AUSTRALIAN
RESEARCH
INDEPENDENT INVESTMENT RESEARCH

Hexagon Energy Materials Limited

(ASX: HXG)

January 2020

INDEPENDENT
INVESTMENT RESEARCH

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INDEPENDENT INVESTMENT RESEARCH

Hexagon Energy Materials Limited (ASX: HXG)

Comprehensive Update - January 2020

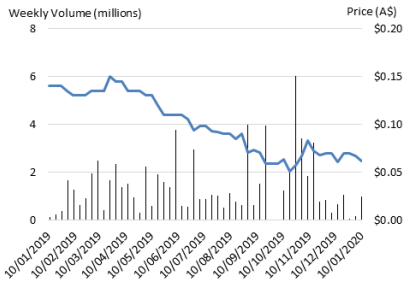
Note: This report is based on information provided by the company as at January 14, 2020

Investment Profile	
Share Price as at Jan 14, 2020	A$0.060
Issued Capital:	
Ordinary Shares	292.4 m
Listed Options	0.0 m
Unlisted Options	24.1 m
Performance Rights	0.95 m
Fully Diluted	317.5 m
Market Capitalisation	A$17.55 m
12 month L/H	A$0.045/$0.16
Cash September 30, 2019	A$3.07 m

Board and Management
Mr Charles Whitfield: Chairman
Mr Mike Rosenstreich: Managing Director
Mr Garry Plowright: Non-Executive Director
Ms Lianne Grove: Chief Commercial Officer
Mr Ty Dinwoodie: Chief Marketing Officer
Mr Gareth Hatch: Senior Technical Adviser and Co-Founder of IMC

Major Shareholders	
Tribeca Investment Group	12.70%
UBS Custody Nominees	6.66%
Mineral Resources Limited	3.60%
Board and Management	2.38%
Top 20	50.90%

Share Price Performance



The investment opinion in this report is current as at the date of publication. Investors and advisers should be aware that over time the circumstances of the issuer and/or product may change which may affect our investment opinion.

CAPTURING THE DOWNSTREAM OPPORTUNITY

Recent years have seen the development of what could be termed the "New Age in Energy", largely driven by increasing demand for batteries, high field strength magnets and related items, for use in electric vehicles, wind turbine generation and consumer electronics amongst others.

This has seen increased demand for raw materials, with graphite, lithium and rare earth elements ("REEs") being the headline grabbers over recent years. There is also the need for downstream processing of the raw materials, with this providing the best opportunity to capture value, and avoiding being a 'price taker", as raw material producers are (and has been seen with recent oversupply in lithium and graphite causing issues for the miners). What we have also seen is China take control of the downstream supply chain, and in some cases, the upstream as well, with China controlling close to 100% of the markets in some cases.

Therefore, there is the need for diversification of downstream supply in what are considered strategic industries, with, in addition to civilian use, several commodities being critical in military applications. In particular, the US is taking a pro-active approach in supporting development of alternative sources of supply, and there is also a strong drive for increasing domestic content in manufacturing with the "Made-in-USA" push.

Hexagon Energy Materials Limited ("Hexagon" or "the Company") has identified and acted upon this opportunity and is now focused on advancing REE downstream processing, looking to commercialise new technology with the potential to disrupt the Chinese domination of the global REE processing market and increasing diversity into the supply chain. Hexagon intends to fast track to cashflow and considers the downstream market segments and North America as the means to achieve this goal. The most recent advance has to become a 49% partner in a new incorporated joint venture with Canadian-based Innovation Metals Corp Inc ("IMC") through funding the construction of a commercial demonstration plant ("CDP") using IMC's proprietary RapidSX™ technology for the separation of mixed REE concentrates into various rare earth products. IMC has successfully completed pilot scale test work of RapidSX™, with the financial support of the US Department of Defense ("USDOD").

The pilot scale test work demonstrated the capability to separate REE concentrates into commercial quality rare earth oxides ("REOs") at a substantially lower operating cost, and significantly lower capital cost than current operations, whilst using proven solvent extraction ("SX") technology. Subject to the successful operation of the CDP, this presents an opportunity to commercialise the RapidSX™ process through licencing and potentially construction of a plant to treat 3rd party feedstocks.

Our view is that Hexagon represents an excellent 'ground-floor' opportunity for investors to gain exposure to REE through a lower-risk, more commercially advanced business strategy than a typical upstream REE exploration/development play. The initial commercialisation strategy, targeting licencing the technology, will require relatively limited capital (and thus result in less dilution for shareholders), and will be located in North America - a business friendly jurisdiction with deep markets.

Given the Company's focus on the REE strategy, we consider this to be the core value driver for Hexagon in the near term with strong news flow expected. However the Company also holds other important assets such as IP in regard to downstream graphite processing, upstream graphite exploration projects (including Mineral Resources) as well as the highly prospective Halls Creek gold-base metals project in Western Australia – we have included descriptions of these in our report for completeness.

KEY POINTS

Successful pilot scale work and possible short time to commercialisation: Downstream RapidSX™ work to date on REE has successfully produced commercial grade/quality products with expected relatively short times to commercialisation should the CDP be successful.

Disruptive technology: The RapidSX™ REE processing has the potential to be a major disruptive technology, delivering substantially lower operating and capital costs than the current alternative REE separation processes used in China. The process is also 'feed agnostic' in being able to treat a wide variety of REE mineral and concentrate types, and thus it should be able to add value to a wide range of projects.

Strong US push for diversified and domestic production of critical and strategic materials: Given China's control of the supply chain in a number of critical and strategic materials, there is a strong push, particularly from the Trump administration, to disrupt and diversify the supply chain for strategic energy materials, particularly given the current trade tensions between the world's two largest economies.

Pricing control in downstream processing: Downstream processing allows participants to have a significant amount of control in product pricing, unlike the upstream raw material producers that are generally price takers and at the whims of the markets.

Growth in demand: Hexagon is in an ideal position to take advantage of the forecast significant growth in demand for the battery and magnet materials over coming years.

Experienced and committed personnel: The management group is focused, well regarded and has the skills and experience required to execute the Company's strategy. Management also hold shares in Hexagon, thus aligning their interests with those of other shareholders.

Steady News Flow: Ongoing work on a number of fronts should provide steady news flow through 2020, leading to commissioning of the CDP by late Q3, 2020. We would expect value appreciation on material positive advances in the Company's projects.

SWOT ANALYSIS

Strengths

- **Demonstrated technologies and successful trials:** RapidSX™ for REE separation is based on existing science related to SX separation but applied in a new, patentable technique offering capital and operating cost savings which have been demonstrated through a US government funded pilot program and is now ready for commercialisation via the CDP.
- **Interest in a potentially disruptive technology:** Potential key advantages (as demonstrated by the pilot plant) that RapidSX™ offers over conventional SX REE separation include:
  - Up to an estimated 90% reduction in separation staging (including equipment requirements and the associated power, reagent and labour reductions),
  - Residency time in the circuit of only hours/days, instead of weeks (or months); and,
  - Expected significant capital and operating cost savings due to the above.
- **Diversified portfolio:** This applies both to the different commodities, as well as the upstream and downstream strategies. On the graphite front, having both upstream and downstream projects allowed the Company to change focus onto the downstream (and significantly add to the Company's IP) when it was clear that the upstream was becoming oversupplied. The introduction of the REE business, which will be the ongoing focus, adds commodity diversification, however it is complementary, and is targeted largely at the same markets as Hexagon's graphite materials.

  The upstream projects, as well as the downstream graphite projects do not have significant holding costs, and thus funds will be available to progress the key REE strategy, the development of which should drive value. It would seem that at the moment most value in the Company is ascribed to the graphite, and thus there is upside value as the REE work advances and gains market recognition.
- **Experienced personnel:** Hexagon has assembled a team that has the relevant experience, including within the critical and strategic metals sector.

Weaknesses

- **Cash position:** With just of A$3 million in cash as of September 30, 2019, and with US$2 million earmarked for the RapidSX™ CDP, Hexagon will need to raise funds in the relatively near term. The Company is assessing a variety of financing options and has commenced on the CDP development expenditure.
- **Currently weak graphite markets:** The declining upstream graphite markets have led to a decline in the value of all listed graphite focused companies, with Hexagon being no exception. However, this provides upside when markets improve and when the REE strategy consolidates.

Opportunities

- **Entry into growing markets:** Although the "Energy Materials" markets can be seen as being currently immature, they are forecast to mature and grow significantly over coming years, with more certainty coming into the supply/demand metrics. The focus on North America ensures a large and receptive market for its planned REE products and Hexagon is ideally positioned to take "first mover" advantage as market confidence strengthens, and the need for supply diversification becomes more evident.
- **Versatility of RapidSX™:** The pilot work demonstrated that RapidSX™ can handle a wide range of REE mineral and chemical concentrate types – which means it can add-value to a wide range of projects.
- **Hall's Creek spin-out:** Our view is that could be, should IPO markets improve, the opportunity to spin-out the Hall's Creek tenement package. This will allow, through a shareholding in the new company, for Hexagon to share directly in any upside, and also provide returns to shareholders.

Threats/Risks

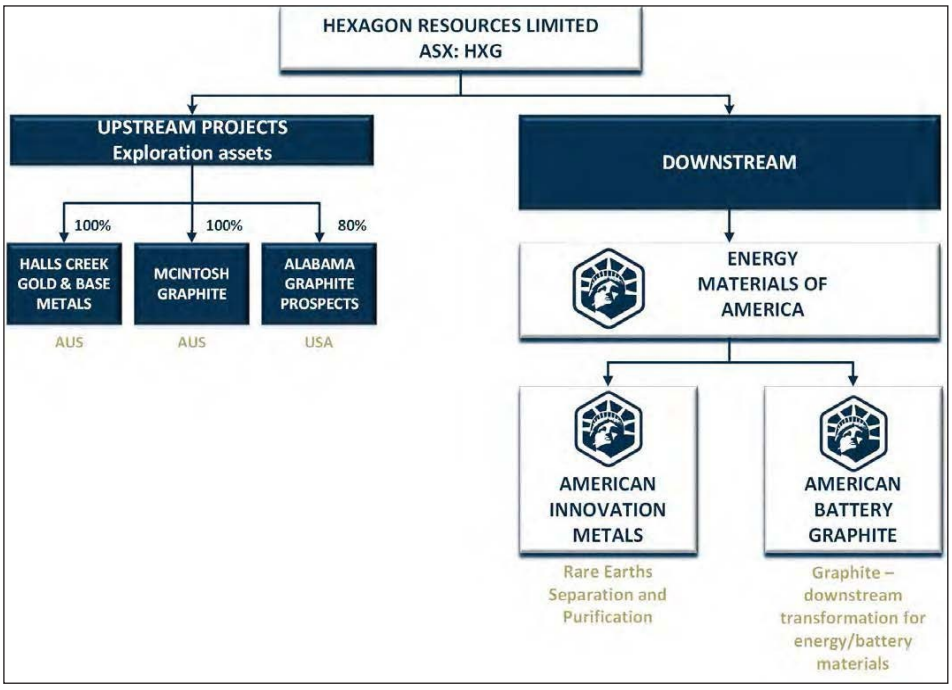
- **Technology/scale up:** This is the key technological risk that applies to the RapidSX™ process. Although the pilot scale work was successful, there is the risk that the upsized plant, and calculations for larger scale plants, may not deliver the reduced costs required to provide the incentive for end users to adopt the technology.
- **Lack of upstream REE production:** Any licencing opportunities for the RapidSX™ process are dependent upon new non-Chinese REE miners coming on-stream and expansions at existing operations. At present there are only a few planned start-ups globally, and thus a potentially limited market, notwithstanding various US, Australian and European government announcements to support REE developments.
- **Markets:** This is the perennial risk for any junior resources company, and in the case of Hexagon relates both to raising ongoing working capital and the ability of potential REE upstream miners to raise project capital, and then, in the case of RapidSX™, to raise the additional capital required for separation. The latter may be made easier should the upcoming CDP demonstrate significantly lower capital costs.

OVERVIEW

STRATEGY AND PROJECT OVERVIEW

- Hexagon's activities are focused on the development of downstream production of REE products, with these targeted for production in North America or to provide a source of diversified supply; as such the Company has partnered with North American entities for the proposed operations, and also brought onto the team personnel with significant skills and experience in the relevant fields.
- Both REEs and graphite currently have downstream operations concentrated in China (which basically controls the supply chain), and hence there is a strategic political and economic imperative to diversify production, and limit the potential for China to manipulate supply and prices for political reasons, particularly in the context of the current "trade war" between the US and China.
- There is also a strong push in the US for the development of a domestic supply of critical and strategic minerals (which include REEs and graphite), and hence Hexagon's focus on establishing its business in North America, and also the potential for US government funding/grants to help in the development of the relevant industries.
- The Company's strategy is to construct a CDP for REE separation by the end of Q3 2020, which, if successful, could lead to relatively rapid commercialisation through licencing of the RapidSX™ process, or potentially the construction of a plant to treat 3rd party feedstock.
- In the background the Company will continue to pursue is plans to establish a US based commercial production of advanced and battery graphite materials leveraging off its significant IP from test work undertaken in the US with its technical partners.
- Given the current oversupply from the upstream graphite industry, the Company is in the process of rationalising the upstream graphite activities and will maintain the projects so as they will be ready for development when markets improve.
- A JV/farmout or divestment is being sought for the highly prospective Hall's Creek Gold Project, however the Company is undertaking low cost exploration activities in the interim.

Figure 1: Company structure



Source: Hexagon

FINANCIAL POSITION

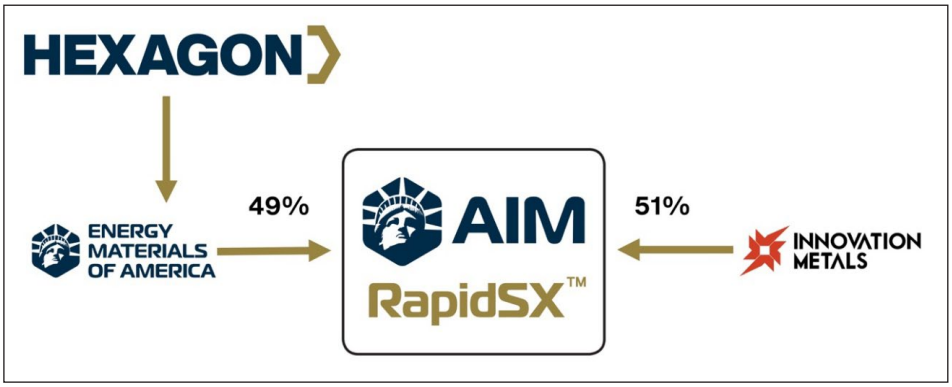
- As of September 30, 2019, the Company had A$3.070 million in cash and no debt
- The Company's most recent capital raising was in the June quarter, 2018, where A$7 million was raised through the 40% oversubscribed placement of 36.8 million shares at A$0.19/share
- Over the twelve months to September 30, 2019 Company spent A$2.090 million on exploration, evaluation and development and $1.56 million on administration and wages; the Company also received A$0.329 million in Research and Development rebates.

RARE EARTHS DOWNSTREAM STRATEGY

Introduction and Background

- On October 10, 2019, Hexagon announced that a binding investment agreement had been reached with Canadian-based Innovation Metals Corp. ("IMC"), the developer of the RapidSX™ rare earth separation technology, for which a successful pilot scale run was previously completed, with the USDOD contributing US$1.8 million, and which is expected to separate mixed REE feedstocks at operating and capital costs significantly lower than current operations.
- The terms of the agreement include:
  - IMC and Hexagon's wholly owned US subsidiary, Energy Materials of America LLC ("EMA") to form an incorporated joint venture, American Innovation Minerals Inc. ("AIM"), with IMC holding 51% and EMA 49%; and,
  - IMC is to contribute the RapidSX IP for REE separation, and EMA to make total payments of US$6 million, including US$2 million to fund construction of a 60,000 kg/yr to 80,000 kg/yr REO CDP in the US; and US$4 million in deferred payments, payable from Hexagon's share of future AIM cash flows.
- The JV structure is shown in Figure 2.

Figure 2: AIM JV structure

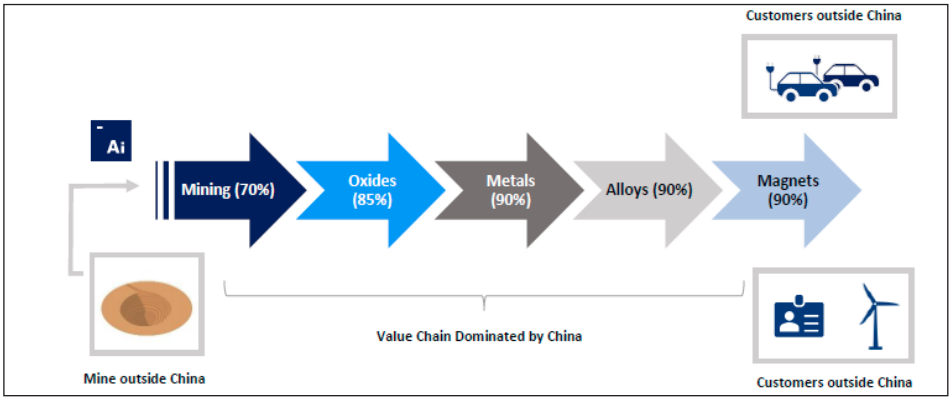


Source: Hexagon

Markets and Transaction Rationale

- One of the key aspects of the REE markets is the significant control that China has over the supply chain - this is shown in the case of magnets (which are the main use of Nd and Pr) in Figure 3.

Figure 3: The REE production and value chain



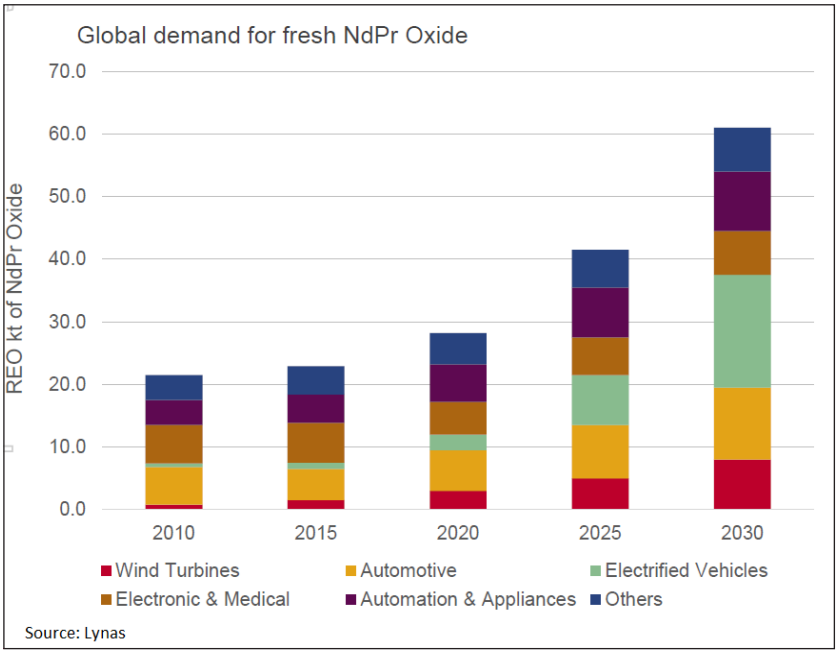
Source: Adamas Intelligence Q2, 2019 Quarterly Report

- As can be seen China controls most steps of the global supply chain, particularly in the separation (85% of the global market) and in the production of magnets (90%) - the remaining separation is largely attributed to Lynas, at their Kuantan plant in Malaysia, which currently produces some 19,000 tpa TREE, including 5,500 tpa NdPr.
- However, it is not all smooth sailing for Lynas in Malaysia, with community opposition as well as the Government being somewhat difficult at times with permitting - one key issue is that the plant generates low intensity radioactive waste, due to the presence of thorium

in the REE mineral concentrates which are shipped from the Mt Weld minesite in Western Australia.

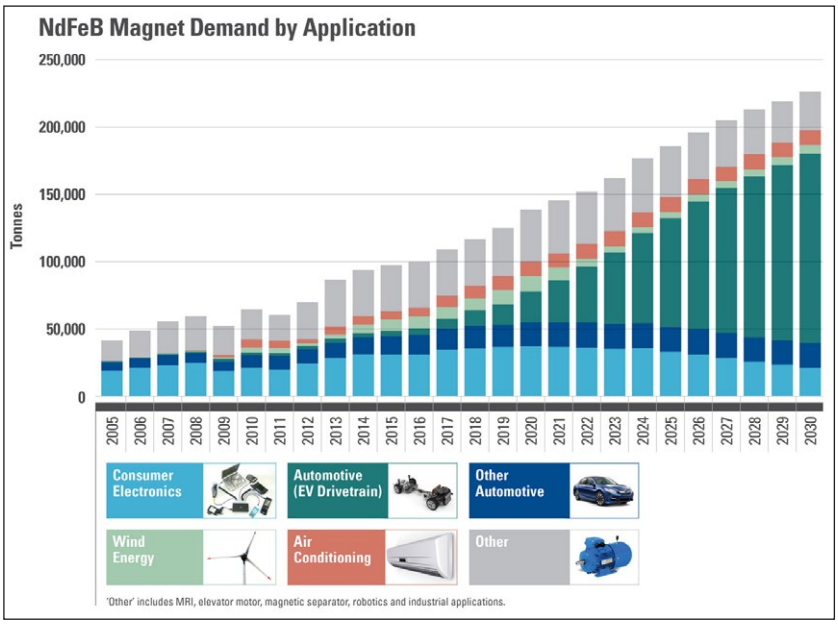
- The current global market is ~160,000 tpa of REOs, with this dominated by the magnet rare earths (~35% by volume, including neodymium, praseodymium, terbium and dysprosium) and lanthanum/cerium (~60% by volume, and used in catalytic and other applications) - NdPr makes up over 90% of the market by value however.
- The overall production of REO is forecast by some to grow to close to 300,000 tpa by 2030 - this will be driven by an increase in demand for NdPr (Figure 4), which in turn will be driven by an increase in demand for NdFeB magnets (Figure 5), of which Nd makes up some 26% to 30% in the alloy $Nd_2Fe_{14}B$; the magnets contain up to 1% of other REEs including Pr, Nb and Dy.

Figure 4: Forecast global demand for NdPr oxide



Source: Lynas

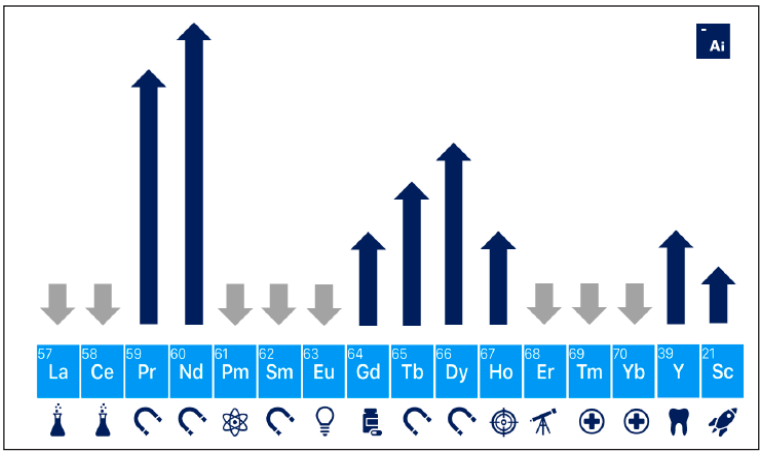
Figure 5: NdFeB magnet demand by application



Source: Arafura Resources

- However one effect of the increased demand for the magnet elements is the resultant production and oversupply of a number of the others, due to the inability to selectively mine REEs - this may lead to price increases in some due to the need to make up for losses made on the oversupplied elements (Figure 6) - significantly oversupplied elements include lanthanum and cerium which have seen large price falls over recent years.

Figure 6: Price movement forecasts



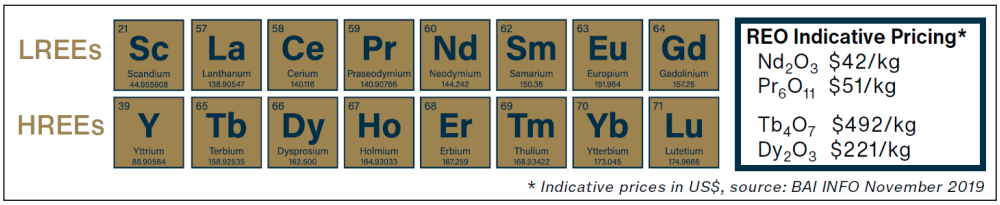
Source: Adamas Intelligence Q2, 2019 Quarterly Report

- Summarising the above, the REE market is forecast to rise strongly, largely due to growth in demand for rare earth permanent magnets, however the supply chain is strongly dominated by China, and the global industry can thus be readily affected by political/ economic manipulation, including tariffs and quotas, which have been freely used by China in the past.
- Therefore there is a real need to diversify supply out of China, given the critical nature of the elements and their products - a number of other companies are now looking at incorporating separation plants into their proposed operations, including Peak Resources (ASX: PEK, Teeside plant in the UK to treat material from the Ngualla Project in Tanzania) and Arafura Resources (ASX: ARU), which has incorporated a standard SX separation plant in the proposed Nolan's operation in Western Australia.
- In addition, Lynas is looking the opportunity to build a HREE separation plant in the US - the US is very keen for diversified supply given the critical nature of REEs, including in military applications, and the potential for China to manipulate supply and prices.
- The recently re-opened Mountain Pass mine in the US is currently exporting REE mineral concentrates to China for separation; the owners are looking at restarting on-site separation activities.
- Should it prove commercial, RapidSX™ provides an ideal opportunity to take advantage of the need for diversification, particularly if the expected capital and operating cost savings over current processes are delivered.

What is RapidSX™?

- Key weaknesses in the rare earths production train are the complexity and hence high capital and operating costs of the separation of the different REEs from REE mineral or chemical concentrate feedstocks - this is largely due to the similarity in chemical properties between the different elements, with HREEs generally being more difficult than LREEs to separate.
- The different REEs are shown in Figure 7 highlighting the general tight range of atomic numbers, with the exception of scandium and yttrium (which some consider not to be rare earths) - despite the collective name, rare earths are not in fact particularly rare – just difficult to separate.

Figure 7: The REEs and indicative pricing for the magnet metals

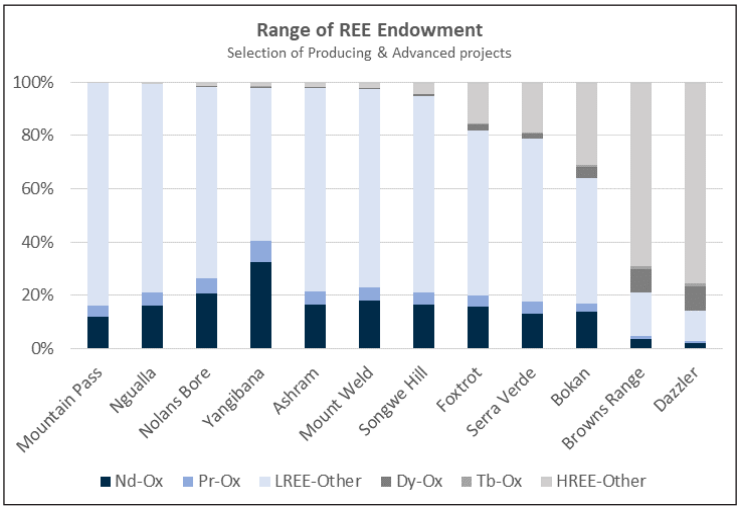


Source: Hexagon

- The standard separation technology is solvent extraction ("SX"), whereby an aqueous solution of the mixed rare earths is first mixed with an organic phase containing an organic solvation agent that forms complexes with the target REE ions in what are termed mixer-settler units.

- The ions are then stripped from the organic phase using another aqueous solution in which the ions have a higher solubility.
- By adjusting the kinematics, the target REE can be concentrated by 10 to 100 times in a single stage, with the process being repeated until the required purity is reached, however, due to the small differences between the different REEs this must be repeated several times (in some cases in the order of 100s of times) for each REE being extracted.
- As such, it is a complicated, time consuming and capital-intensive process, although on the other hand SX itself is a proven and well understood treatment process used for 95% of REE separation and in a wide variety of other industries.
- The RapidSX™ process has targeted separation kinematics of SX processing to speed up processing of the feedstock, with this being initially successfully demonstrated in the 2016 pilot plant.
- The key advantages of RapidSX™ over conventional processing as shown by the pilot plant include:
  - Up to an estimated 90% reduction in the number of mixer-settler units required,
  - Residency time in the circuit of only hours/days, instead of weeks (or months); and,
  - Expected significant capital and operating cost savings due to the above.
- Another key factor is that the process can treat different mixtures of both LREE and HREE, and even mixtures of both - this versatility is important to any future commercialisation of the process as different REE deposits contain different proportions of the separate REE as shown in Figure 8 - no two deposits are the same.

Figure 8: REE endowment for selected deposits



Source: Hexagon, data verified by IIR

- Table 1 presents a comparison of the expected commercial performance of RapidSX™ with conventional SX separation based on the results of the pilot scale work.

Table 1: RapidSX™ competitive advantage

RapidSX™ competitive advantage		
Parameter	**RapidSX**	**Conventional SX**
Performance and Efficiency		
Commercial Purity	Yes	Yes
REE Recovery Rates	High	High
Processing Time	Rapid	Slow
Time to Equilibrium	Hours/Days	Weeks
CAPEX		
Equipment Cost	-60% to 70% Reduction	High
Separation Staging	~90% Reduction	High
OPEX		
Metal Inventory/WIP	Low	High
Organic Volumes	Low	High
Labour	Low	High
Power Consumption	Low	High

Source: Hexagon

Estimated Costs

- Part of the path to commercialisation will be undertaking a Front-End Engineering and Design ("FEED") study, for the RapidSX™ process, with this, amongst others, to include an overview of the budget and estimated costs prepared by IMC, and to extrapolate capital and operating costs for a full-scale commercial plant.
- Work to date by Hexagon and IMC, based on the RapidSX™ pilot operation and comparing results to published reports on Feasibility Study outcomes utilising conventional SX, has estimated that capital costs may be some 60% to 70% lower in terms of start-up capital per kg of annualised separation capacity, and with operating costs savings in the order of 15% to 20% of conventional plants.
- The Company has released estimated separation costs in the order of les than US$2/kg for LREOs and less than US$12/kg for HREOs, however no numbers have been provided for estimated capital costs, other than the estimated savings as given above.

Current REE Project Cost Data

- There is only limited cost data in the market, due to the concentration of activities in China, however some public numbers include:
  - Hastings Technology Metals (ASX: HAS) November 2017 DFS - US$2.50/kg REO separation fee (inclusive of impurity removal) for 3rd party separation in China - this is predicated upon producing a mixed rare earth carbonate ("MREC") on site at Yangibana,
  - Peak Resources' Teeside, UK extraction/separation plant, April 2017 BFS (updated figures - July 2019 presentation) - US$4.00/kg REO equivalent extraction/separation OpEx for the production of ~10,000 tpa REO equivalent - this will produce a mixture of oxide and carbonate products; and,
  - The estimated capital intensity for the US$165 million Teeside plant is US$16.50/annual kg REO equivalent, however, given that NdPr oxide is the key payable material, a capital Intensity of US$59/kg of annualised production is more meaningful,
- The only company that has published separate extraction/separation costs is Arafura for their Nolan's Project - The published direct capital cost for the Nolan's combined separation/extraction plant is US$239.9 million.
- We estimate that, from the DFS figures, that reagents and services ("total line item of U$106.7 million) may add a further ~US$95 million (not including those we have applied pro-rata to the beneficiation circuit), increasing the estimated combined extraction/separation plant final cost by 40% to US$335 million.
- Applying the 40% to the "separation plant" line item only results in a total separation plant direct cost of US$50 million, for a production of 4,800 tpa REO equivalent.
- This results in a separation plant annual capital intensity of ~US$10.50/kg REO equivalent, or US$12.00 for NdPr oxides; the estimated separation OpEx is US$4.45/kg NdPr oxide.
- It needs to be noted that the Nolan's planned SX separation plant produces NdPr oxide plus SEG/HRE carbonate only - around $^{2}/_{3}$ of the total annual production of ~13,300 REO equivalent is Ce hydroxide, which is not a product of the SX plant - as such, NdPr oxides make up 85% of the SX plant products, unlike other planned operations (e.g. Teeside), where it is in the order of 30%.
- Applying an overall separation capital intensity of US$10.30/kg REO equivalent to a plant with a lower percentage of NdPr oxide production would therefore result in a proportionately higher capital intensity per NdPr oxide unit production.
- However, the limited data presented above precludes rigorous analysis, and any derived figures should be treated as ballpark only and used with caution.

Commercialisation Strategy

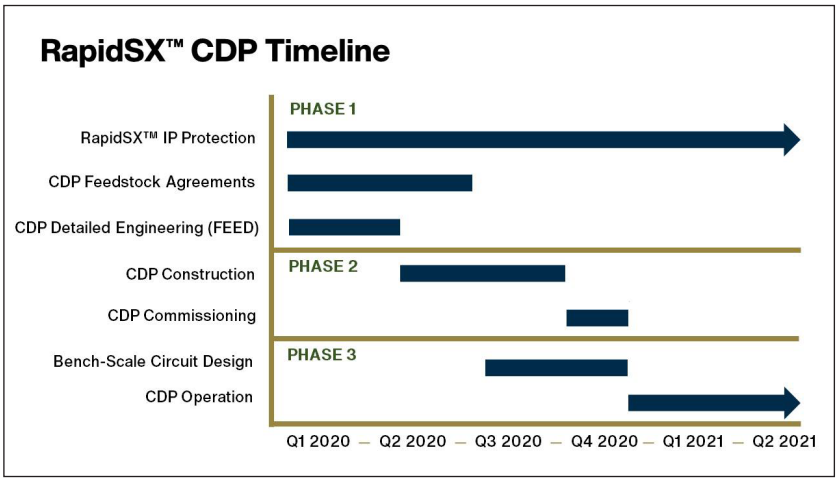
- AIM is looking to a "capital-lite" revenue model, whereby it would look at licencing the technology through structured licencing fees to current and future REE producers - it is expected that these would largely be geared to the savings in capital cost, volumes and value of the separated REOs.
- Comparing to other technology licencing type arrangements, IIR considers that the value to Hexagon may be possibly linked to a fixed percentage share in the capital saving with the project developer (potentially payable up-front).

- Although the percentage share will be dependent upon negotiations between the licensor and licensee, the overall royalty could be significant if the expected 60% to 70% capital cost savings are realised in the CDP, given the expected capital costs (in the US$10's of millions) for plants as presented above.
- There could also be a percentage share in the operating savings based on the volume of production, with the examples given above looking to produce at 3,000,000 kg/yr to 4,500,000 kg/yr NdPr oxide; again we cannot speculate on what the percentage royalty may be, nor the future production of any possible licencees, but this has the potential, given plant volumes, to bring in not inconsequential annual cash flow.
- The JV may also consider constructing a plant for 3rd party treatment of REE concentrates, either through toll treating or concentrate purchase arrangements, with also the potential to treat blended feedstocks; this however will require significant upfront capex.
- It is expected that income may also be earned through the operation of the CDP, thus defraying some of the costs of operating the facility.
- IRR's view is that it will be the lower expected capital cost for RapidSX™ that would provide the incentive for take-up of the technology should it prove commercially viable - the expected lower operating cost alone may not prove enough of an incentive to develop a plant; in addition any potential saving in OpEx could also be matched through aggressive pricing by the current separators in China.

Planned Work

- A Q4, 2020 start-up for the CDP is planned, with the proposed timeline presented in Figure 9.
- The site for the CPD is that used for the pilot plant in Mississauga, Ontario; the benefit here is that the site is fully permitted for the planned operation.
- Hexagon, as announced to the market on December 18, 2019, has now agreed to fund Phase 1 of the commercialisation from existing cash (and which will count towards the US$2 million option obligation), with the main steps including:
  - RapidSX™ Front-End Engineering Design (FEED) Study for the CDP to provide an independent overview of the capital budget and schedule prepared by IMC, as well as some early extrapolations on capital costs for a full-scale commercial plant based on specific mixed REE chemical concentrate feedstock types,
  - Securing RapidSX™ Intellectual Property by finalising provisional patent applications on the RapidSX™ technology and related flow sheets, initially in the United States; and,
  - The incorporation of American Innovation Metals (AIM) in the United States. AIM will serve as the incorporated joint venture vehicle for HXG and IMC to commercialise RapidSX™.
- Positive results from this work should lead to a decision to proceed to Phase 2, which will include construction of the CDP facility.

Figure 9: RapidSX™ CDP Timeline



Source: Hexagon

GRAPHITE DOWNSTREAM TREATMENT STRATEGY

Introduction

- The second string to Hexagon's downstream bow is the graphite downstream production strategy, originally commenced as a result of work carried out in looking at the marketing aspects and vertically integrating the McIntosh Graphite Project in Western Australia, and which has subsequently evolved to be considered as a standalone operation in view of the higher more stable downstream margins and the weak upstream graphite markets.
- It is planned to be US based and to provide a series of "Made-in-USA" products to American end users, with these including an expected significant increase in battery plants.
- As part of the strategy, Hexagon, in mid-2017 partnered with a North American battery materials specialist corporation, hereby termed "NAmLab", with the corporation wishing to remain anonymous.
- The opportunity now is to leverage off that association and the significant graphite transformation IP as demonstrated in the Scoping Study, released in May 2019 – Hexagon is examining strategic partnerships and funding opportunities for this business.

Downstream Graphite Testwork

- Significant testwork has been completed under the partnership, initially including proprietary thermal purification and then spheroidisation - all testwork to date has been undertaken on flake graphite from the McIntosh Graphite Project, however the aim is to ultimately treat material from different sources.
- The results of this initial work were positive - the purification resulted in up to a 99.999% (five nines) purity product, more than suitable for battery anodes which require 99.95% purity, and with the spheroidisation producing material that has been successfully tested in end applications.
- Subsequent work has successfully produced a range of high-quality products targeting different sectors of the downstream graphite market, with these including:
  - Purified natural flake graphite, with >99.99% purity, suitable as a pre-cursor for all high-value downstream graphite products,
  - Li-ion coated battery anode, suitable for Li-ion battery anodes,
  - Conductivity-enhancement graphite ("CEG"), which is produced by the specialised milling of ≥99.95% purified graphite flake; - end uses of CEG include all major commercial battery cathode chemistries,
  - Antioxidant conductivity enhancement additive - this is a material developed by Hexagon to be used as an additive in graphite electrodes, largely for electric arc furnaces, to increase thermal and electrical performance and to extend electrode life.
- As mentioned, all products have been tested in, and been found suitable for the required applications.

Scoping Study

- On May 17 2019, the Company released the results of a positive Scoping Study for the advanced graphite processing and the development of a standalone Graphite Purification and Processing Plant ("GPPP").
- The study looked at the production and sale of a suite of a dozen high end products, and the alternatives of operating in Western Australia or Washington State, USA, with the latter being the preferred option.
- Table 2 presents the financial outcomes of the Study.

Table 2: GPPP Scoping Study financial highlights

GPPP Scoping Study 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

GPPP Scoping Study financial highlights		
	Geraldton (Australia)	Chelan County (USA)
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 (Equivalent to US$1,504/ Tonne)	
Weighted Ave Basket Price of Products	A$8,487 / Tonne (Equivalent to US$6,110 / Tonne)	
Start-Up Capital Phase 1 (qualification plant)	A$23 Million	A$27 Million
Start-Up Capital Phase 2 (commercial plant)	A$118 Million	A$135 Million
Start-Up Capital Phase 3 (commercial expansion, fully funded from operations)	A$139 Million	A$153 Million

Source: Hexagon

Current Strategy and Ongoing Work

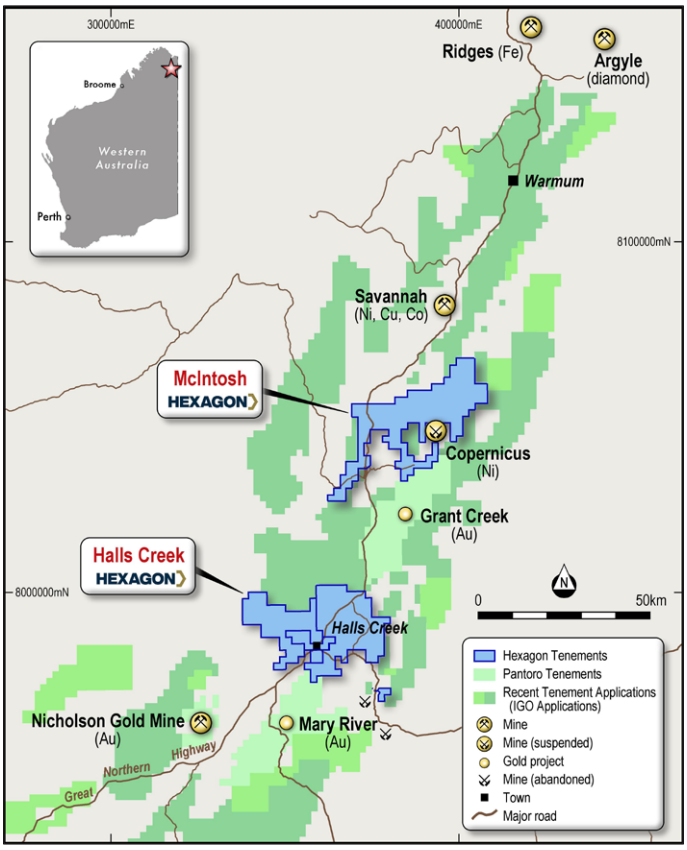
- Subsequent to the release of the results, the Company revisited the strategy, with a view now to fast track commercialisation of battery materials produced using industry standard and understood processes - the rationale behind this is that it will significantly shorten any qualification periods that would be required for products using new or innovative processes, and hence shorten the period to cashflow.
- The Company has a two year time frame for commercialisation of standard products - at the same time development of new more efficient and greener processes will continue in parallel, with a planned time to commercialisation in the order of five years, which also takes into account expected longer product qualification times.
- Hexagon will also consider strategic acquisitions or partnerships to accelerate the strategy.
- Current activities are concentrated on a feasibility study for the revised strategy, with this including significant financial modelling.

HALLS CREEK PROJECT – HEXAGON 100%

Location and Tenure

- The Halls Creek Project is centred around the township of Halls Creek in Western Australia (Figures 10 and 11), 370 km south of Wyndham via the Great North Highway.

Figure 10: Australian project location map



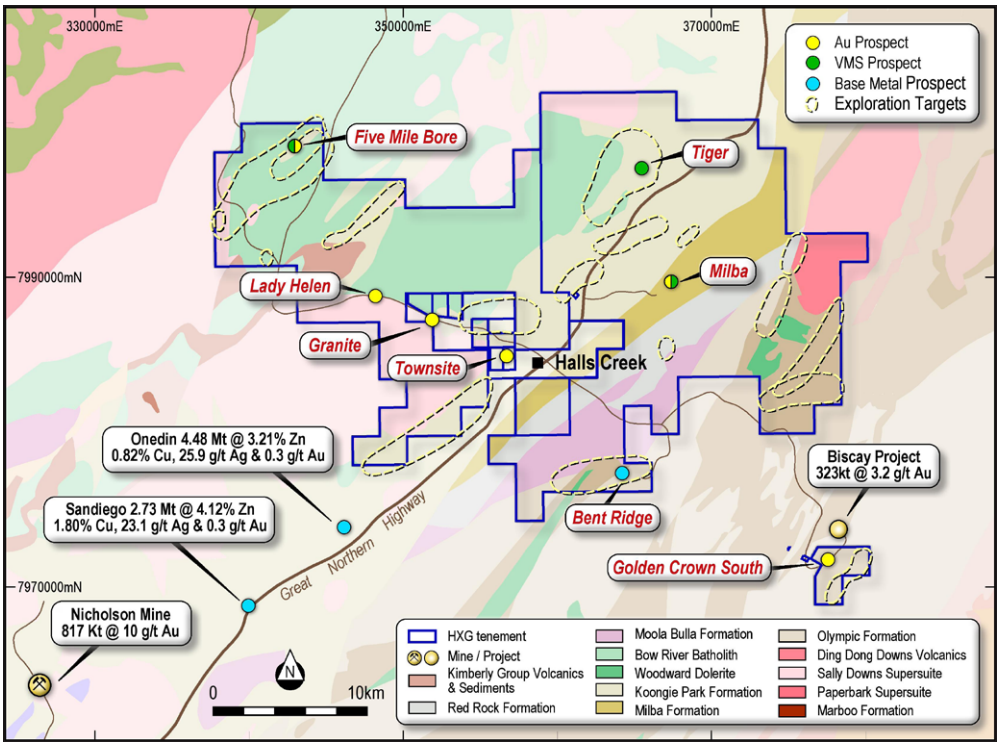
Source: Hexagon

- The project includes eight granted prospecting licences ("PL"), four granted exploration licences ("EL") and one EL application ("ELA") for a total area of 571 km^2.
- All tenements except the EL application (ELA80/5126) are 100% held by Hexagon and are in good standing; the Company is acquiring 75% of the ELA for a total of A$20,000 and a 1.5% Net Smelter Return Royalty payable to the vendors
- Hexagon has a call option to acquire the outstanding 25% for either A$25,000 in cash or A$30,000 in shares within two years - should the call option expire the vendors will be free carried up to a decision to mine.
- The Company is looking at outright sale or JV/ Farmout options for Halls Creek based on the underexplored nature of the ground and clearly prospective attributes of the project - nearby operations include Pantoro's (ASX: PNR, market capitalisation of A$180 million) Nicholson high grade gold mine.

Geology and Mineralisation

- Halls Creek Project is located over a units of the Proterozoic Halls Creek Orogen, which include felsic to mafic volcanics and volcaniclastics (with coeval intrusives) and sediments.

Figure 11: Halls Creek Project location and tenements



Source: Hexagon

- Later intrusives include dolerite and orogenic granites.
- The units have been deformed, with a generally NE strike, and have undergone both regional (generally to greenschist facies) and contact metamorphism.
- The Project is considered prospective for a number of mineralisation styles, including:
  - Orogenic Gold, with a nearby example being Pantoro's operating high grade Nicolsons mine,
  - VMS, with regional examples including Onedin and Sandiego, and,
  - Magmatic Ni-Cu sulphide - Panoramic Resources' Savannah Ni-Cu mine (currently under care and maintenance) is a nearby example - it is hosted in a layered mafic-ultramafic intrusive.

Recent and Upcoming Work

- In September 2019, following the acquisition of the final tenement, Hexagon flew a detailed airborne magnetic survey, with the final interpretation expected in early 2020.
- This will be used in target generation work and in planning activities for the upcoming 2020 field season - this will initially include geological mapping and geochemical sampling to help define drill targets.
- Hexagon is currently looking to attract a suitable JV partner to Hall's Creek.

MCINTOSH GRAPHITE PROJECT - HEXAGON 100%

Location and Tenure

- The McIntosh Graphite Project is located approximately 280 km south of the port of Wyndham, adjacent to the all-weather Great Northern Highway (Figure 10).
- The project comprises 16 granted ELs (665 km^2), two Mining Lease applications ("MLA", 2,347 ha) and one Miscellaneous Licence application ("LA", 54.23 ha); all of the granted tenements are in good standing (Figure 12).
- Given the change of focus to downstream operations the Company is now in the process of rationalising the holdings, which may include applying for Retention Leases over some areas and relinquishing other areas.
- There are no encumbrances on the tenements, except for a 1% mill gate net royalty on each of E80/4733 and E80/4732, as a part of the tenement acquisition in 2014:

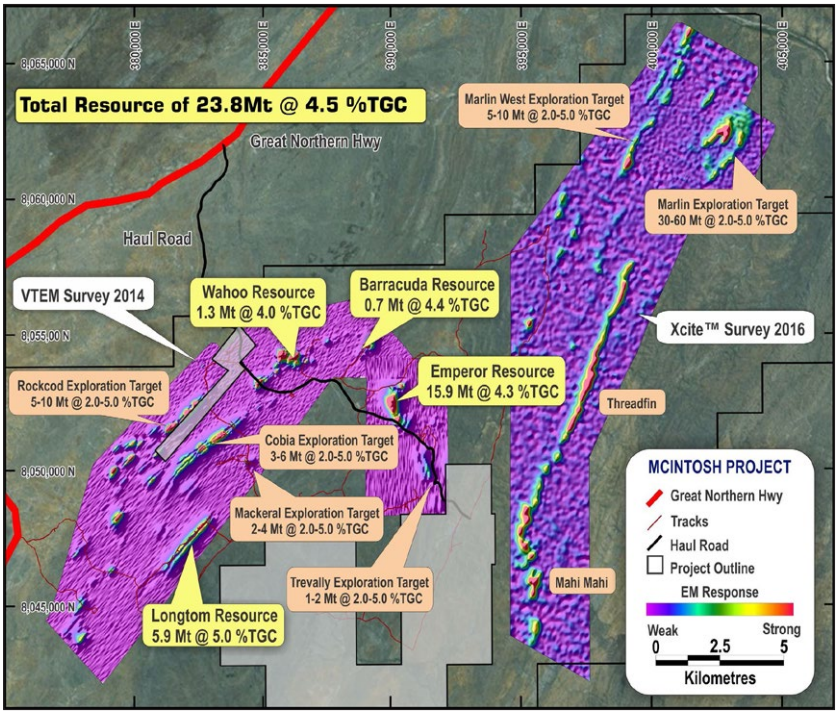
Mineral Resources Ltd (ASX: MIN) Earn-In and Financing Agreement

- As announced to the market on March 27, 2018, Hexagon entered into an agreement with MIN, whereby MIN could earn up to 51% of McIntosh by sole-funding all activities through to commercial production.
- However due to the state of the graphite market and competing capital requirements, MIN withdrew from the Joint Venture as announced to the market on October 2, 2019, with the McIntosh tenements, all data and samples reverting 100% to Hexagon.

Geology and Mineralisation

- The prospective graphitic schist units are hosted in metasediments of the Paleoproterozoic Tickelara Metamorphics, a major group within the Halls Creek Orogen, one of a number of Proterozoic mobile belts surrounding the Archaean cratons of Western Australia.
- Graphitic schists, which host the mineralisation, are co-incident with clear EM anomalism, forming generally NE striking steeply dipping horizons, however with folded stratigraphy identified at a number of the targets (Figure 12).

Figure 12: McIntosh tenements and mineralisation



Source: Hexagon

Summary of Work Completed and Resources

- The original strategy, following Hexagon's (then Lamboo) acquisition of the Project in 2012, was to rapidly prove up and commercialise a resource, focusing on the lithium ion battery anode market.

- Activities included several drilling campaigns, metallurgical testwork to produce graphite concentrates and several geophysical programs – namely the airborne EM and VTEM surveys which highlight the extent of the prospective graphitic schist units.
- The introduction of new management in early 20175 included a change of strategy; namely completion of a pre-feasibility level study for production of graphite concentrates but also focusing work on downstream tests to understand the value drivers for marketing of any graphite concentrates and to explore opportunities to diversify the product range away from just battery anode material – a market 100% dominated by China. The downstream testwork culminated in the GPPP study referred to above which now underpins its graphite battery materials business activities in the USA.
- Subsequent work included a number of drilling programs leading to three resource upgrades, with the latest of 23.8 Mt @ 4.45% TGC released to the market in April 2019 (Table 1).
- An Exploration Target of 50 to 100 million tonnes grading at between 2.5% to 5% TGC has also been estimated for the Project in addition to the MRE; this and the latest MRE are presented in Figure 12 and Tables 3 and 4.

Table 3: McIntosh Mineral Resource Estimate

McIntosh Mineral Resource Estimate				
Deposit	**JORC Classification**	**Tonnes (Mt)**	**TGC %**	**Contained Graphite (Kt)**
	Indicated			
Emperor	Inferred	3.8	4.35	165
	Total	**15.9**	**4.3**	**684**
	Indicated	1.3	3.97	51
Wahoo	Inferred	-	-	-
	Total	**1.3**	**3.97**	**51**
	Indicated	5.1	4.93	253
Longtom	Inferred	0.8	5.25	40
	Total	**5.9**	**4.97**	**293**
	Indicated	**0.7**	**4.4**	**32**
Barracuda	Inferred	-	-	-
	Total	0.7	4.4	32
	Indicated	19.2	4.44	854
Total	Inferred	4.6	4.5	206
	Total	**23.8**	**4.45**	**1,060**

Source: Hexagon

- This Exploration Target (which is in addition to the Resources) is critical, in that it highlights the potential for resource expansions to be able to support a long term operation, with only limited drilling expected to be required to prove up resources in a number of the target areas.

Table 4: McIntosh Exploration Target

McIntosh Exploration Target			
Prospect	**Tonnage Min (Mt)**	**Tonnage Max (Mt)**	**Grade Range (%TGC)**
Emperor	2	4	4.0 – 5.0
Wahoo1	1	2	4.0 – 5.0
Barracuda	1	2	4.0 – 5.0
Cobia	3	6	2.0 – 5.0
Marlin	30	60	2.0 – 5.0
Marlin West	5	10	2.0 – 5.0
Rockcod	5	10	2.0 – 5.0
Mackerel	2	4	2.0 – 5.0
Trevally	1	2	2.0 – 5.0
Total	50	100	2.0 – 5.0

Source: Hexagon

Pre-Feasibility Study

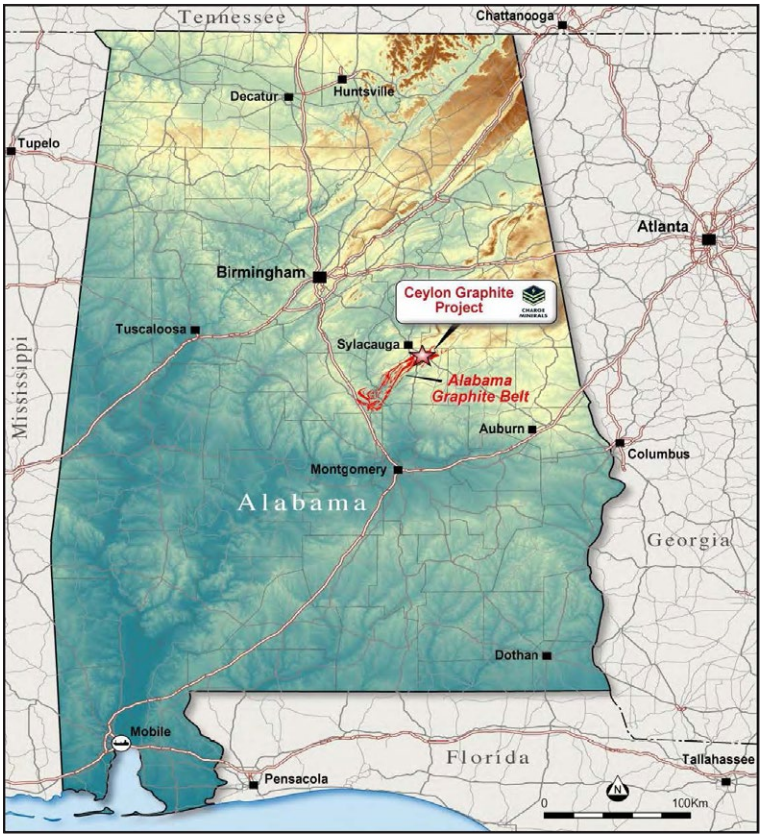
- The PFS for Stage 1, which was released to the market on May 31, 2017, highlighted a robust project treating an average of 2.4 mtpa of ore to produce 88,000 tpa of a 98% TGC graphite concentrate over a mine life of six years.
- The Study was predicated on producing a bulk concentrate; the strategy then changed to produce a range of targeted specialty products for which a Feasibility Study was planned, with this then being put on hold due to the soft upstream graphite markets and the change in company focus to downstream processing.

CEYLON GRAPHITE PROJECT, ALABAMA

Background, Location and Tenure

- The Ceylon Graphite Project, which covers claims totaling some 500 acres in area, is located within the historically mined Alabama Graphite Belt, near the town of Sylacauga in central Alabama (Figure 13), and traverses a four-lane highway, with gas and power also available on site.

Figure 13: Ceylon Graphite Project location



Source: Hexagon

- The Project has the potential to be a key plank in the Company's "Sourced and Made in the USA strategy, in providing raw materials for the planned downstream graphite processing.
- The property covers the historical Ceylon Mine and Rushing property, which supplied graphite during the World Wars - the Alabama Graphite Belt has historical been the US's primary source of graphite during trade embargoes and periods of war.
- The property is held by Hexagon's 80% owned subsidiary Charge Minerals LLC ("Charge"); 15% is held by US Critical Minerals, whose founder, Jesse Edmondson is based in Alabama and has significant graphite experience in the region.

Mineralisation

- Historically, mineralisation with a grade of 3% to 5% TGC was mined, with this being amenable to free dig mining methods.
- Mineralisation has been identified in the base of the Ceylon open pit, and for a strike length of ~1 km - there has been no modern exploration hence there is the potential to add additional tonnage to the known deposits.

Work by Hexagon

- Since acquisition of the project in March 2019, work by Hexagon has included geological mapping, rock chip sampling, pitting, trenching and the collection of a 100 t bulk sample.
- Laboratory assay results showed a range of graphite grades from 0% to 4.93% TGC, with a median of 1.86.
- A 500 kg sub-sample of the bulk sample was sent to a testing facility in China to undertake bench-scale test work, with this potential progressing to pilot scale work to generate graphite concentrates - results are expected in early 2020.

PEERS

- Given the change in strategy and the diversified portfolio of projects Hexagon now has no direct peers, however it can be compared to both the graphite companies and the junior base/precious metals explorers.
- Within the graphite space, our view is the closest analogue is EcoGraf Limited (ASX: EGR, formerly Kibaran), which has an EV of A$22 million.
- In addition to its advanced upstream projects in Tanzania (Epanko and Merelani with combined Resources of 48.40 Mt @ 8.66% TGC), Ecograf is looking to make a final investment decision in H1, 2020, on a 20,000 tpa spherical graphite plant planned to be located in Kwinana, Western Australia.
- Although not strictly a peer of Hexagon, in the REE space Lynas has signed an MoU with Texas-based Blue Line Corp to develop a HREE separation facility at Blue Line's site in Hondo, Texas, which would be the only medium to large scale producer of HREE outside of China.
- There are a wide range of junior base and precious metals explores operating in Western Australia, with EV's ranging from under A$1 million to close to A$200 million, dependent largely upon project stage and results - these are active in a range of terranes, including the Archaen Yilgarn and Pilbara Cratons and the Proterozoic mobile belts.
- Exploration companies operating in the Halls Creek region include Anglo Australian Resources (ASX: AAR, market capitalisation of A$37 million), Buxton Resources (ASX: BUX, market capitalisation of A$12.9 million).
- Anglo Australian significant ground, prospective for base metals and gold, to the southwest of Halls Creek, and continuing to the southwest of Pantoro's Nicolson Mine - the tenements include the Onedin and Sandiego VMS deposits (Figure 11).; Anglo Australian also holds a number of gold projects in the Yilgarn Craton.
- Operators in the area include Pantoro Resources (ASX: PNR, A$180 million market capitalisation) - Pantoro operates the high grade Nicholson Mine, which gives the idea of the value that can be released on exploration success followed by the development of an operation.

CAPITAL STRUCTURE

- Hexagon currently has 292.43 million shares, 24.10 million options and 0.95 million performance rights on issue.
- All of the options are out of the money, with exercise prices of between A$0.15 and A$0.20, and an expiry date of October 16, 2020 - a large proportion of the options are yet to be vested.
- The top 20 hold 50.90%, with insiders holding 2.38%; the largest shareholder is Tribeca Investment Partners, with 12.70% of the issued shares.
- The Company has ~1,700 shareholders.

BOARD AND MANAGEMENT

- **Mr Charles Whitfield – Chairman:** Mr. Whitfield is the Principal Investment Officer at Drumrock Capital, an investment firm providing capital and advisory services to start-up and early round companies. He has undertaken board and supporting roles in several companies in the specialty resource and new energy space. He was formerly a Managing Director with Citigroup where he held the position of head of the corporate equity solutions group (Asia Pacific). Prior to this, he worked for Deutsche Bank where he was head of

the strategic equity transactions group (Asia Pacific). Mr. Whitfield received his Masters in Business Administration (majoring in Finance and Strategy) from Columbia Business School (New York) in 1998 and his Bachelor of Economics from The University of Exeter (U.K).

- **Mr Mike Rosenstreich - Managing Director:** Mr. Rosenstreich is an international mining executive with over 30 years' experience including;13 years as an exploration and mine geologist with Homestake Gold and Dominion Mining; 6 years Corporate Finance with Rothschild Australia; 9 years as founding Managing Director of ASX listed Bass Metals from pre IPO stage, exploration success and over 5 years of base and precious metals production; and 3 years at Keystone Resource Development providing corporate, technical and financial consulting services. During his career he has been involved in a wide range of commodities from gold and base metals to industrials such as tantalum, feldspar and mineral sands across the globe. He joined Hexagon in March 2017 and since then has been instrumental in charting Hexagon's path to commercialise its REE and graphite assets.

  Michael is a Fellow of the AusIMM and a member of the AICD. He holds a BSc (Hons) in Geology and Masters in Mineral and Energy Economics.

- **Ms Lianne Grove – Chief Commercial Officer:** Ms Grove is an experienced senior finance executive with 25 years' experience and a wealth of commercial and finance knowledge, a strong track record in the development and implementation of business strategy, joint venture management and project planning and execution. She has held senior positions in several Australian and international companies predominantly in mining and oil and gas, including AWE and Rio Tinto. She joined Hexagon in September 2018 and has played a key role in the commercialisation of its REE and graphite assets.

  Lianne holds a Bachelor of Commerce from the Australian National University, is a Certified Practicing Accountant and a member of the Australian Institute of Company Directors.

- **Mr Garry Plowright - Non-Executive Director:** Mr Plowright has extensive experience in the resource sector, having a background in mining law and administration, as well as regulatory process and mine development. Mr Plowright has held board and senior management positions in both Australia and South Korea.

- **Mr Ty Dinwoodie - Chief Marketing Officer:** Mr. Dinwoodie is the Managing Director of G&W, a strategic advisory and communications firm based in Toronto. A marketing professional with an extensive background in market and industry analysis for the global graphite and rare-earth elements industries, he has served as a senior advisor for several private and public resource and advanced-materials companies, in North America, Europe and Australia. Since 2012, Mr. Dinwoodie's work has played a critical role in raising more than US$100 million in investments.

  Most recently, Mr. Dinwoodie served as President and Corporate Secretary of TSX Venture-listed Alabama Graphite Corp, prior to overseeing the company's acquisition by a NASDAQ-listed company. Previously, he served as Chief Marketing Officer of additive-manufacturing metal powders producer, Equispheres Inc, where he was instrumental in the company's founding and development of its business strategy.

  Mr. Dinwoodie is partner of Benchmark Mineral Intelligence's annual Benchmark Mineral Summit in Washington, DC and serves as the event's Chairman. He sits on the Board of Directors of the National Alliance for Advanced Technology Batteries (NAATBatt International) and is an active member of The American Society of Mechanical Engineers®, the Governance Professionals of Canada, the Canadian Investor Relations Institute, and the US-based National Investor Relations Institute. Mr. Dinwoodie studied economics at McMaster University and physics at Laurentian University.

- **Dr Gareth Hatch - Senior Technical Advisor and Co-Founder, Innovation Metals Corp:** Gareth Hatch was a co-founder of Technology Metals Research, LLC. He is interested in helping people to understand the challenges associated with the growing demand for rare-earth elements (REEs), lithium and other critical and strategic materials, and how those challenges affect market sectors throughout the entire technology supply chain. He is also a co-founder of Innovation Metals Corp, developer of proprietary separation and purification processes for REEs, nickel, cobalt, lithium and other metals.

  Gareth is also Managing Director of Strategic Materials Advisors Ltd., which continues his advisory and consulting work in the critical-materials sector. He was previously interim CEO and Executive Director of Alabama Graphite Corp. and Director of Technology at Dexter Magnetic Technologies, Inc. He holds five patents on a variety of magnetic devices.

Dr Hatch recently served as Principal Investigator on a multi-million-dollar research program on innovative processes for REEs, funded by the US Army Research Laboratory. He has advised numerous government agencies on threats to the strategic-materials supply chain. He is a member of a NATO STO strategy team on REEs and is a member of the Canadian ISO TC/298 Mirror Committee on standards for REEs.

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