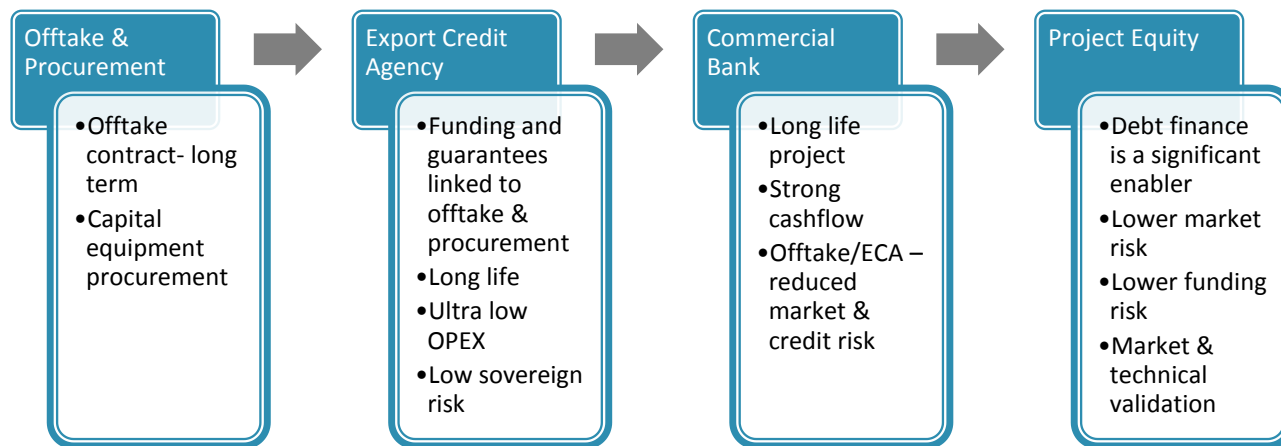
- Finalisation of piloting
- Environmental approvals – supplement lodged with NT Environment Protection Authority
- Advance offtake arrangements
- Completion of definition stage engineering and Definitive Feasibility Study
- Engage with strategic partners for capital equipment and project funding



# Nolans Funding Strategy

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- Export Credit Agencies (ECA) will be key to providing government-backed funding and guarantees, leveraged against the strategic link of NdFeB magnet production
- ECA funding linked to offtake arrangements, capital equipment supply and construction
- ECA-linked project finance will be catalyst to attract equity at corporate and/or project level



Attribute	Arafura
High-growth and high-value NdFeB permanent magnet focus	✓
NdPr production planned to coincide with projected supply gap	✓
Lowest production cost to remain competitive in a cyclical downturn	✓
Located in a jurisdiction with low geopolitical risk and with strategic support	✓
Long-life, low-risk resource with planned output that supports >30 years of production	✓
Close to vital transport, energy and water infrastructure	✓
Regulatory approvals well advanced, including all-important environmental	✓
<b>Dedicated team that has developed an efficient, high-recovery flowsheet proven from mine to market now in final piloting phase</b>	✓



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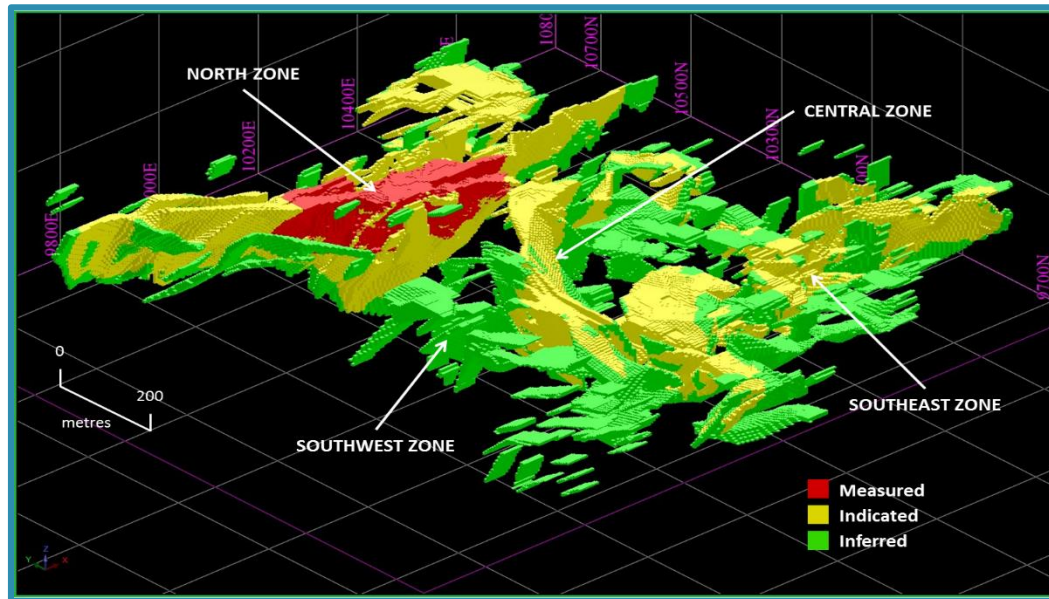
E: [arafura@arultd.com](mailto:arafura@arultd.com)

# Appendix A: Mineral Resources

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RESOURCES	TONNES M	RARE EARTHS TREO %	PHOSPHATE P <sub>2</sub> O <sub>5</sub> %	NdPr ENRICHMENT %
Measured	4.9	3.2	13	26.1
Indicated	30	2.7	12	26.4
Inferred	21	2.3	10	26.5
<b>TOTAL</b>	<b>56</b>	<b>2.6</b>	<b>11</b>	<b>26.4</b>

1% TREO cut-off grade. Numbers may not compute exactly due to rounding. "NdPr enrichment" is the proportion of TREO comprising Nd<sub>2</sub>O<sub>3</sub> and Pr<sub>6</sub>O<sub>11</sub>.



# Appendix B: Peer Comparison

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Notes and assumptions used in the preparation of the Peer Comparison

- Exchange rate of AUD1 = USD 0.795.
- Forecast operating data for development projects based on published company reports and project updates. ARU operating expense includes provision for staff and administration costs.
- NdPr “enrichment” (%) is based on published company reports and project updates for rare earth element distribution for mineral resources or reserves where applicable.
- Contained NdPr (kt) is based on reserves or Measured and Indicated mineral resources where no reserves quoted.
- Contained NdPr (kt) and Annual NdPr Production (kt) is presented on a project basis. NdPr production has not been adjusted to reflect the relevant underlying project interest for PEK (75%) and HAS (91%).
- LYC Annual NdPr Production (kt) is based on total reported “ready for sale production volumes” for the year ending 30 June 2017. Operating costs are based on total operating costs, staff and administration cashflows reported for the 12 month period ending 30 June 2017. Operating cashflows have been converted at an average exchange rate of AUD1= USD 0.755 for that year.

## ASX-Listed Peer Group Companies

Code	Company Name	Project	Location	Project Interest
ARU	Arafura Resources Ltd	Nolans	NT	100%
LYC	Lynas Corporation Ltd	Mt Weld/LAMP	WA & Malaysia	100%
HAS	Hastings Technology Metals Ltd	Yangibana	WA	91%
PEK	Peak Resources Ltd	Ngualla	Tanzania	75%
GGG	Greenland Minerals and Energy Ltd	Kvanefjeld	Greenland	100%

Source: Resource Capital Research Pty Ltd (AFSL 325340)