

# DISRUPTING THE RARE EARTH SUPPLY CHAIN

March 2020

+99.9% Neodymium (Nd) oxide



**HXG**

**HEXAGON** 

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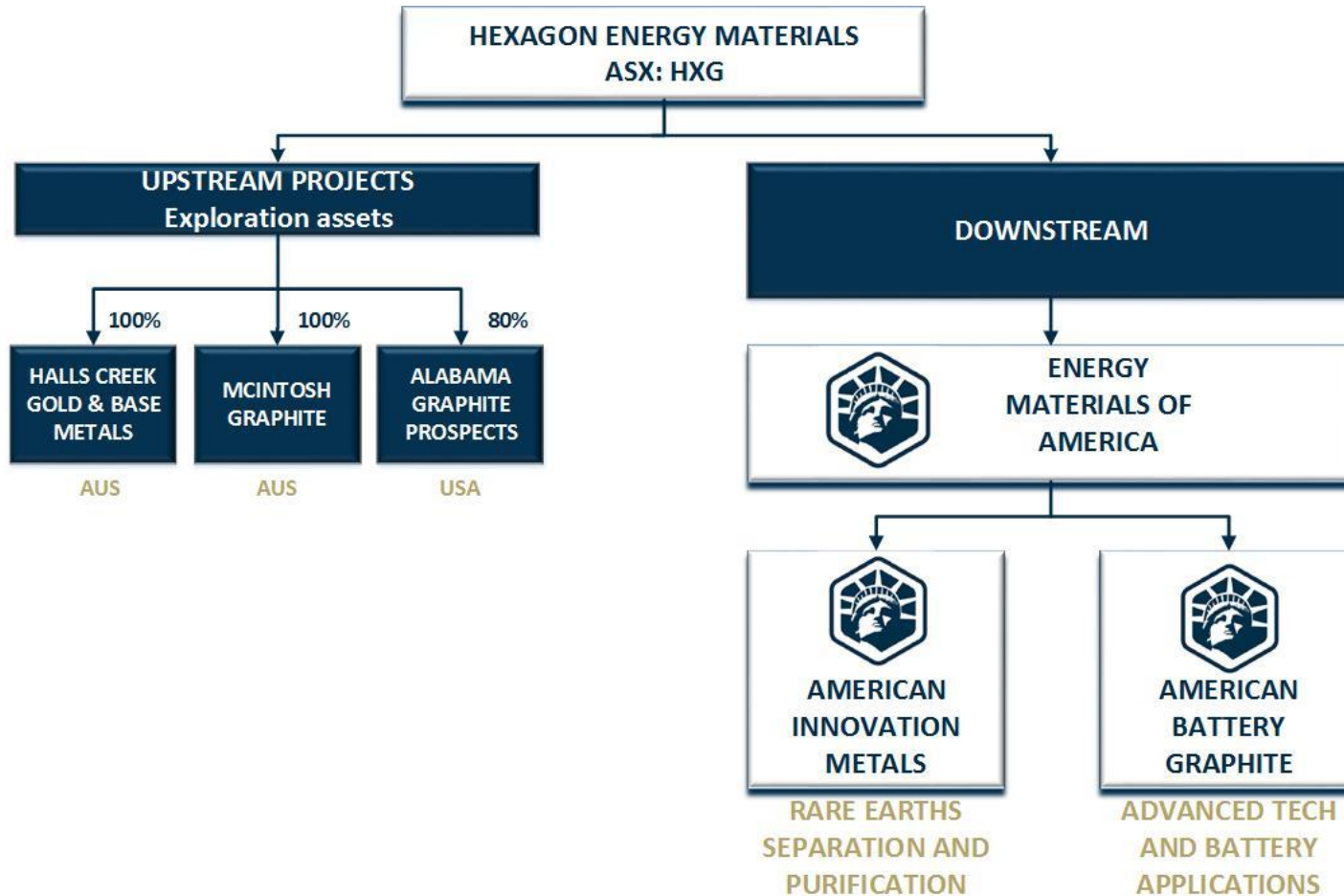
# HXG's Business Strategy

Hexagon is an energy-materials business focused on downstream processing of rare-earth elements (REEs) and graphite for advanced applications:

- Disrupting & diversifying the global REEs supply-chain
- Lower OpEx & CapEx costs & faster downstream REEs processing
- Pathway to near-term sustainable cash generation
- Leveraging high-growth E-mobility & renewable energy sectors
- North America; the right place, at the right time for 'energy materials'

**Building a business on 'energy materials' – which are essential to a renewable, sustainable, high-tech, low-carbon future**

# Corporate Overview



ASX Code	HXG
Shares on Issue	292.4M
Options & Performance Rights	25M
Share Price (27 Feb 2020)	A\$0.046
Market Capitalisation	A\$13.5M
Debt	nil
Cash/Receivables (31/12/19)	A\$2.3M

## Share Register

Tribeca Natural Resources Fund 12%  
 Top 40 shareholders hold 63%  
 Board & Management 3%



# An Experienced Team



**Mike Rosenstreich**  
Managing Director

Formerly: Founding MD base / precious metals producer, Bass Metals. Banking – Rothschild. Mining and exploration, Homestake Gold & Dominion Mining.



**Lianne Grove**  
Commercial/ CFO

Extensive experience in project development. Formerly: Commercial management and financial control in Oil & Gas projects at AWE Ltd and Sea Trucks Group and mining experience at Rio Tinto.

**Garry Plowright**  
Non-Executive Director

Extensive experience in the resource sector, having a background in mining law and administration as well as regulatory process and mine development.



**Gavin Beer**  
Strategic Advisor

A metallurgist with more than 30 years' experience in technical and operational roles and has spent the past 13 years exclusively working within the rare earth and energy materials sector.

**Charles Whitfield**  
Chairman

Formerly: Executive Director at lithium producer Galaxy Resources Ltd. Investment Banking – Citigroup & Deutsche Banks.



# Downstream REEs Demand



**Electric Vehicles**  
(2kg REPM/EV)



**Renewable Energy**  
(3,000kg REPM /  
5 MW turbine)



**Electronics**  
(1-2g / device – currently 3  
billion devices)



**Catalysts**  
(Mainly Ce & La - linked  
to ICE fuels)



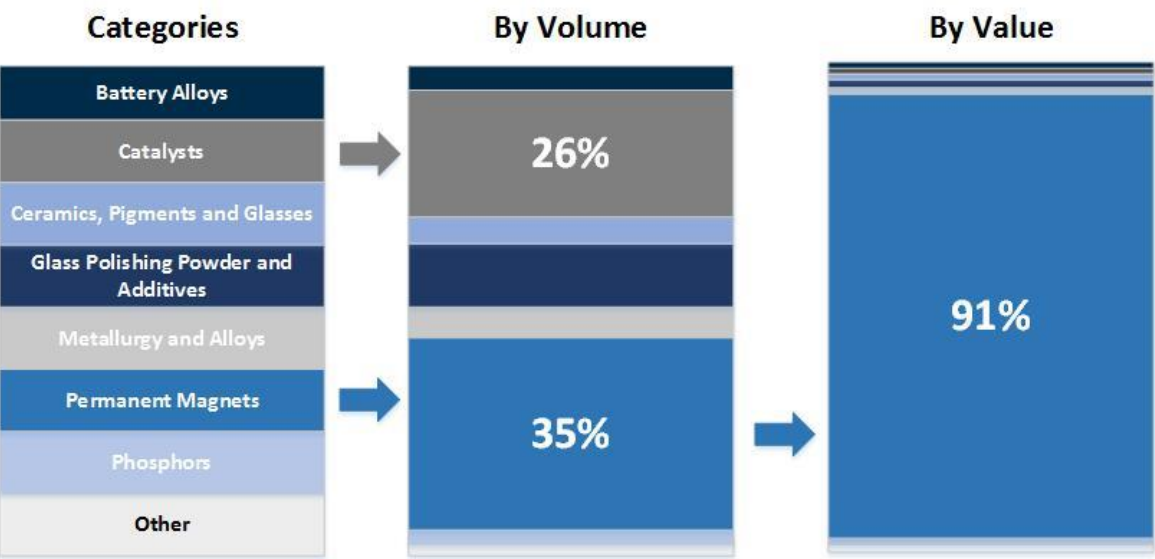
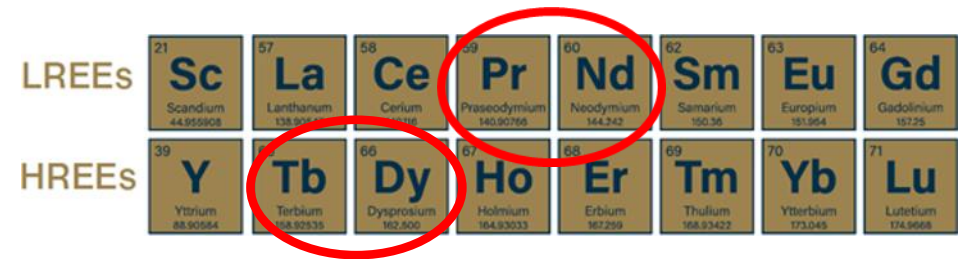
**Defence & Aerospace**  
(Topical, c.400-900kg / jet-  
fighter)

- Critical, non-substitutable inputs to high-tech, green-energy, e-mobility and defence applications
- REE Permanent Magnets (REPM) are the most significant and lucrative demand drivers for REE
- US government has prioritised REE/ REPM supply chain as a “strategic national priority”
- US Department of Defense has invited funding proposals for REE/ REPM technology projects – *demonstrates supply concerns*

# REE Value & Demand

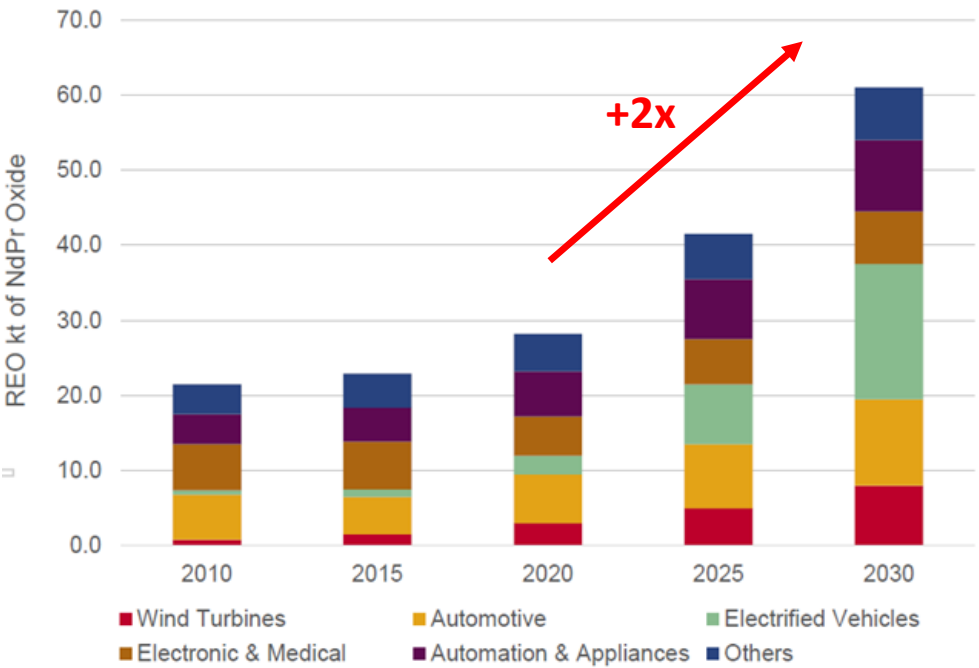
Light REE (LREE) rich deposits are more common than heavy REE (HREE) rich deposits

The ‘Magnet Metals’ (REPMs) - Pr, Nd, Tb & Dy



Source: Adamas Intelligence

## Global demand for NdPr Oxide



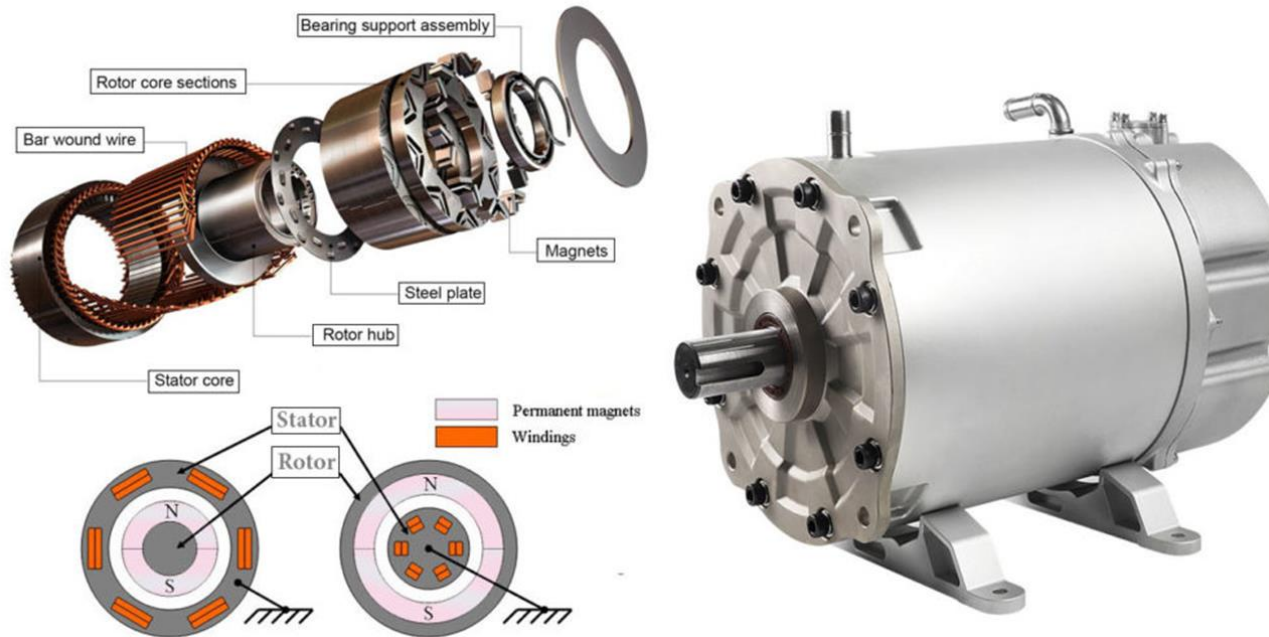
Source: Lynas

2x demand growth forecast for NdPr – the most common LREE magnet metals, for next 10 years



# Rare Earth Permanent Magnets (REPMs)

## Permanent Magnet Synchronous Motor (PMSM)



## PMSMs are:

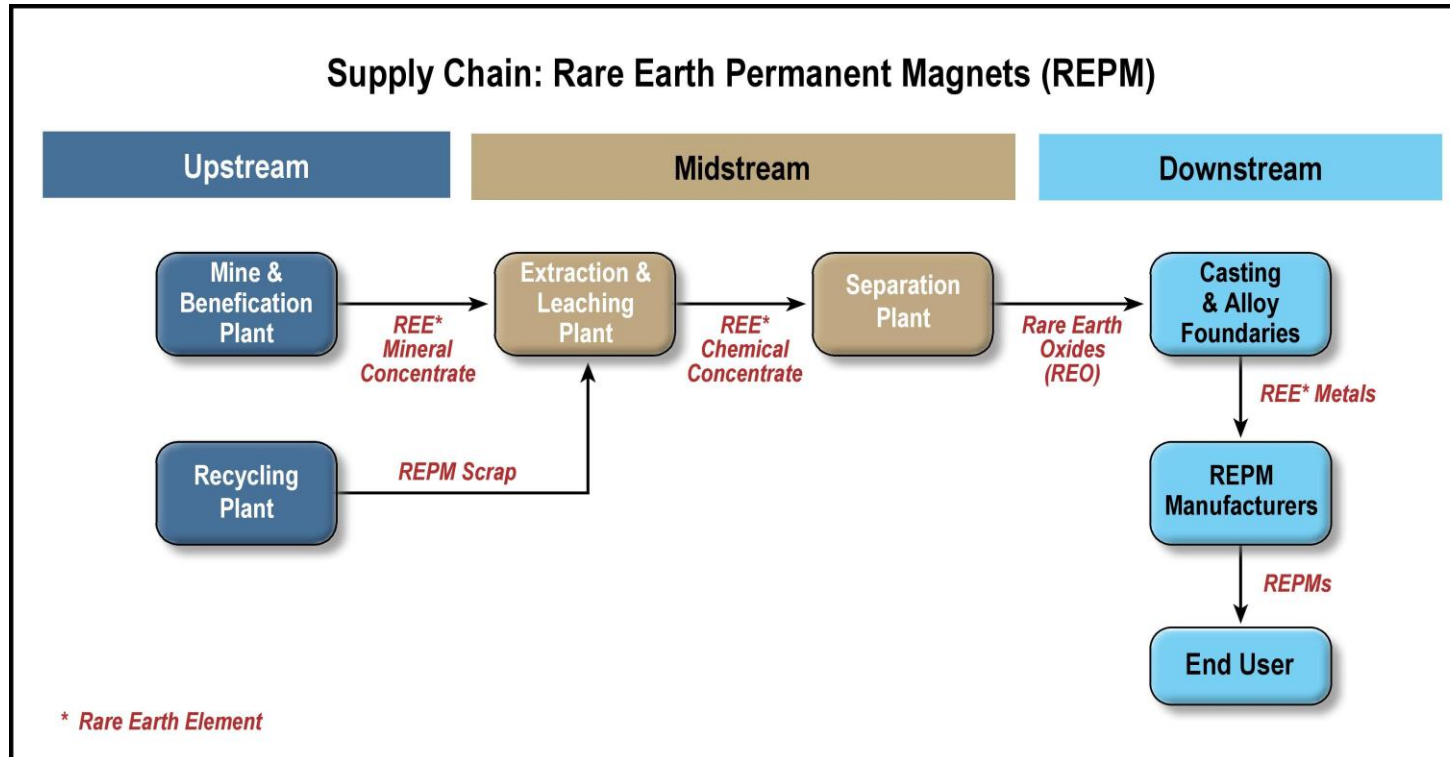
- The only electric motor with REPMs
- Used in +90% of all EVs made to date and increasing
- Up to 15% more efficient than induction electric motors, therefore they either:
  - ✓ **EVs** - Provide more power and range; or
  - ✓ **Turbines** - Generate more electricity





# REE Supply Chain – for REPMs

## Simplified REPM Supply Chain



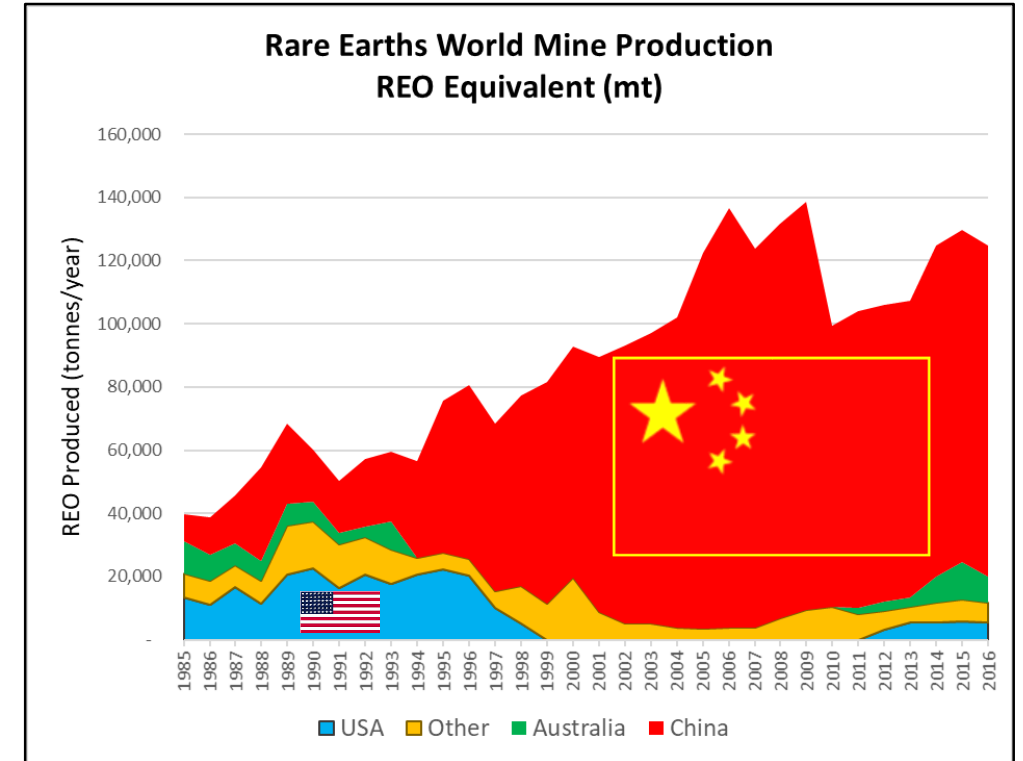
## Complex Processing

- REEs are hard to separate – requires complex and expensive processing
- 100% of all REE separation is by conventional counter-current solvent extraction (SX)
- Separated products are converted into high-purity, high-value REE oxides (REOs)

**Q. So what is the problem?**

# A. China dominates the global REE market

- 70% of global REEs production
- 85% of global REOs production
- 95% of global REPM production
- Established, capital-intensive 'conventional' SX REE separation plants
- China has 'form' in REE price & supply manipulation
- Makes China difficult to compete with



Data compiled by HXG – sourced from USGS & BAIINFO

## Q. How can we diversify the REE supply chain?



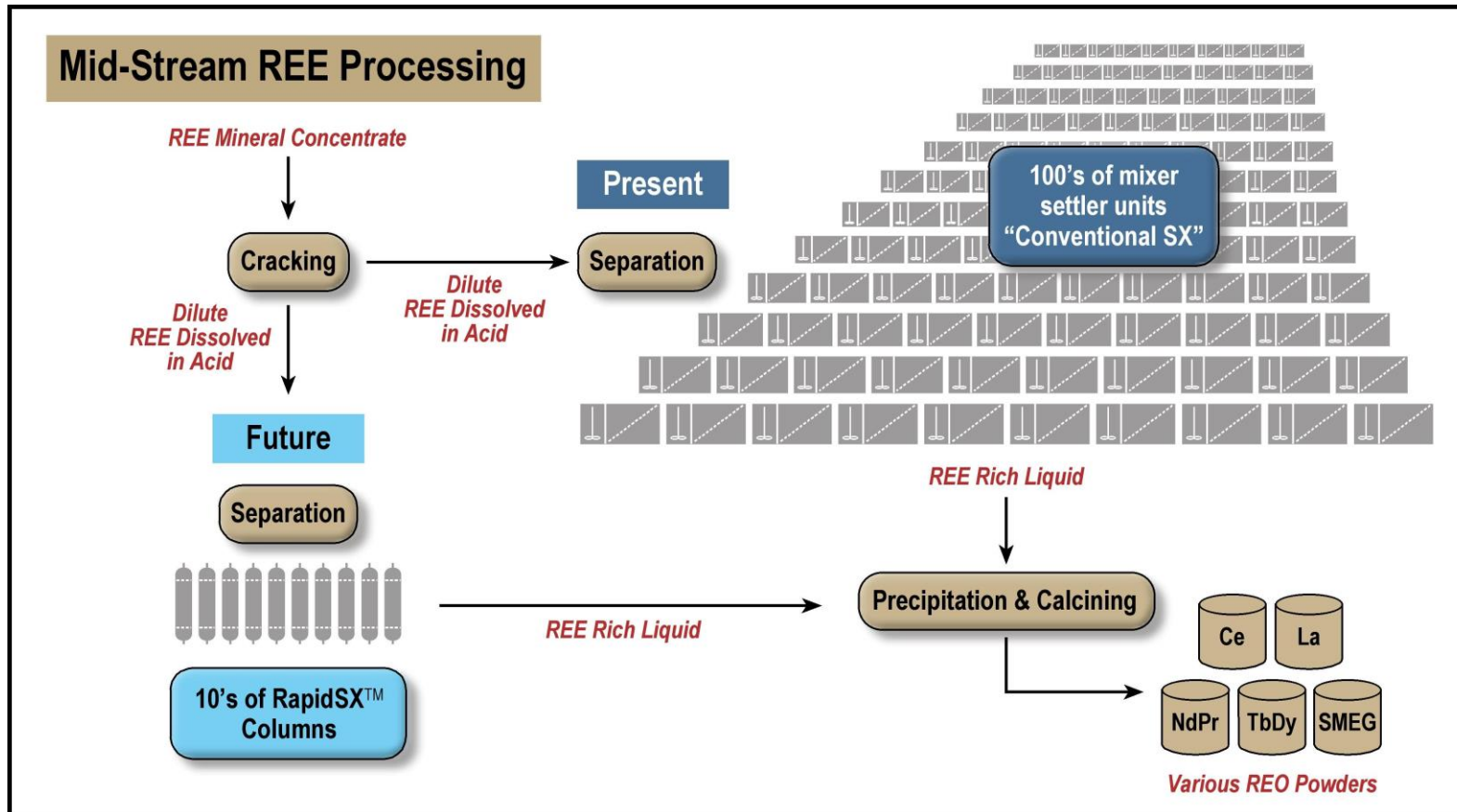


# A. RapidSX™

The RapidSX™ REE separation Pilot Plant in Mississauga,  
Ontario, Canada



# Q. What choices do producers have?



## Option 1 – “take a big hit”

Sells concentrates to China and loses c. 30-50% of the REE basket price value

## Option 2 – “millions more debt/equity \$”

Spends 100's of millions of dollars on a conventional separation plant

**OR**

## Option 3 – “no-brainer – RapidSX”

- Lower capital – less staging
- Lower OpEx
- Enhanced performance
- Cost competitive with China

***RapidSX™ – a disruptive force in REE, enabling producers to capture greater value***

# **RapidSX™ - Proven Process**

- **Innovation Metals Corporation (IMC) successfully developed and piloted the RapidSX™ process for REE separation**
- **Same ‘science’ and chemistry as conventional SX – but with modified media and liquid interaction to significantly accelerate the process**
- **Pilot testing facilitated by US\$1.8M funding from the US Department of Defense on LREE and HREE feedstocks**
- **Successful piloting of RapidSX™ on REE separation demonstrated fast and cost-effective production of REOs**



# AIM

# American Innovation Metals (AIM)

**AIM** is a jointly owned entity to commercialise the RapidSX™ technology



## Hexagon will acquire a 49% interest in RapidSX™ for REE separation through AIM

- Investment is US\$6.0M, comprising:
  - ✓ US\$2.0M to build a Commercial Demonstration Plant (CDP) within 12 months
  - ✓ US\$4.0M deferred payments, payable through Hexagon's share of future AIM cash flows
- Hexagon will contribute commercial and marketing skills, identify/secure feedstocks, generate RapidSX™ licencing opportunities, and sales/offtakes for REOs produced



# RapidSX™ vs Conventional SX

RapidSX™		Conventional Solvent Extraction
<b>Performance &amp; Efficiency</b>		
Commercial Purity	Yes	Yes
REE Recovery Rates	High	High
Processing Time	Rapid	Slow
Time to Equilibrium	Hours/Days	Several Weeks
<b>CAPEX</b>		
Equipment Cost	60-70% Saving	High
Separation Staging	90% Reduction	Very High
<b>OPEX</b>		
Metal Inventory/WIP	Low	High
Organic Volumes	Low	High
Labour	Low	High
Power Consumption	Low	High

## Increased Separation Kinetics

Reduced metal residence time

## Low CAPEX

Considerably reduced footprint

## Low OPEX

Significantly reduced separation times

<\$2/kg for LREOs and <\$12/kg for HREOs\*

## Commercially Available

All construction materials, equipment and chemistry are readily available with no 'black-box' technology

## Scalable & Modular

Process lines are modular and scalable

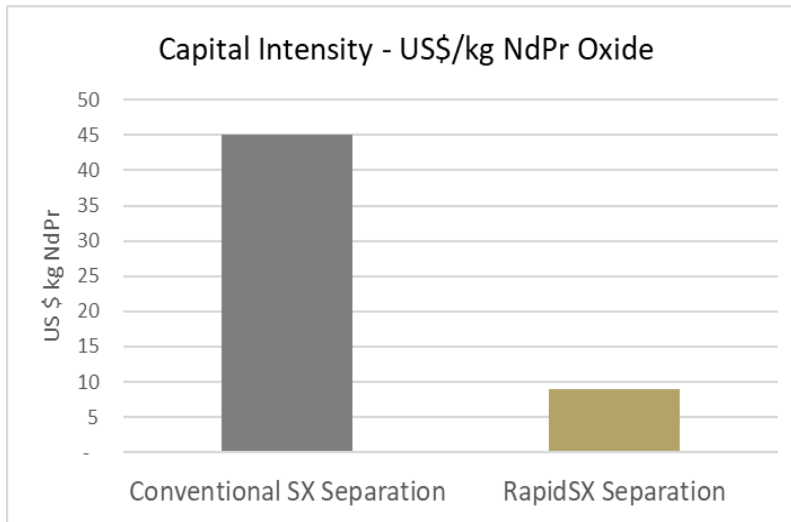
\* From Pilot Testwork



# RapidSX vs Conventional SX

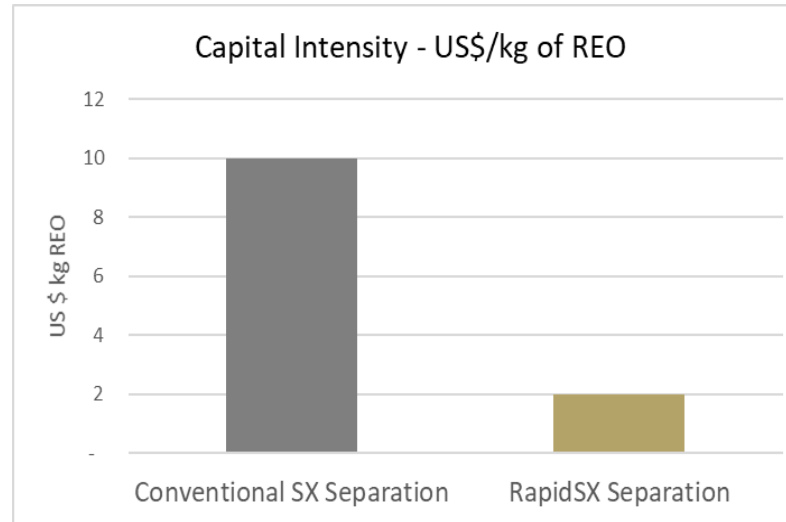
For a “typical\*” LREE feedstock type:

Capital Intensity – US\$/kg NdPr



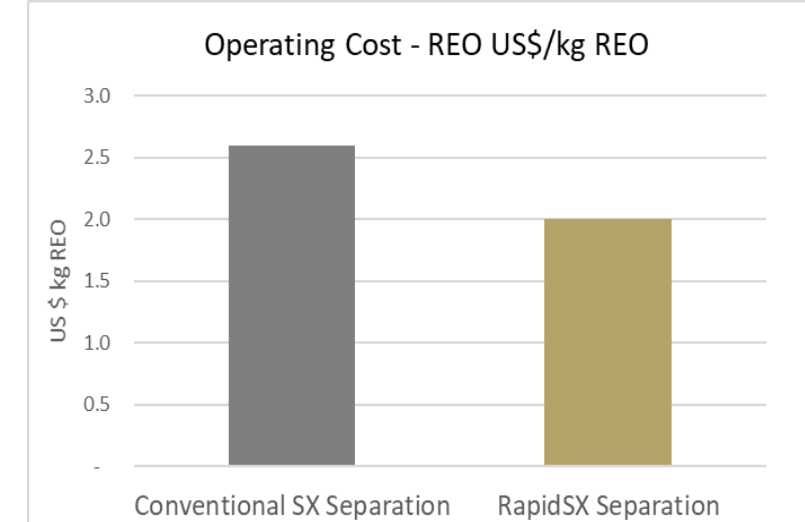
**+60-70%  
CapEx Saving**

Capital Intensity – US\$/kg REO



**+60-80%  
CapEx Saving**

Operating Costs – US\$/kg REO



**+15-20%  
OpEx Saving**

**CapEx - 10's of millions \$ saved per project**

*Potentially greater savings for HREE deposits which require more processing*

**OpEx – millions \$ saved  
per project/year**

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# Key Milestone

## 9 Feb 2020 1<sup>st</sup> Technical Services Agreement

### REE Industry Endorsement from



- Ucore is a 15 year REE industry stalwart
- Has evaluated a range of REE separation processes
- Has US\$145 million in designated financing from the Alaska Industrial Development and Export Authority (AIDEA) for its advanced US, Bokan-Dotson Ridge REE Project
- Plans a downstream Strategic Metals Complex for REE separation

### Implications - *Potential fast-track development time line*

- Ucore is “...also assessing other, nearer-term commercially available, U.S. allied-sourced, mixed REE concentrate sources for potential utilisation at its planned Alaska Strategic Metals Complex in the United States.”
- 23 Dec 2019 – “...Ucore partnered with Materion Corporation of Ohio (NYSE: MTRN) to respond to an open U.S. Government solicitation for a strategic assessment of the domestic heavy rare earth element market...”





# AIM Business Strategy

## RapidSX™ commercialisation pathway:

- **The value to Customers**

- ✓ Greater REE value capture: 30-50% of basket price by selling refined REOs not mineral concentrates
- ✓ Enables on-site separation – lower CapEx and OpEx as well as operational control

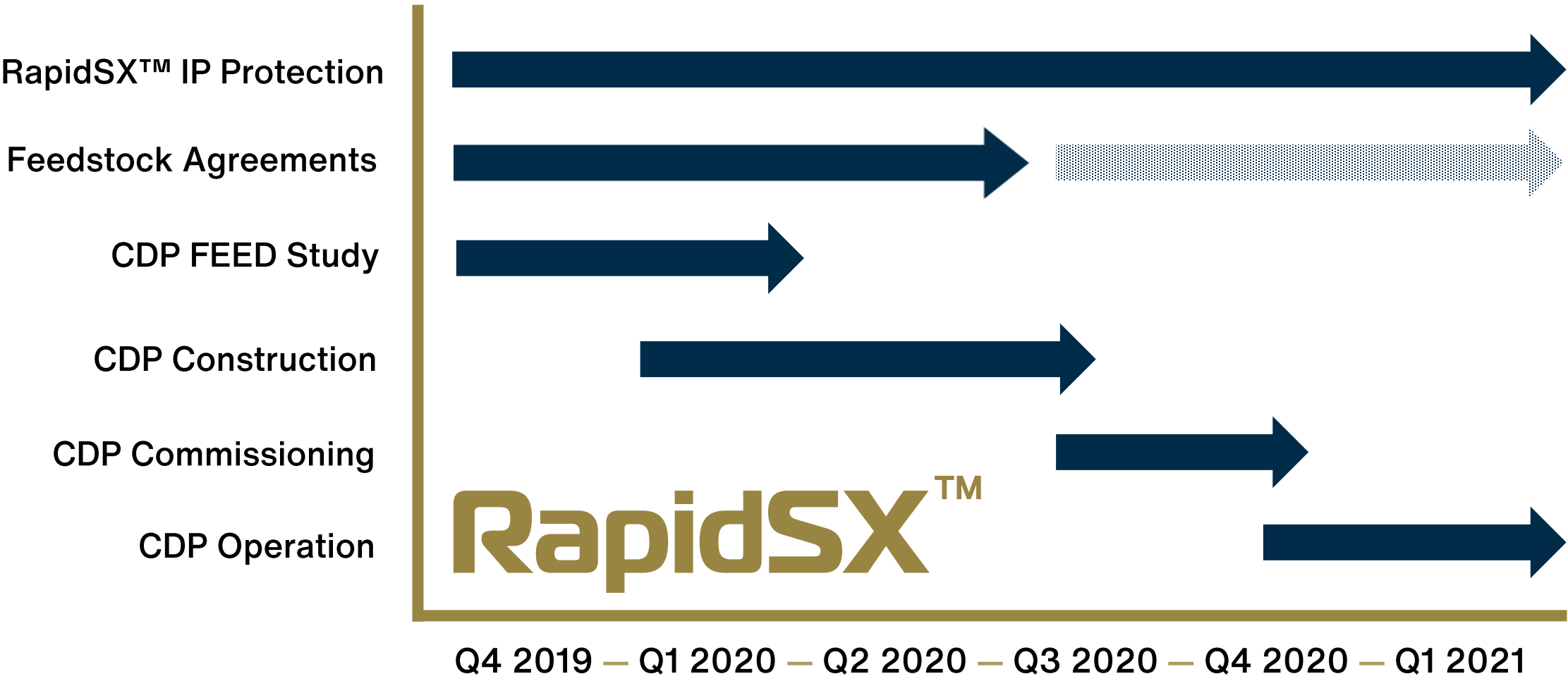
- **New Customers – access to CDP is a major de-risking step**

- ✓ CDP operational in Mississauga, Ontario by Q4 2020, Planned capacity of 6,000–8,500 kg/month of separated REOs
- ✓ Will provide clients operating data and samples for customer testing, at clients' cost
- ✓ After start-up CapEx – the CDP will be largely self funding

- **Revenue**

- ✓ RapidSX™ Technology Licencing Fees – based on leverage to CapEx and OpEx savings
- ✓ Fees – combination of 'front-end' and ongoing Sales – linked payments
- ✓ Opportunity to build and operate separation plant to produce REOs for sale

# RapidSX™ CDP Timeline



# REE – Next Steps

- **Execute Technical Services Agreements with new customers**
- **Lodge patent applications**
- **Establish AIM JV entity**
- **Appoint FEED Study Engineers for Commercial Demonstration Plant**
- **Finalise funding HXG or ‘SubCoy’ level**



# Contact

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# Next-Generation Energy Materials Start Here

*Neodymium (Nd) metal*

[www.hxgenenergymaterials.com](http://www.hxgenenergymaterials.com)