



## ASX Announcement

18 December 2019

# HXG Commences Funding the Commercialisation of RapidSX™ Rare-Earth Elements Separation Technology

Hexagon Energy Materials Limited (ASX:HXG) (HXG, Hexagon or the Company) is pleased to announce that it has commenced funding of the Phase-One commercialisation of RapidSX™ rare-earth element (REE) separation technology for REE concentrates.

Per HXG's October 10, 2019 ASX announcement ("Hexagon Enters US-based Rare Earth Downstream Processing Industry"), the Company has executed a binding Investment Agreement whereby Hexagon has secured an option to acquire a 49% interest in RapidSX™ for REEs - an advanced, proprietary low-cost downstream REE separation technology developed and piloted by Innovation Metals Corp. (IMC). With US\$1.8 million in funding assistance from the US Department of Defense, IMC's proprietary RapidSX separation technology holds the potential to cost-effectively enable current and future REE producers to move downstream into REE separation. This would potentially mitigate current concerns about the extreme concentration of the REE supply chain with greater participation by Western producers and manufacturers.

## HIGHLIGHTS

HXG has agreed to commence funding the Phase-One commercialisation of the RapidSX Commercial Demonstration Plant (CDP) from existing cash for the following development and commercialisation initiatives:

- **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.

Hexagon Energy Materials Limited ABN 27 099 098 192 (ASX:HXG)

Registered Office: Suite 3, 7 Kintail Rd, Applecross WA 6153 T: (+61 8 ) 6244 0349  
E: [info@hxgenergymaterials.com](mailto:info@hxgenergymaterials.com) W: [www.hxgenergymaterials.com](http://www.hxgenergymaterials.com)

- **Securing RapidSX Intellectual Property** by finalising provisional patent applications on the RapidSX technology and related flow sheets, initially in the United States.
- **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.

The AIM business case is underpinned by:

- **Substantial CAPEX and OPEX savings** compared to traditional SX separation processes which are competitive with Chinese separation costs; savings which have already attracted significant end-user interest.
- **A 'capital-lite' revenue model.** RapidSX is planned to be licenced to users in exchange for variously structured licencing fees, but essentially leveraged to the capital cost savings, volumes and value of separated REE oxides (**REOs**).
- **Explosive global demand forecasts for REE's** over the next decade with the growth of REE permanent magnets (**REPMs**) used in renewable energy projects, electric vehicles (**EVs**) and a wide range of military and high-tech applications.
- **Substantial market opportunity.** Current primary REE oxide (REO) market size of more than 183ktpa with a market value of US\$3.4B; forecasted to grow 60% (to 293ktpa) in terms of market size and forecasted growth of more than 85% (to US\$6.3B) in market value by 2025. Certain sectors are projected to have significantly higher growth rates, with the use of REEs for EV traction motors projected to grow by 350% between 2018 and 2025<sup>1</sup>, demonstrating the considerable potential scale of the AIM business.

## FUNDING UPDATE

IMC and Hexagon have agreed to form AIM - an incorporated joint venture - with IMC contributing the RapidSX technology IP and expertise for rare-earth separation. Hexagon contributes commercial and marketing skills and has agreed to invest US\$2 million into the construction of the RapidSX CDP and to pay US\$4 million to IMC as Deferred Consideration, payable from Hexagon's share of future AIM cash flows.

HXG's Phase-One funding contribution will be applied towards HXG's US\$2 million option obligation and will enable IMC - through AIM - to advance the requisite development work to ensure the RapidSX CDP timelines are achieved on time and on budget; and, concurrently, to protect the IP of this important and potentially disruptive REE technology.

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<sup>1</sup> Adamas Intelligence, Electric Growth: EVs, Motors and Motor Materials (2019 H2)

AIM's mandate is to commercialise the RapidSX technology for the separation and processing of REEs, and by doing so create a viable alternative to the Chinese monopoly over virtually the entire global REE supply chain.

HXG's Managing Director, Mike Rosenstreich, commented, *"Given the strong support at our recent AGM for Hexagon's expanded strategy and entry into REE processing, we are tremendously pleased to be able to start working with IMC and fund development of the Commercial Demonstration Plant forthwith."*

*"The RapidSX technology is a game changer for the global REE processing industry, and a historic opportunity to diversify a global REE supply chain with greater participation from Western producers and manufacturers,"* stated Mr. Rosenstreich. *"With Front-End Engineering Design work commencing in early January 2020, we intend to have a RapidSX-based commercial demonstration plant fully operational – in North America – in Q4 2020, with a planned production capacity of between 60 and 80 tonnes per annum. Our focus is on the commercialisation of RapidSX to generate returns for our shareholders and to build a viable and sustainable energy-materials business."*

HXG has commenced several discussions with various potential funding and strategic partners exploring near-term financing opportunities for HXG's ongoing participation in the AIM joint venture, in addition to the Company's US-based downstream graphite development plans.

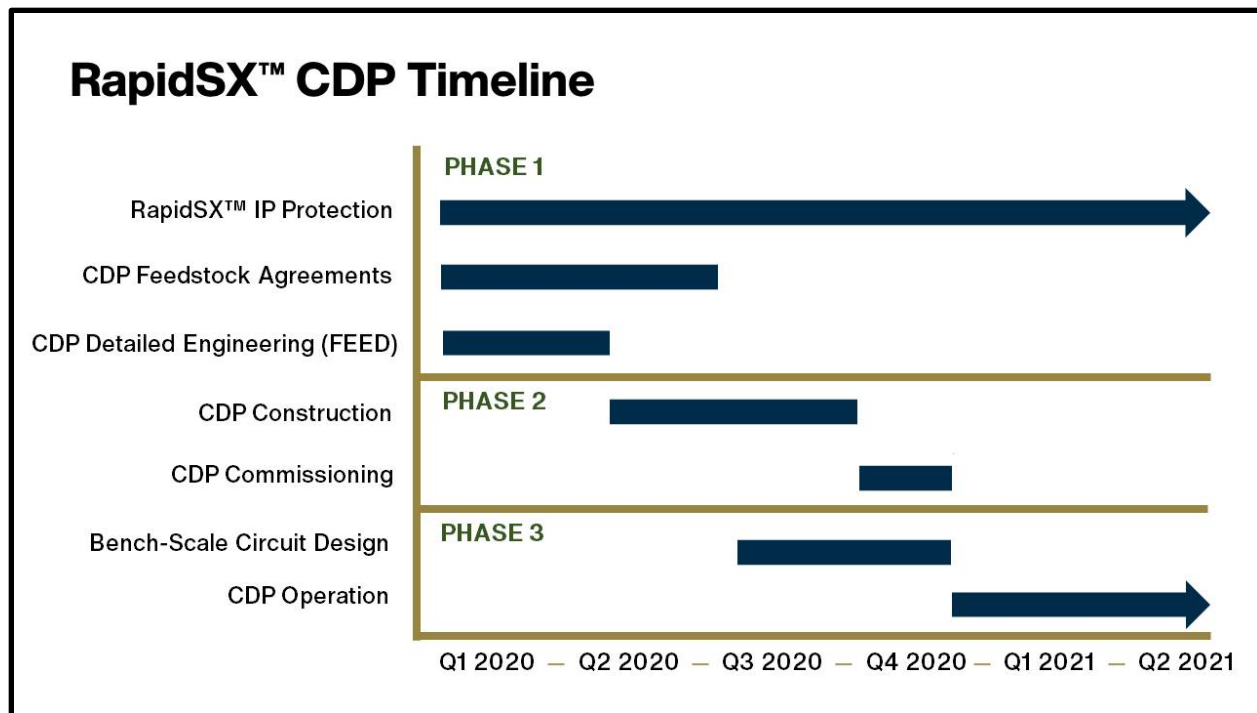


Figure 1: The RapidSX CDP Development Timeline.

### RapidSX™ COMMERCIALISATION STRATEGY

Based on IMC’s pilot-scale work, RapidSX has demonstrated robust economics, the ability to effectively separate LREE and HREEs, significantly reduced footprint/staging, and the ability to build out and commission quickly. However, the most compelling aspect of the technology to HXG is the fact that RapidSX is not a ‘new’ technology (*with uncertain technological, scalability and economic uncertainties typically associated with new technologies*), but rather a radical improvement on the well-established and understood solvent extraction (SX) separation technology (*SX is a well-established, time-proven separation technology for separating REE concentrates into commercial-grade REE products. All commercial separation of REEs today relies on conventional SX*).

The RapidSX CDP will be financially self-sufficient following the initial investment, leaving HXG’s shareholders positively exposed to the revenue potential via AIM’s planned licencing commercialisation strategy. Core components of the commercialisation strategy are set out in the following sections.

## a. RapidSX Competitive Advantages

Table 1: Summary of RapidSX vs. conventional solvent extraction for REE separation.

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	Weeks
<b>CAPEX</b>		
Equipment Cost	~60% to 70% Reduction	High
Separation Staging	~90% Reduction	High
<b>OPEX</b>		
Metal Inventory/WIP	Low	High
Organic Volumes	Low	High
Labor	Low	High
Power Consumption	Low	High

- Low CAPEX:** Due to the considerably reduced number of separation stages per SX circuit and resultant smaller physical plant footprint, compared to conventional SX approaches. Based on the IMC pilot-scale test work and review of various 'typical' light REE (LREE) projects, IMC estimates that there is a 60-70% saving in terms of start-up capital per kg of annualised separation capacity, contingent on the specific feedstock utilised and resulting REE products desired.
- Rapid Equilibrium:** As a result of the significantly increased separation kinetics of the RapidSX proprietary technology, the time to equilibrium/steady state is dramatically accelerated - from weeks (as is typical in the case with conventional SX) to hours/days with RapidSX.
- Low OPEX:** Due to significantly reduced separation times, reduced reagent and power consumption, reduced manpower requirements, and reduced in-process metal inventories. The piloting work undertaken by IMC also indicated meaningful cost savings of between 15-20% compared to utilisation of conventional SX, depending on the feedstock and resulting REE products. Estimated separation costs of less than US\$2/kg for light REOs and less than US\$12/kg for heavy REOs (depending on the feedstock and resulting REE products) are competitive with current estimated Chinese separation costs.

- **Agnostic:** RapidSX is capable of separating LREE-rich, heavy REE (HREE) rich and even blends of mixed REE feedstocks.
- **Commercially Available:** all construction materials for the RapidSX technology - all associated equipment and chemistry - are readily commercially available.
- **Scalable and Modular:** the RapidSX technology's process lines are modular and scalable, providing licensees to scale commercial production capacity.

## **b. AIM Revenue Model**

A 'capital lite' approach is the prime revenue model. RapidSX is planned to be licenced to users in exchange for variously structured licencing fees, but essentially leveraged to the capital cost saving, volumes and value of separated REOs.

An additional opportunity may arise, e.g. in the USA where, with external funding support, AIM may establish its own commercial scale separation facility for toll processing or for AIM to acquire materials to separate and sell to its own account.

The growth of AIM's business is tied into the demand growth of the REPM metals. Its revenue model is tied directly to 'units' separated and is predicated on increasing Western-sourced materials. Rapid SX is potentially a key contributor to providing upstream project sponsors with cost-effective, competitive alternatives to simply selling a REE chemical concentrate to China.

Under this commercialisation strategy, HXG would also be leveraged to improving REO prices. Given the positive demand fundamentals for the magnet, metals analysts expect prices to improve in line with the non-substitutional inputs into high-growth sectors such as EV, wind power generation and tech and defence applications.

## **FURTHER INFORMATION, please contact:**

### **Mike Rosenstreich**

Managing Director

Hexagon Energy Materials Limited

[info@hxgenergymaterials.com](mailto:info@hxgenergymaterials.com)

+ 61 8 6244 0349

### **Tony Dawe**

Investors/Media

Corporate Communications

[info@hxgenergymaterials.com](mailto:info@hxgenergymaterials.com)

+61 (0)405 989 743