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# **HXG's Business Strategy**

Hexagon is building a highly profitable energy-materials business employing a fast-track to cash flow strategy, initially focused on graphite and rare-earth elements

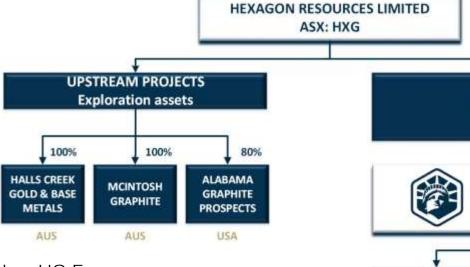
- Supply-chain positioning identifying the 'pinch-points' and supply concentration risks
- Short-term cash generation is a core focus
- Targeting, deep, high-growth, high-margin market sectors; EVs, renewable energy generation and storage
- North America; the right place, at the right time for 'energy materials'

**Building a business around 'energy-materials'** - essential components of a renewable, mobile, high-**tech, electrified......** *better world* 



# Hexagon Overview





## **Evolving US Focus**

- HXG's key technical partnerships since late 2017 are in the US
- Attractive supply chain and funding opportunities in large scale market
- Creates platform to enhance and develop Australian, Asian and European interests



ASX Code	HXG
Shares on Issue	291.8M
Options & Performance Rights	25.7M
Share Price (25 Nov 2019)	A\$0.07
Market Capitalisation	A\$21M
Debt	nil
Cash (30 Sept 2019)	A\$3.1M

## **Strong Share Register**

25% Institutional holders (with Tribeca Natural Resources Fund holding 12%), Management 9%

#### Planned US listing

Planned listing on the OTC Markets' OTCQB® Venture Market



## Common Downstream Demand Drivers



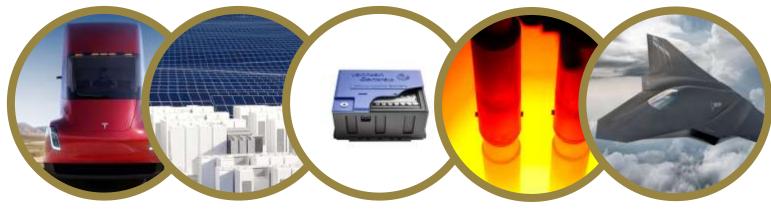
Defence & Aerospace

Renewable Energy

Electronics Fluid-Cracking Electric Catalysts Transportation

Rare Earth Elements (REE) & Graphite - Clear overlap

- REEs are critical, non-substitutable inputs required in countless hightech, green-energy, transportation and defence applications
- REE permanent magnets are the most significant and lucrative demand driver for the RFF



**Flectric** Transportation

Stationary Storage

Primary Batteries

Industrial & Energy

Defence & Aerospace

Natural graphite based materials are essential inputs for the high-growth energy storage sector



# Supply Chain Issues

China controls:

- 85% of global REE production
- 100% of global graphite battery anode production

This is a non-sustainable, concentrated market structure threatening critical supply chains

A rare-earth processing plant pollutes the air and produces hazardous waste in Baotou, Inner Mongolia, China Illegal and undocumented REE mining and production in China is a serious, ongoing issue



Opportunities for HXG

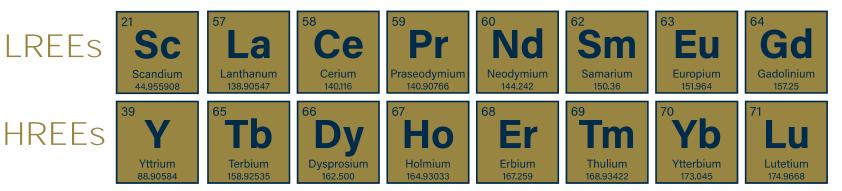
Rare Earths



Praseodymium (Pr) metal

## Rare-Earth Elements

- REEs comprise a relatively abundant group of 17 elements, including the 15 lanthanide elements on the periodic table, plus two other related elements, scandium and yttrium
- The unique magnetic, electric, optical, and chemical properties of REEs have made them an integral part of modern life
- REEs are divided into light REEs (LREEs) and heavy REEs (HREEs), with HREEs being more valuable, but LREEs being used in greater quantities
- Nd, Pr, Tb and Dy are the key ingredients of permanent rare-earth magnets vital for electric motors and generators



REO Indicative Pricing\*  $Nd_2O_3$  \$42/kg  $Pr_6O_{11}$  \$51/kg  $Tb_4O_7$  \$492/kg  $Dy_2O_3$  \$221/kg

\* Indicative prices in US\$, source: BAI INFO November 2019



## REE Downstream Constraints

There is <u>no</u> shortage of REE upstream projects outside of China, with ~800 known deposits world-wide

REE Separation

REE separation is the supply-chain constraint.

China which controls 85% of REO supply - creating a supply-chain vulnerability

REE Metal & **Alloy Making** 

REE Magnets & Components

REE separation capacity is needed to support and grow the REE downstream

## Huge opportunity for HXG

- Current REO production ~160k tpa
- Growth forecasts of 2-3x increase by 2025
- Investing in critical supply chain 'pinchpoint', REE separation
- HXG revenue targets linked to CapEx and OpEx savings of an enhanced REE separation process offered to customers



## REE Constraint is in the Downstream

REE separation to produce REOs - is the key technical challenge

- Solvent extraction (SX) is the dominant, industry-standard commercial processing method for 95% of REE separation
- China dominates downstream REE separation, producing ~85% of global REO output
- Highly capital-intensive due to technical challenges of REE separation and the hundreds of mixer-settler stages required for conventional SX







# RapidSX™ Rare-Earth Separation

# RapidSX







## Innovation Metals Corp (IMC)

- Private Canadian company, founded to develop cost-effective separation processes for critical minerals (REEs, Lithium, Cobalt, Nickel)
- World-renowned technical research and development expertise; partners and clients include public/private companies and government agencies

## **RapidSX™** - proven technology

- IMC successfully developed and piloted the RapidSX™ approach a
  proven, enhanced SX technology offering major REE separation
  efficiencies, with significantly reduced CAPEX & OPEX
- The RapidSX<sup>™</sup> technology was piloted with US\$1.8M funding from the US DoD, via the US Army Research Laboratory
- Successful piloting of RapidSX™ REE separation for demonstrated highly efficient and cost-effective production of REOs
- RapidSX<sup>™</sup> Pilot Plant demonstrated a production capacity of 1 2 tonnes of REOs per month (depending on the REE feed)



# RapidSX™ vs Conventional SX

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

## **Increased Separation Kinetics**

Faster metals separation

#### Low CAPEX

Considerably reduced footprint

#### Low OPEX

Significantly reduced separation times

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

## Agnostic on feedstock type

Robust process capable of taking LREE-rich, HREE-rich and even blends of mixed REE feedstocks

## Commercially Available

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

### Scalable & Modular

Process lines are modular and scalable



<sup>\*</sup> From Pilot Testwork

# American Innovation Metals (AIM)

# HEXAGON)

100%



49%



INNOVATION METALS

AlM will be a jointly owned entity to commercialise the RapidSX™ downstream REE separation technology

Hexagon has a binding Investment Agreement to acquire 49% of the RapidSX<sup>™</sup> technology for REE separation through AIM

- Investment is US\$6.0M, comprising:
  - ✓ US\$2.0M to build out 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<sup>™</sup> licencing opportunities, and sales/offtakes for REOs produced
- Transaction received overwhelming Hexagon shareholder support at AGM (22 Nov. 2019)



# AIM - Critical Supply Chain Position

REE Mining/ Concentration

#### ↑ UPSTREAM

- REE Ores
- REE Mineral Concentrates
- Mixed REE Chemical Concentrates





REE Separation

#### **↓** DOWNSTREAM

- Separated REE Oxides (REOs)
- Separated REE Chemical Compounds





REE Metal & Alloy Making

### **↓** DOWNSTREAM

- REE Metals
- REE Alloys



REE Magnets & Components

## **↓** DOWNSTREAM

- REE Permanent Magnets
- REE Components/Applications



# RapidSX™ CDP Timeline

RapidSX<sup>™</sup> IP Protection

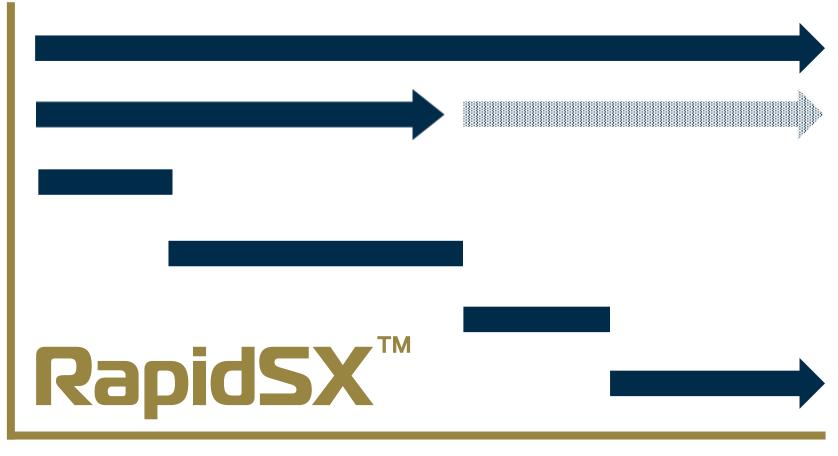
Feedstock Agreements

**CDP** Detailed Engineering

**CDP Construction** 

**CDP Commissioning** 

**CDP Operation** 



Q4 2019 - Q1 2020 - Q2 2020 - Q3 2020 - Q4 2020 - Q1 2021



## AIM - Business Plan

## RapidSX<sup>™</sup> commercial opportunity:

- CapEx Savings 70 to 90%
- OpEx advantages in lowest quartile of separation costs across a range of feedstock types
  - ✓ LREE separation <\$2/kg\*
  - ✓ HREE separation <\$12/kg\*
    </p>
- Enhanced REE recovery and REO purity

## **RapidSX™** commercialisation steps:

- CDP
  - ✓ planned capacity of 6,000–8,500 kg/mo REO (70–90 tpa)
  - ✓ Will provide clients operating data and samples for customer testing, at clients cost
- Conservative assumption of generating fees from executing RapidSX<sup>™</sup> Technology Licencing Agreements
- Opportunity for AIM to build and operate its own plant to produce REOs for clients or sale





Revenue to AIM – through sharing the CapEx and OpEx savings with clients





# US Defense Production Act, Title III

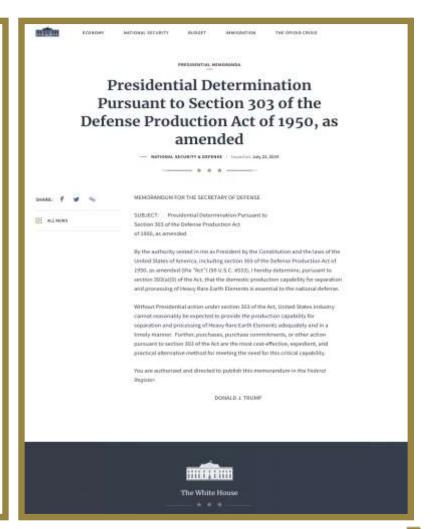
The five Presidential
Determinations
proclaimed domestic REE
processing capabilities
are essential to national
defence and addressed:

- HREE Separation \*
- LREE Separation \*
- REE Metals & Alloys
- NdFeB Magnets
- SmCo Magnets

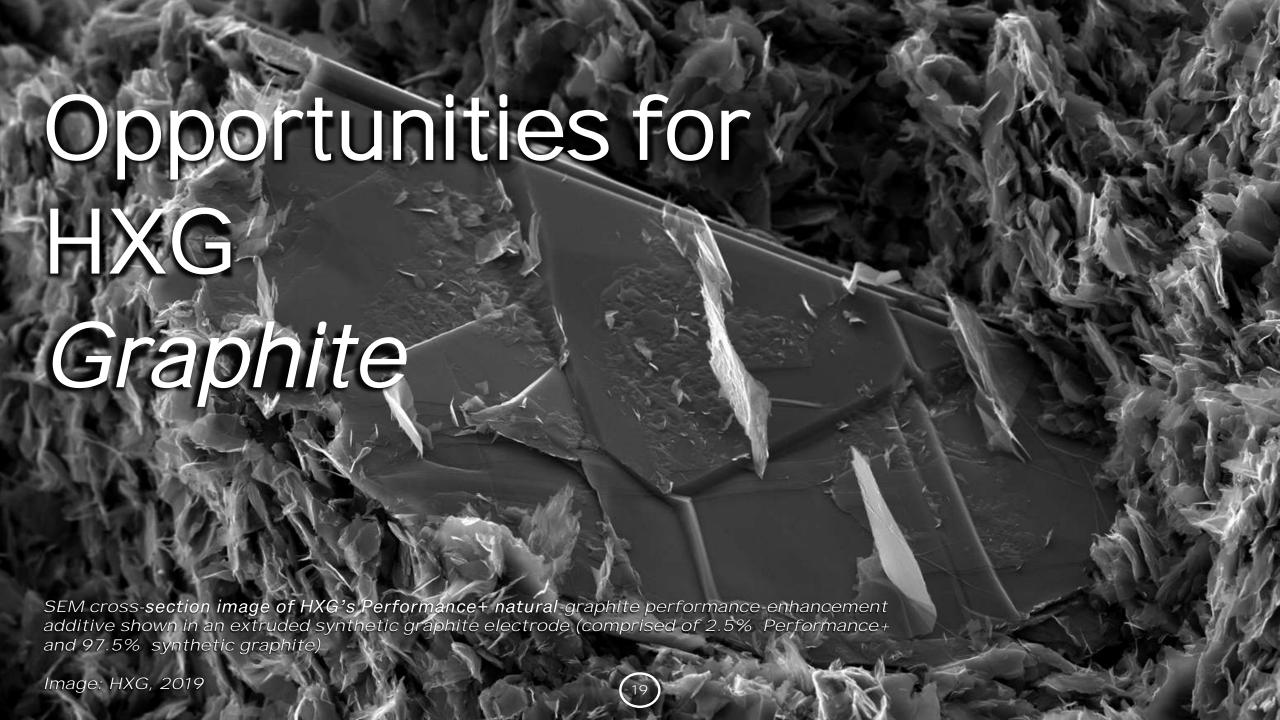
\* The RapidSX™ technology is a proven, low-cost solution to both HREE & LREE separation

## **Presidential Documents** Presidential Determination No. 2019-18 of July 22, 2019 Presidential Determination Pursuant to Section 303 of the Defense Production Act of 1950, as Amended Memorandum for the Secretary of Defense By the authority vested in me as President by the Constitution and the laws of the United States of America, including section 303 of the Defense Production Act of 1950, as amended (the "Act") (50 U.S.C. 4533), I hereby determine, pursuant to section 303(a)(5) of the Act, that the domestic production capability for Rare Earth Metals and Alloys is essential to the national defense. Without Presidential action under section 303 of the Act, United States industry cannot reasonably be expected to provide the production capability for Rare Earth Metals and Alloys adequately and in a timely manner. Further, purchases, purchase commitments, or other action pursuant to section 303 of the Act are the most cost-effective, expedient, and practical alternative method for meeting the need for this critical capability. You are authorized and directed to publish this memorandum in the Federal

Register.







# HXG's Downstream Graphite Transformation Technical Accomplishments

HXG's value is in its demonstrated ability to transform graphite into specialty downstream products

SEM cross-section image of one of HXG's extruded synthetic graphite electrodes produced for testing the Company's natural-graphite antioxidant conductivity-enhancement additive



# Battery-Grade Purification

Produced ≥99.99% C purified natural-flake graphite concentrate via thermal purification

Purified natural-flake graphite concentrate to ≥99.99% C

All specialty battery-graphite applications (anode and cathode) require a finished graphite product with a net purity of ≥99.95% C

Applications: serves as the precursor for all high-value downstream graphite products

SEM image of HXG's 99.9999% C purified natural-flake graphite concentrate



# Li-ion Coated Anode Graphite

Manufactured Li-ion battery anode graphite materials

- Purified natural-flake graphite concentrate to ≥99.99% C
- Milled (sized)
- Spheroidised (shaped; high yield)
- Surface-treated (coated)
- Produced  $D_{50}$  sizes ranging from 7 to 25 microns
- Tested performance in Li-ion cells

Application: Li-ion batteries

SEM image of HXG's coated anode graphite for Li-ion batteries



# Conductivity-Enhancement Graphite

Manufactured battery cathode conductivity-enhancement graphite (CEG) materials

- Purified natural-flake graphite concentrate to ≥99.99% C
- Milled (sized)
- Produced expandable graphite (graphite intercalation)
- Produced expanded graphite (thermal shock)
- Milled expanded graphite into high-performance CEG
- Tested performance of both standard and premium CEG products

Applications: all major commercial battery-cathodes chemistries (Li-ion, primary lithium, alkaline, and lead-acid batteries)

SEM image of HXG's cathode conductivity-enhancement graphite



# Antioxidant Conductivity Enhancement Additive

Manufactured natural-flake graphite antioxidant conductivityenhancement additive - 'Performance+' for synthetic graphite electrodes

- High-performance purified natural-flake graphite antioxidant additive to increase electrical and thermal performance, while extending life in synthetic graphite electrodes
- Tested performance in graphite electrodes

Application: graphite electrodes for electric-arc furnace (EAF) steel making

SEM cross-**section image of HXG's Performance+ natural**-graphite performance-enhancement additive shown in an extruded synthetic graphite electrode (comprised of 2.5% Performance+ and 97.5% synthetic graphite)

The fine, ultra-thin sheets are synthetic graphite particles. The significantly larger flake (centre) is HXG's Performance+ natural-flake graphite additive



# Downstream Scoping Study outcomes

Study findings underscore potential high margins and identify the challenges

Financial Highlights		
	Geraldton (Australia)	Chelan County (USA)
Pre-tax NPV (10% discount)	A\$0.88 to A\$1.20 Billion	A\$0.92 to A\$1.24 Billion
Post-tax NPV (10% discount)	A\$594 to A\$804 Million	A\$708 to A\$958 Million
Pre-tax Internal Rate of Return	40% to 61%	40% to 58%
Post-tax Internal Rate Return	32% to 48%	35% to 49%
Operating Margin (EBITDA)	51%	54%
Payback period from FID (post-tax)	4 years	4 years
Payback period from full commercial production (post-tax)	2 years	2 years
Operating Cost Product (life of project)	A\$2,618 / Tonne	A\$2,248 / Tonne
Feedstock Price	A\$2,089 / Tonne	
Weighted Ave Basket Price of Products	A\$8,487 / Tonne	
Start-Up Capital Phase 1	A\$23 Million	A\$27 Million
Start-Up Capital Phase 2	A\$118 Million	A\$135 Million
Start-Up Capital Phase 3 (fully funded from operations)	A\$139 Million	A\$153 Million

- A standalone business sourcing feedstock from third parties or possibly from McIntosh / Ceylon
- Positives Impressive investment criteria for preferred USA location:
  - ✓ High margins 54%
  - ✓ Post tax  $NPV_{10}$  A\$708 to A\$958 million
  - ✓ Post tax IRR 35 to 49%
  - ✓ Financial Model uses conservative price assumptions
- Challenges start-up capital requirements
- Solution updated downstream strategy; as follows



AMERICAN BATTERY GRAPHITE

# **So-To-Market Strategy**

# HXG Updated Downstream Strategy

## **HXG's competitive advantages**

Speed to Market & Revenues
Accelerated Qualification Timelines

Product Diversification

Addressing Multiple Markets Now

Leading Technical Expertise & Commercial Partners

Established Relationships with Industry & End Users

Comprehensive Testing Data Library



Workers assembling a Tesla Model 3 battery pack at the Tesla Gigafactory 1 in Nevada — the largest Li-ion batterycell factory in the world Photo: Las Vegas Review Journal, 2019



# HXG Updated Downstream Strategy

## HXG's 'Go-to-Market' US downstream

business strategy is based on extensive input and guidance from battery-industry leaders

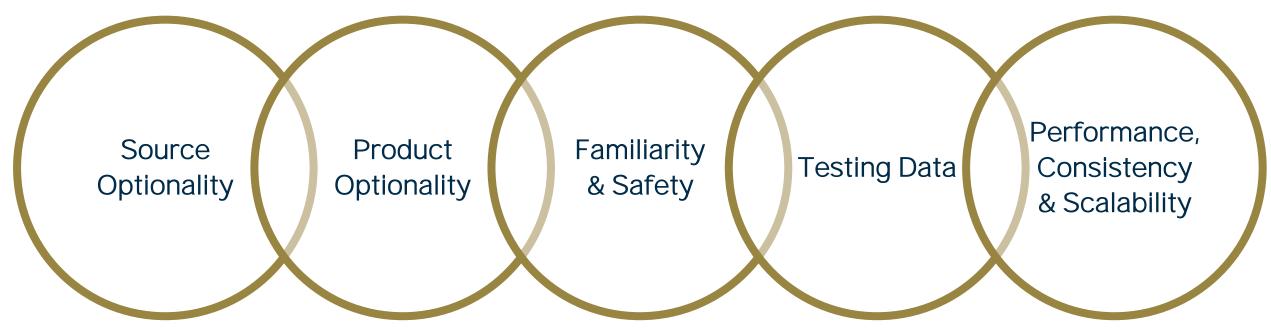
- Driven by major end users
- Not reliant on upstream development activities
- Underpinned by positive downstream scoping study (May 2019)
- HXG has gained an intimate knowledge of major potential customers' immediate and future needs (this knowledge and insight is the foundation of the Company's downstream business strategy)
- With this deep understanding, HXG can better serve the wants and needs of potential customers and, in turn, build long-term trusted business relationships



Li-on battery anode manufacturing at CATL in China. Led by its American CTO Robert Galyen, CATL has become the world's second largest Li-ion battery manufacturer in less than 10 years Photo: CATL, 2018



# Battery Customer Requirements



Customers require products derived from several different upstream commercial graphite-concentrate producers Customers require a suite of natural, synthetic and blended specialty graphite products Customers require specialty graphite products manufactured by current industry-accepted technologies

Customers require extensive materials and commercial performance testing, utilising standard industry formulations

Customers require consistent, high-performance, Made-in-USA products with capacity to scale production



# Responding to Current Market Needs

## Ready to address customers today - 2 year time line

**HXG's unique, go**-to-market strategy is based on commercially available feedstocks, transformed utilising only proven commercial technologies already approved and understood by end users to sell into markets as quickly as possible

## Ready to address customers tomorrow - 5 year time line

HXG's downstream is underpinned by ongoing commercial development with leading next-generation technologies such as low-temperature chemical and electrothermal fluidised-bed furnace purification testwork (i.e. partnering on alternative purification technologies with industry leaders) to maintain and/or increase market share if/when new transformation technologies are adopted by end users



## Made-in-USA

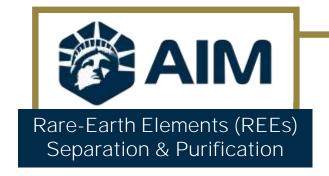
Products provide customers a potential competitive advantage (US content must be disclosed by automobile manufacturers per the US Federal Trade Commission's American Automobile Labeling Act)





Made-in-USA Premium Energy Materials









#### DOWNSTREAM RARE-FARTH ELEMENTS

- Proven RapidSX™ REE separation & purification technology
- "Best-in-class" cost and performance efficiencies
- Successfully piloted; produced commercial-grade REOs with 99.5-99.97% purities
- US\$1.8M initial development funded by US Department of Defense's Army Research Laboratory



#### DOWNSTREAM GRAPHITE

## Battery Graphite

- Comprehensive, go-to-market 'Made-in-USA' battery-graphite materials business, driven by leading ends users (natural-flake, synthetic and blended battery-graphite products)
- Suite of Tier-1 performance anode & cathode battery materials
- Utilising commercially available feedstocks, transformed via proven commercial technologies already approved/understood by end users
- Not reliant on upstream development activities

## Energy & Industrial Graphite

Diverse suite of specialised products



## **HXG** Near-term milestones

## RARE EARTHS

- 1. Exercise Option to acquire 49% of AIM
- 2. Secure agreements for REE concentrate feedstocks and licencing agreements (in progress)
- 3. Meet US Govt requests for funding proposals to gain potential funding support for US facility
- 4. Commence construction of the CDP first commercialisation step of RapidSX
- 5. CDP demonstrate self-funding aspects; through clients meeting operating costs and subject to testwork, start of licence fees receipts

## **GRAPHITE**

- 1. Assess opportunities to fast-track graphite business in North America e.g. strategic partner
- Engage short-listed technical partners for characterisation, anode coating and cell testing ongoing test outcomes (valuable IP)
- 3. Site selection and offtake agreements for the Go-to-Market plan

## CORPORATE

- 1. Research Report from Independent Investment Research early December
- 2. Increase US/European investor base; OTCQB listing/ Newswire service and local IR support





