

Hydrogen

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# HYDROGEN PRODUCTION DISRUPTION

HAZER GROUP LTD ASX:HZR

July 2018



# VALUE PROPOSITION



**Disruptive, global and scalable low cost, low emission solution to a decarbonised hydrogen future.**



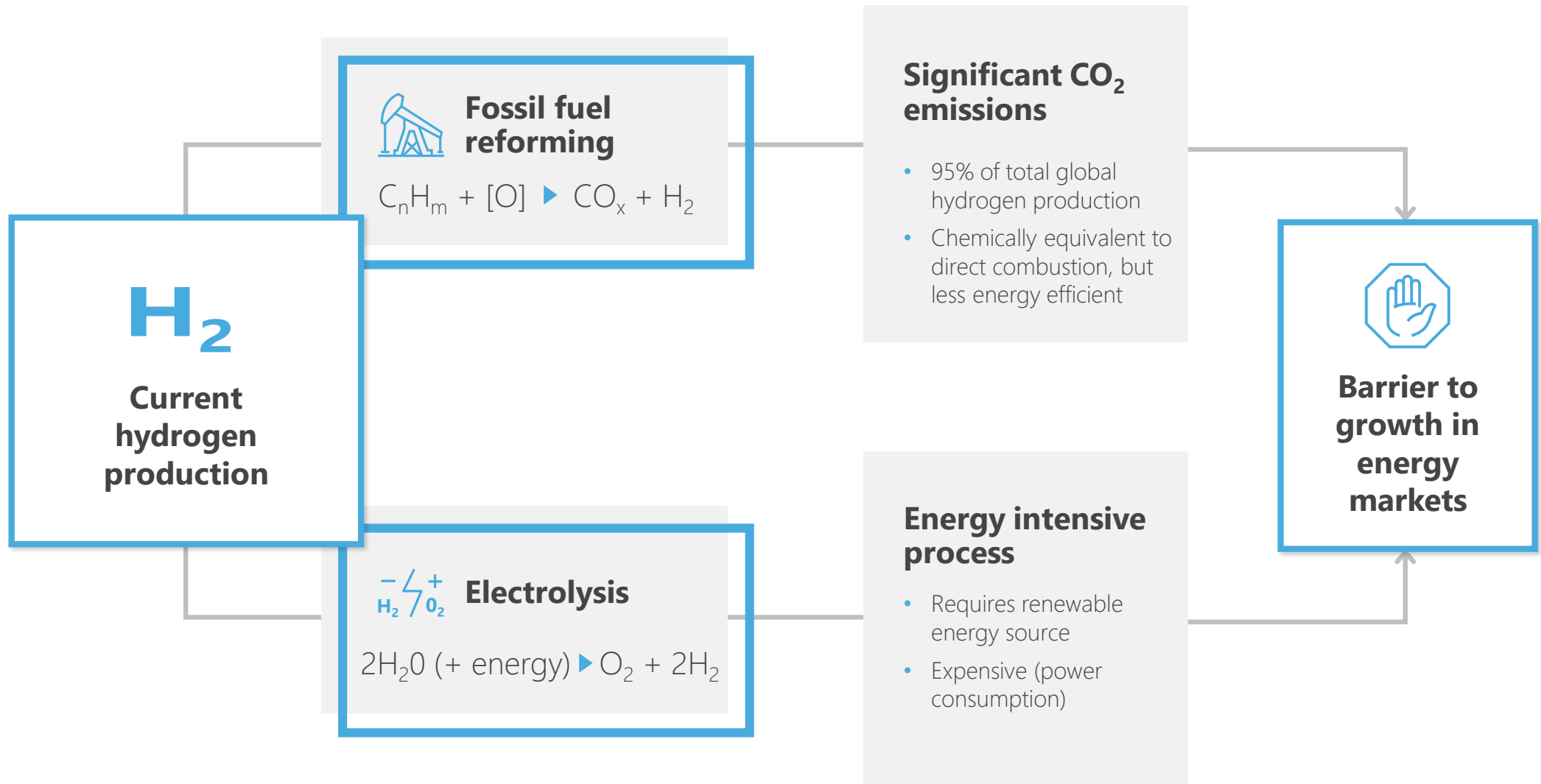
**Technical development successfully progressed to enable transitioning into commercial phase with a strong focus on additional partnerships and offtake.**



**Multiple potential revenue streams.**

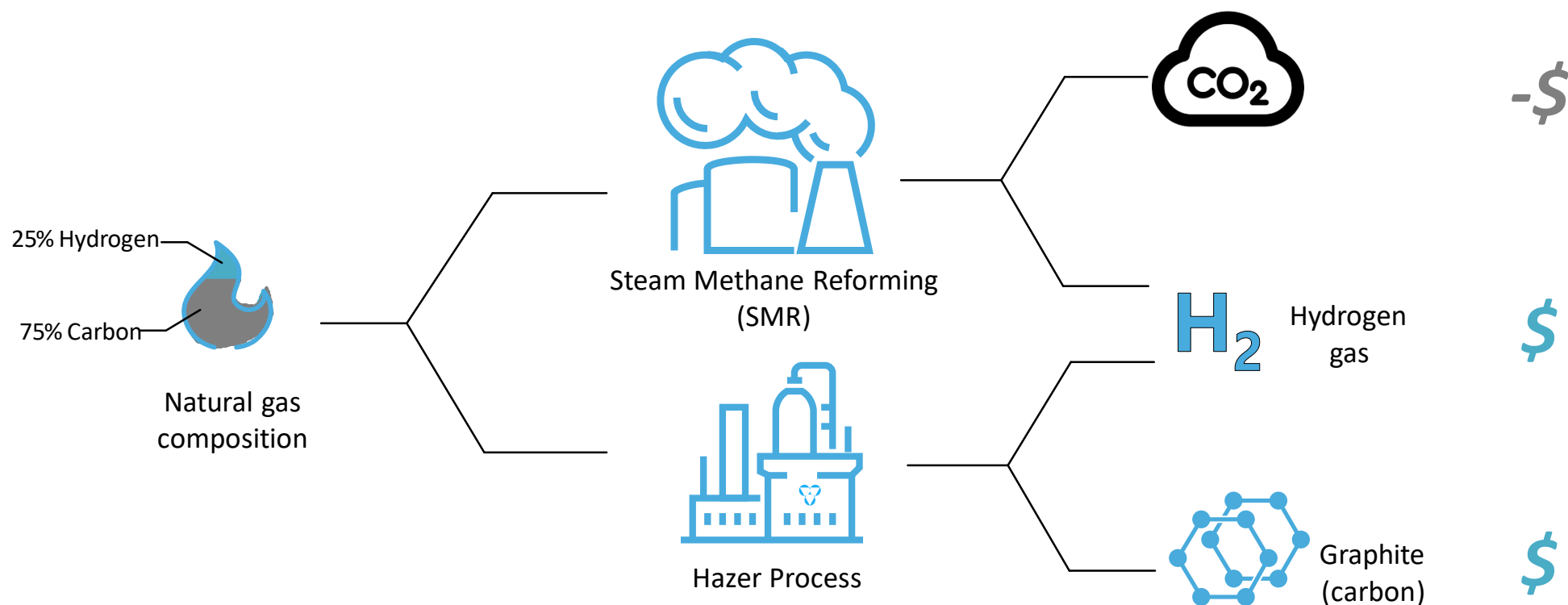
# WHY CURRENT HYDROGEN PRODUCTION IS RIPE FOR DISRUPTION?

Production is high in emissions or expensive



# THE HAZER ADVANTAGE

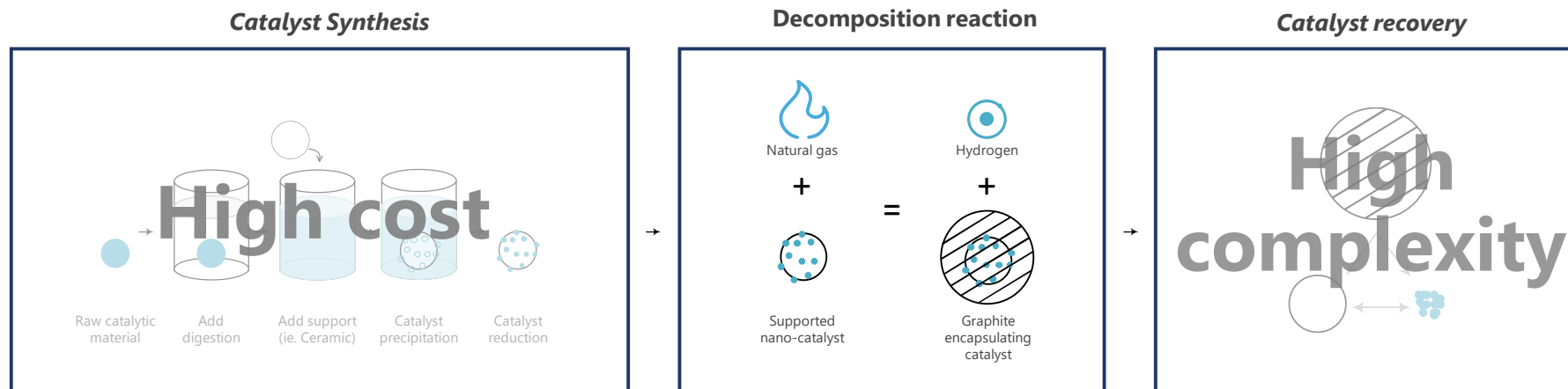
Capturing more value of feedstock gas and dual revenue streams



# THE BREAKTHROUGH

## Methane Decomposition - Simplified approach to old science

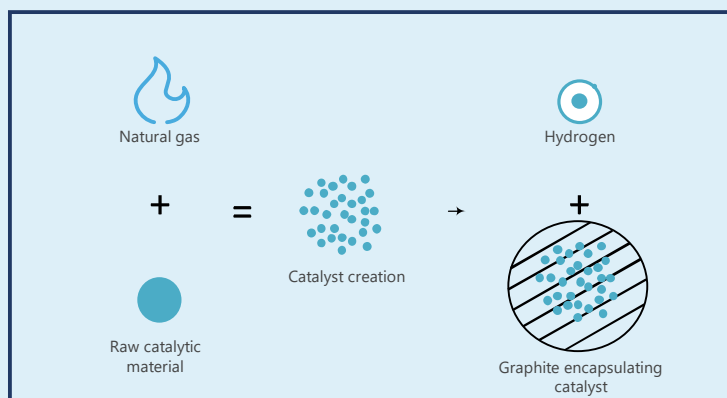
### Traditional methane decomposition research



### Hazer Group

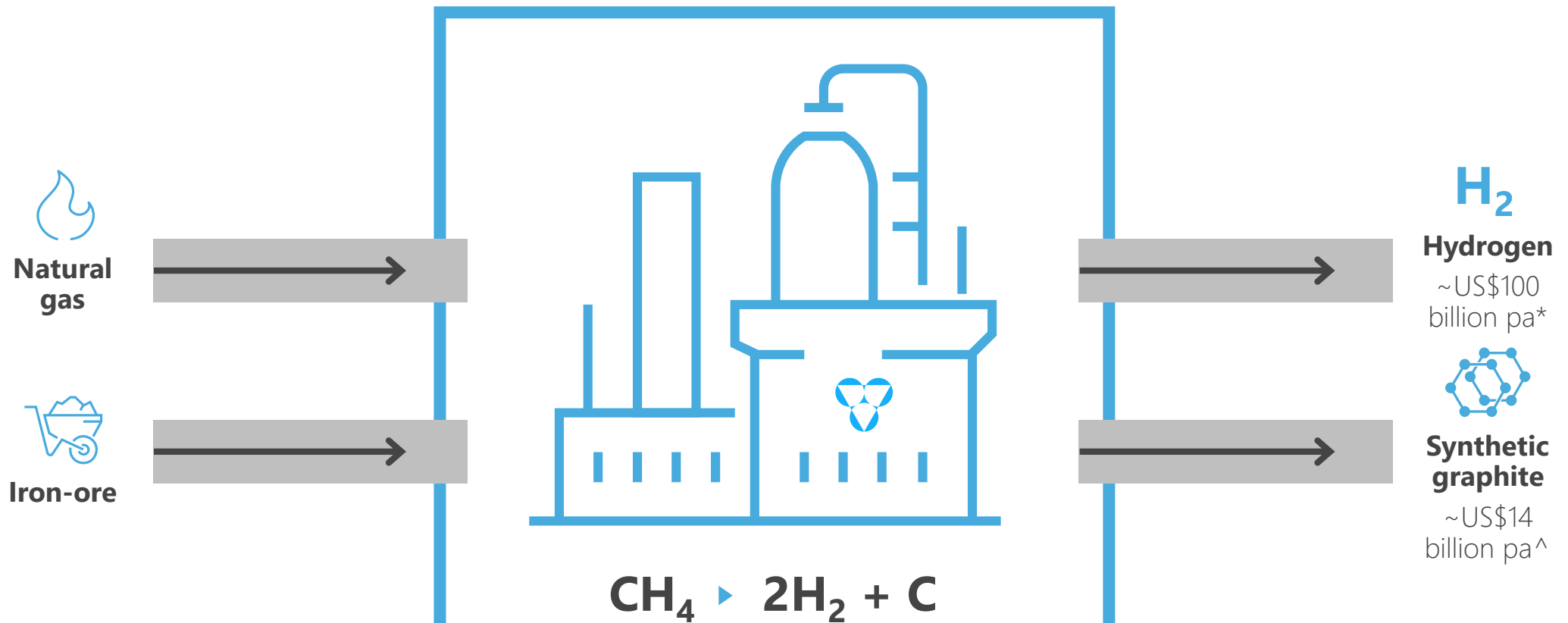
- Reaction creates catalyst from cheap material
- No need for catalyst synthesis
- No need for catalyst recovery and reuse

### Decomposition reaction



# THE HAZER PROCESS

Hydrogen and graphite from natural gas



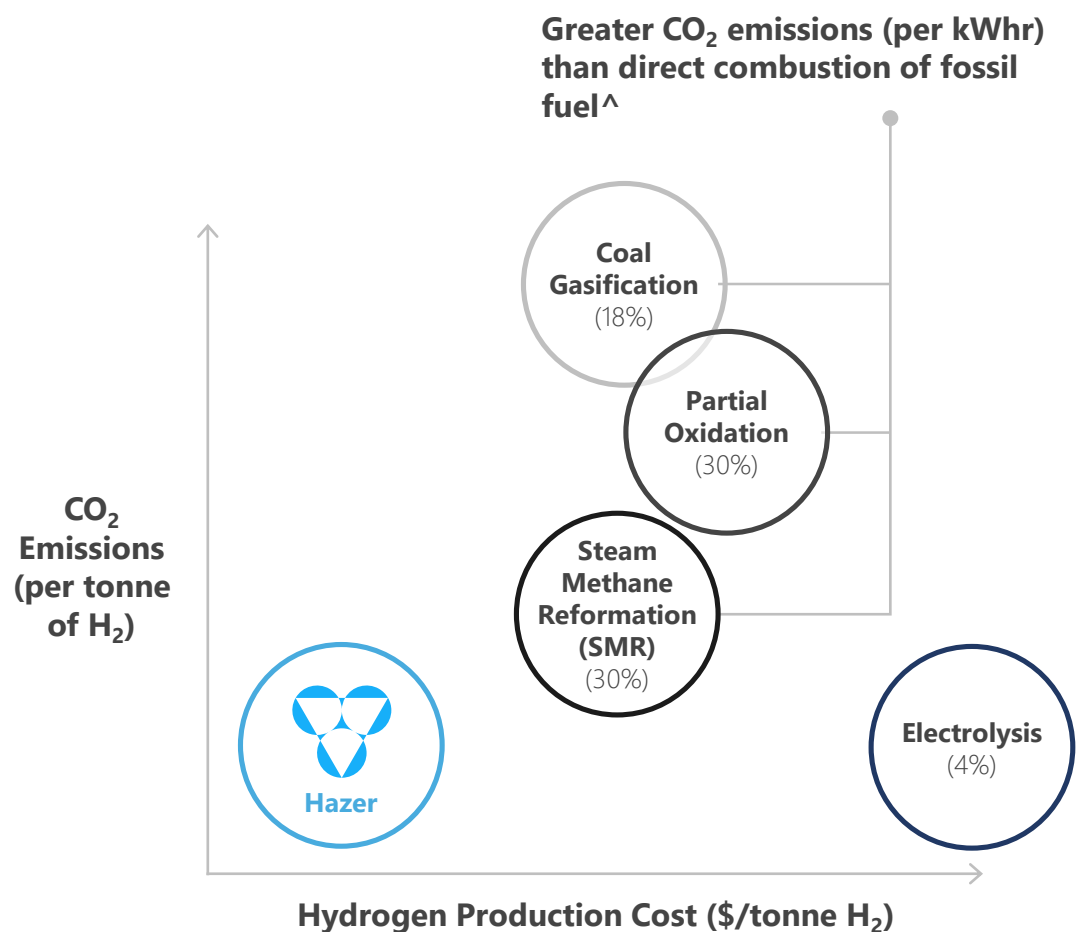
\* "Hydrogen Generation Market – Global Trends and Forecasts to 2019", Market to Markets report, pg 45

^ "Global Market Study of Graphite Market", Persistence Market Report, pg 14

# HAZER HYDROGEN COMPARISON

Positioning as a low cost, low emission alternative

Targeting low cost, low emission hydrogen production



Significant emissions reductions.



Emissions can be reduced further by harnessing clean energy options.



Lower operating cost\* through graphite sales to enable access to US\$100 Billion Industrial hydrogen market.



# OPPORTUNITIES IN THREE MAJOR GLOBAL MARKETS



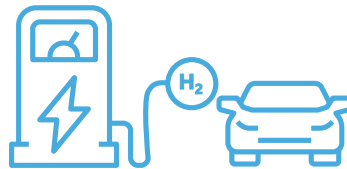
## Industrial hydrogen US\$100 billion\*

### Low emission, low cost alternative

Currently primarily addressed by fossil fuel reformation processes (high CO<sub>2</sub> byproduct).

Hazer has potential to deliver significant cost savings with graphite revenue offset.

Industry is beginning to turn toward cleaner solutions.



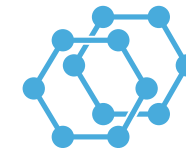
## Clean hydrogen and energy US\$12 billion<sup>a</sup> by 2023 (FCV)

### Multiple applications

Clean (low carbon) hydrogen has price or value premium to standard hydrogen.

Key component of clean energy future ( $H_2 \Rightarrow H_2O + \text{energy}$ ).

Fundamental cost, energy limitations for existing clean hydrogen production options.



## Synthetic graphite US\$14 billion<sup>^</sup>

### High quality, low cost graphite source

Growth - energy storage (batteries)

Graphite has a wide range of desirable properties and is used in a range of industrial materials applications.

Current methods of graphite production (natural or synthetic) are costly and have significant environmental impacts.



# MULTIPLE CLEAN HYDROGEN APPLICATIONS

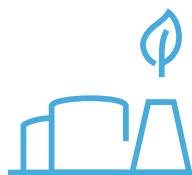


## Clean energy – Vehicle fuel and stationary power

Fuel Cell Vehicle (FCV) models being developed.

Potential distribution via traditional clean energy systems, including hydrogen injection into gas pipelines

Cost, energy and carbon emission barriers for existing hydrogen production methods .

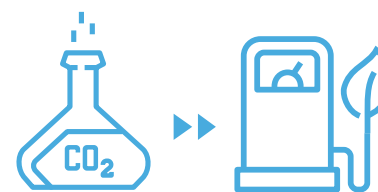


## Clean Industrial Hydrogen Market

Traditional industrial hydrogen users are seeking cleaner alternatives.

This offers opportunities to disrupt the large and growing industrial hydrogen market

Recent attention has been in iron production, and green ammonia.



## Carbon Capture and Utilisation (CCU)

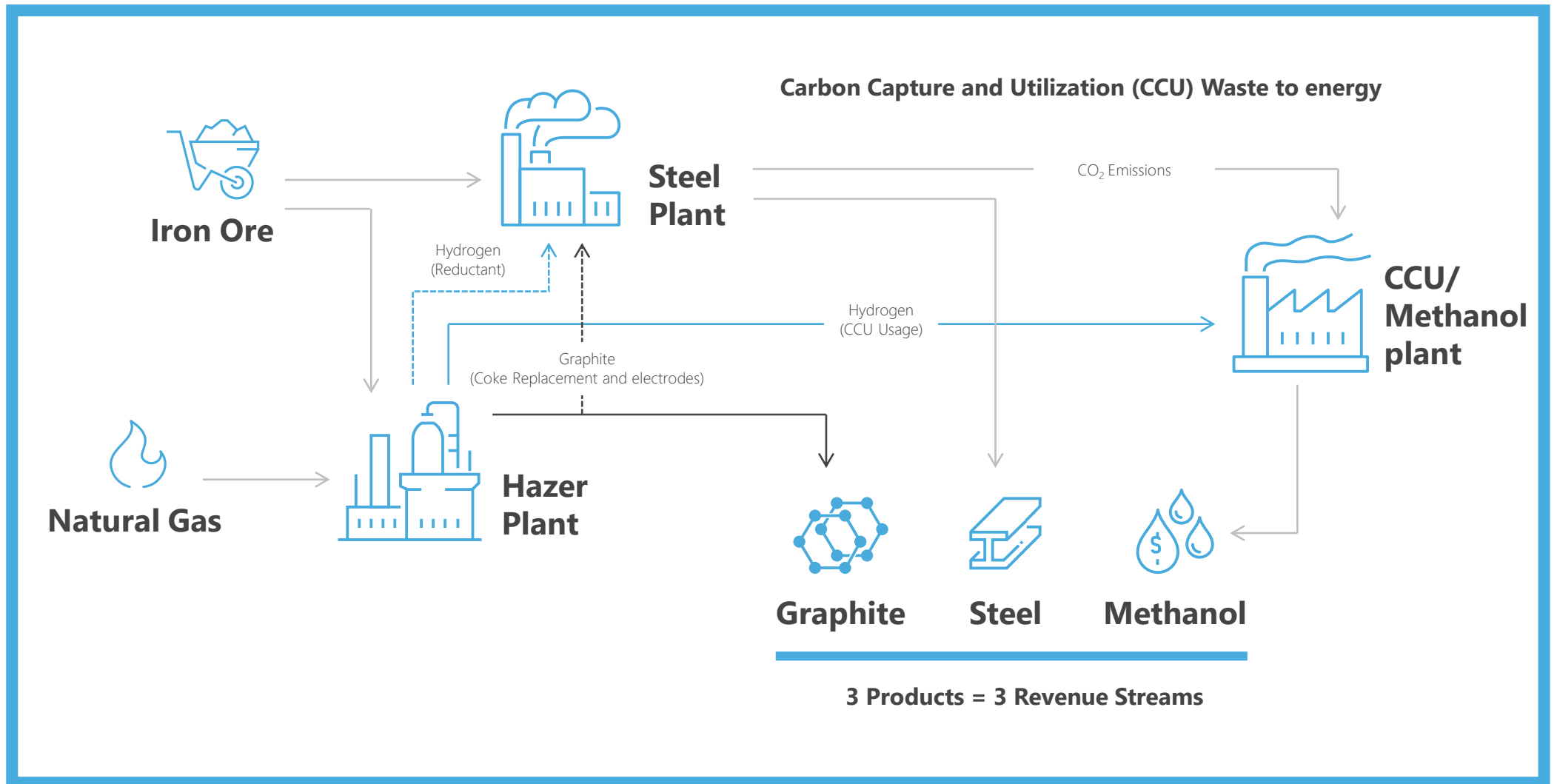
An alternative to CCS (Carbon Capture and Storage), where CO<sub>2</sub> emissions can be captured and used as feedstock for other chemical products.

These include methanol and liquid fuel (diesel).

Low cost, low emission hydrogen will be in demand as a key additional feedstock.

# INDUSTRIAL HYDROGEN MARKETS TRANSITIONING TO LOW CARBON HYDROGEN

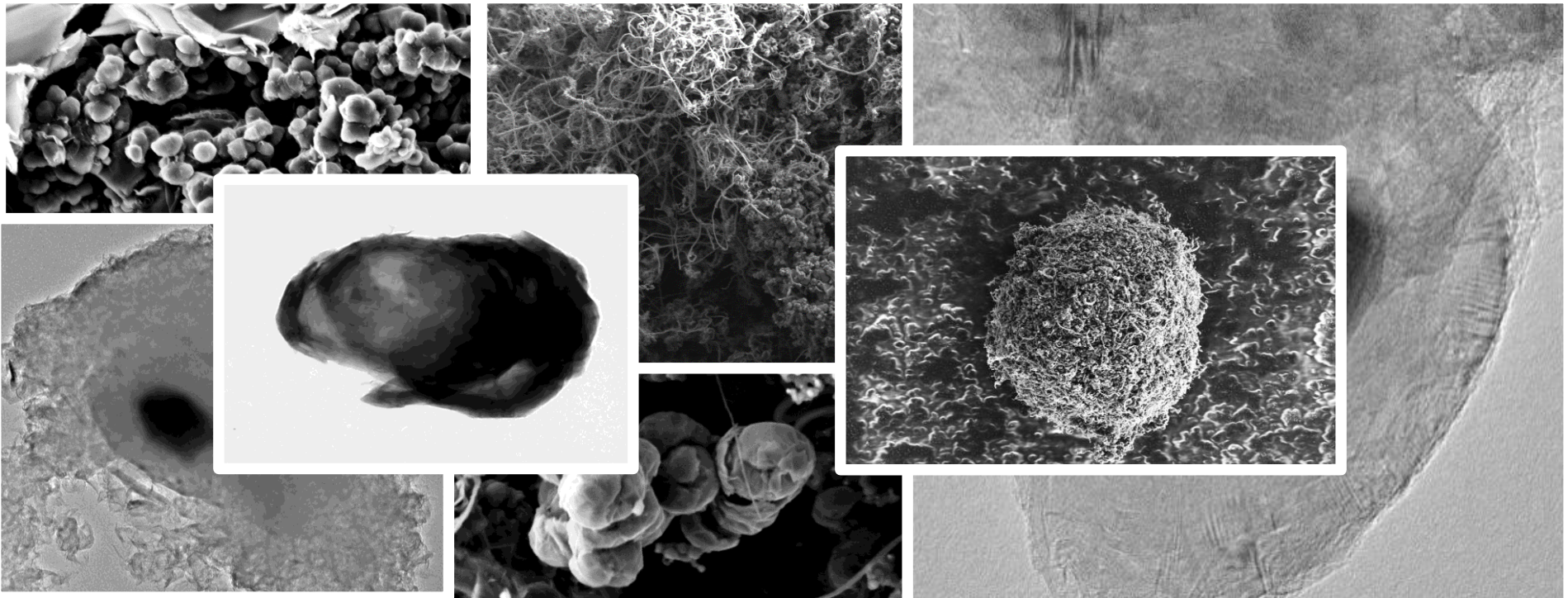
Conceptual Hazer plant integration into steel production with CCU



# HAZER GRAPHITE

## VERSATILE PROPERTIES – MANY OPPORTUNITIES

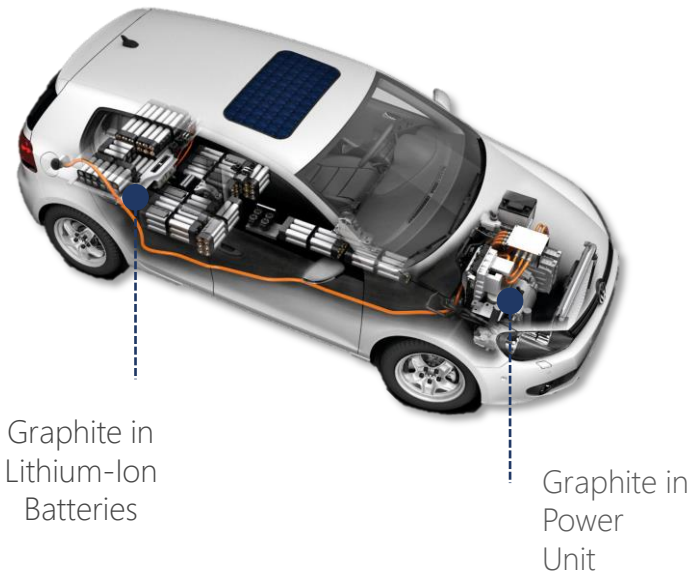
- Current graphite market value in excess of US\$ 14 Billion per annum<sup>^</sup>
- Hazer graphite structure and properties can be altered to potentially suit different market by changing the process conditions
- Graphite purity ex reactor can range between 80-95%wt, and can be purified to 99.9%<sup>></sup> with standard purification techniques
- Promising preliminary results in using Hazer Graphite in Li-ion batteries



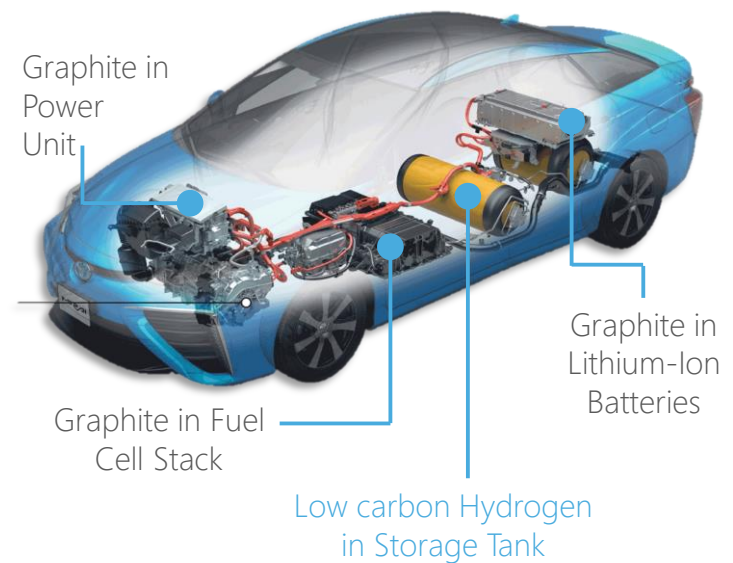
# HYDROGEN & GRAPHITE SYNERGY

Potential to be a major part of the revolution in future mobility

## Electric Vehicle

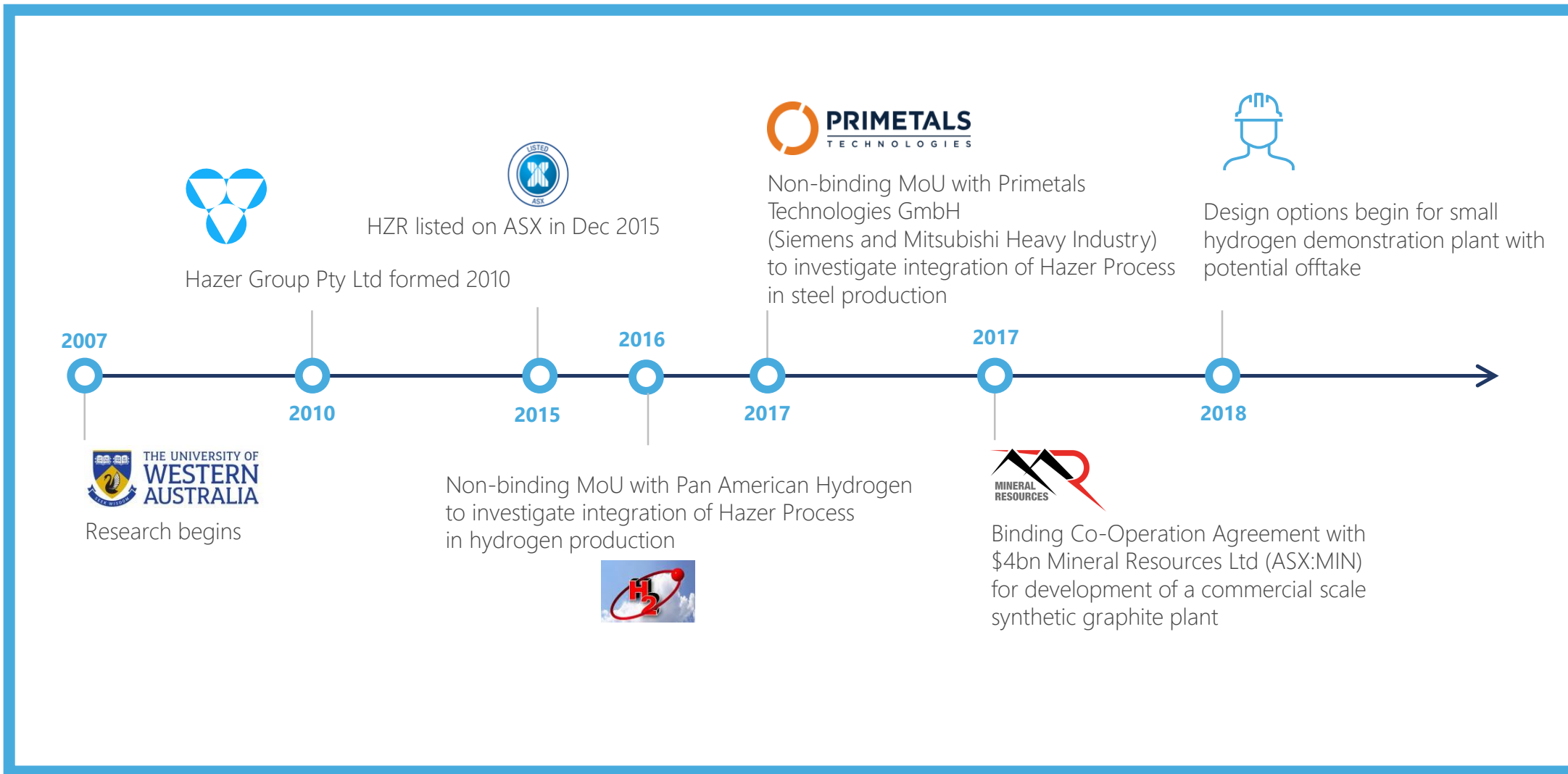


## Fuel Cell Vehicle



# STRONG COMMERCIAL PROGRESS SINCE IPO

## Milestones





# COLLABORATION WITH ASX:MIN

Investment and Commercial Partner



March 2017 MIN made a A\$5M strategic placement and significantly increased their stake in Hazer to 14%.

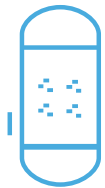
December 2017 binding agreement for the potential development of a commercial scale synthetic graphite facility;

- MIN to fund the commercial development.
- Hazer to obtain royalties from graphite sales.
- Stage 1 commissioning to commence Q3 2018.
- Stage 3 target production of 10,000tpa.



# MULTIPLE REACTOR OPTIONS

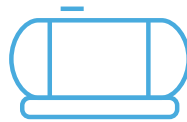
Using Hazer Process



Hazer Reactor

## **Fluidised Bed Reactor FBR**

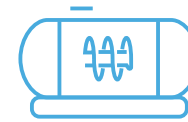
Reactor flexibility allowing for a range of graphite purity options and high hydrogen production with best productivity for reactor size.



External Reactor

## **Rotary Tube Reactor RTR**

Alternative off the shelf reactor design identified for a range of graphite purity options, medium hydrogen production but lower productivity for reactor size.



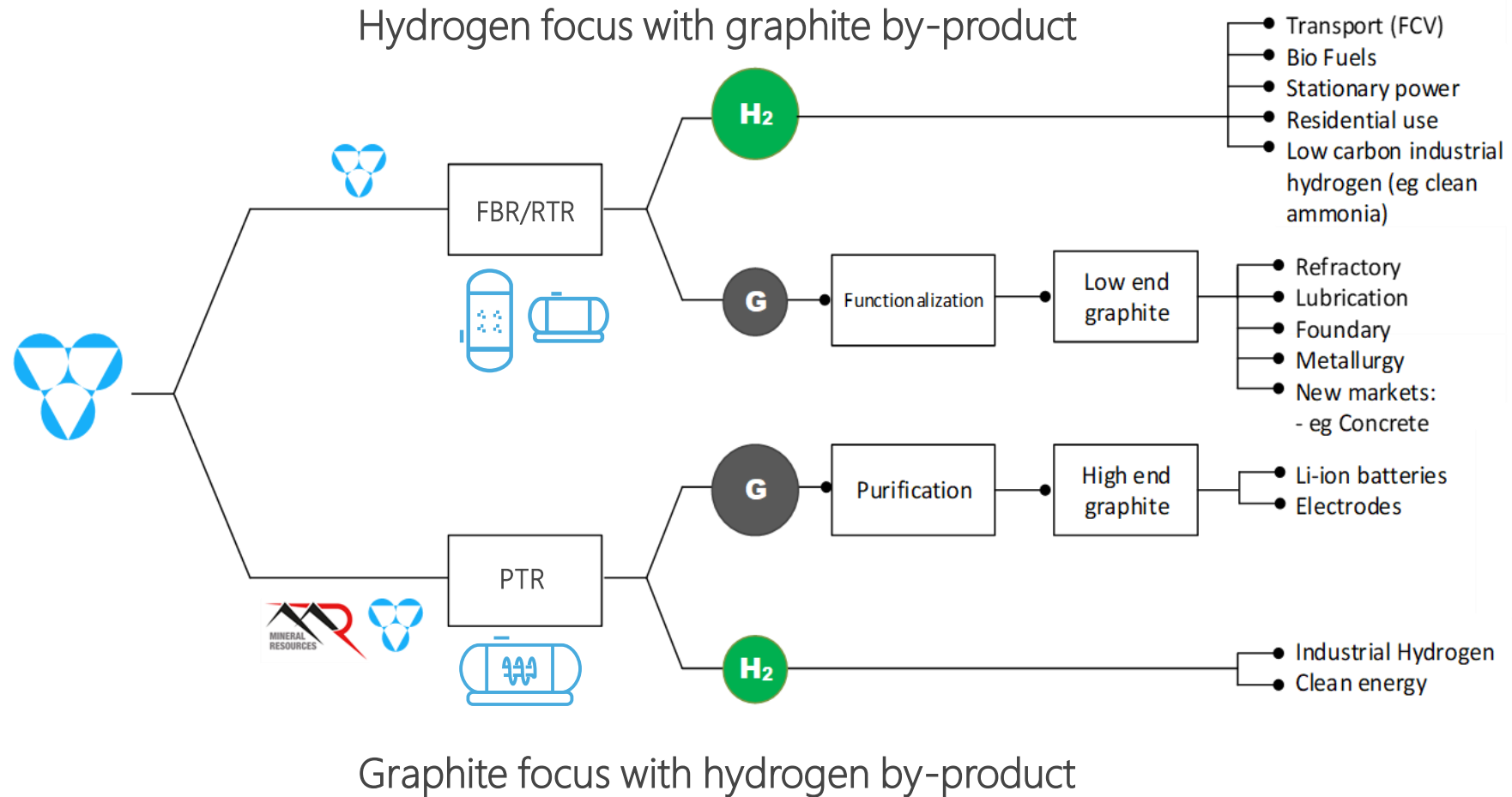
MRL/HZR Reactor

## **Paddle Tube Reactor PTR**

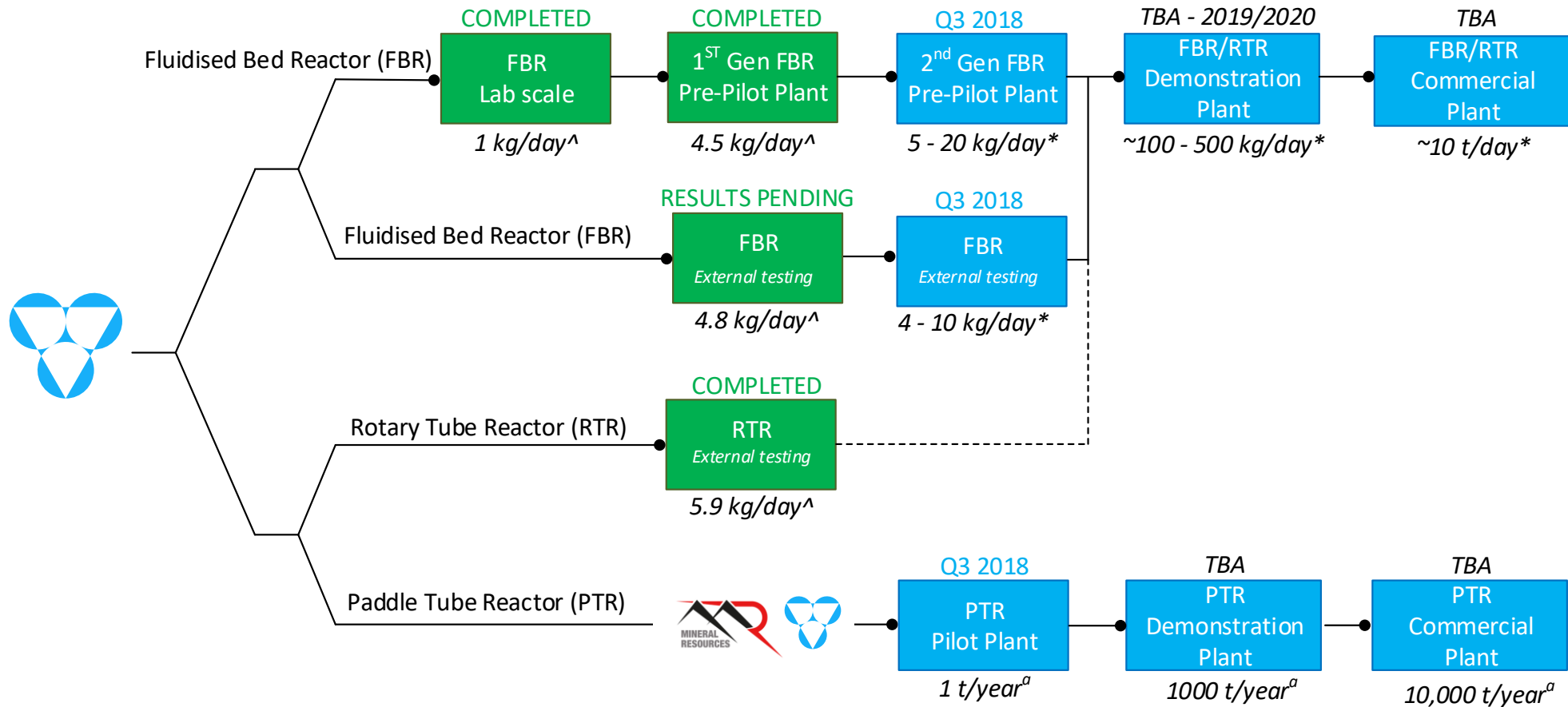
Reactor tailored towards production of high purity graphite for battery applications with good hydrogen potential.



# PROPOSED PATHWAY & POTENTIAL MARKETS



# SCALE UP TECHNICAL DEVELOPMENT



<sup>^</sup> Actual equivalent graphite capacity rate achieved (unpurified)

<sup>\*</sup> Nominal graphite target capacity (unpurified)

<sup>a</sup> Nominal graphite target capacity (purified)

These rates are given in terms of graphite capacity for comparative purposes only. Each plant will inherently produce hydrogen in addition to graphite. The ratio of hydrogen to graphite is approximately 1:4.

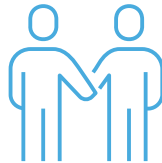
# MULTIPLE COMMERCIAL OPTIONS

## Using Hazer Process



### **License**

License IP to 3rd parties and generate high margin royalty



### **Partnership**

Share capital & operating costs with hydrogen or graphite partners



### **Build, Own & Operate**

Hazer can construct own and operate plants and sell products

**Currently investigating multiple options across different business models**

# REDUCE CASHBURN & INCREASE NEWSFLOW



## Reduce Operating Costs

- Cash burn reduced in budget forecast to below \$1M/quarter by Q4 2018\*



## Scale Up Development

- Increase production rates and product quality for PPP
- Begin design process for demonstration plant and identify offtake potential
- Operation of 1 tpa PTR in Q4 2018 with MRL



## Graphite Development

- Ongoing development in Li-ion batteries
- Ongoing testing in other markets

# STRONG LEADERSHIP

Commercial, Technical, Contract & Regulatory expertise



Mr Tim Goldsmith  
**Chairman**

- Over 20 years as Partner with global professional services group PwC
- Leader of PwC's Mining Group, and National China Desk leader at PwC
- Over 30 years corporate and commercial experience across international mining and industrial business operations



Mr Simon Rushton  
**NED**

- Executive General Manager - Corporate Development at Mineral Resources Limited
- 18 years global corporate experience in financial, advisory and legal roles
- Corporate contracts including M&A expertise within the mining sector



Ms Danielle Lee  
**NED**

- Corporate lawyer with more than 23 years' experience shared between private law firms and the ASX
- Main practice areas are corporate advisory, governance and equity capital markets; regularly advises on issues relating to the Corporations Act and ASX Listing Rules



Dr Andrew Harris  
**NED**

- Lead Director of the Engineering Excellence Group, Laing O'Rourke
- Professor of Chemical and Biomolecular Engineering at the University of Sydney
- Previously the CTO of Zenogen, a hydrogen production technology company, and a co-founder of Oak Nano, a start-up commercialising novel carbon nanotube technology

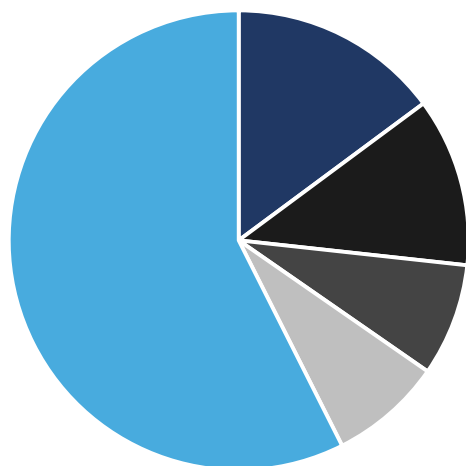
# TIGHTLY HELD REGISTER

Top 20 own 42%

## Capital Structure

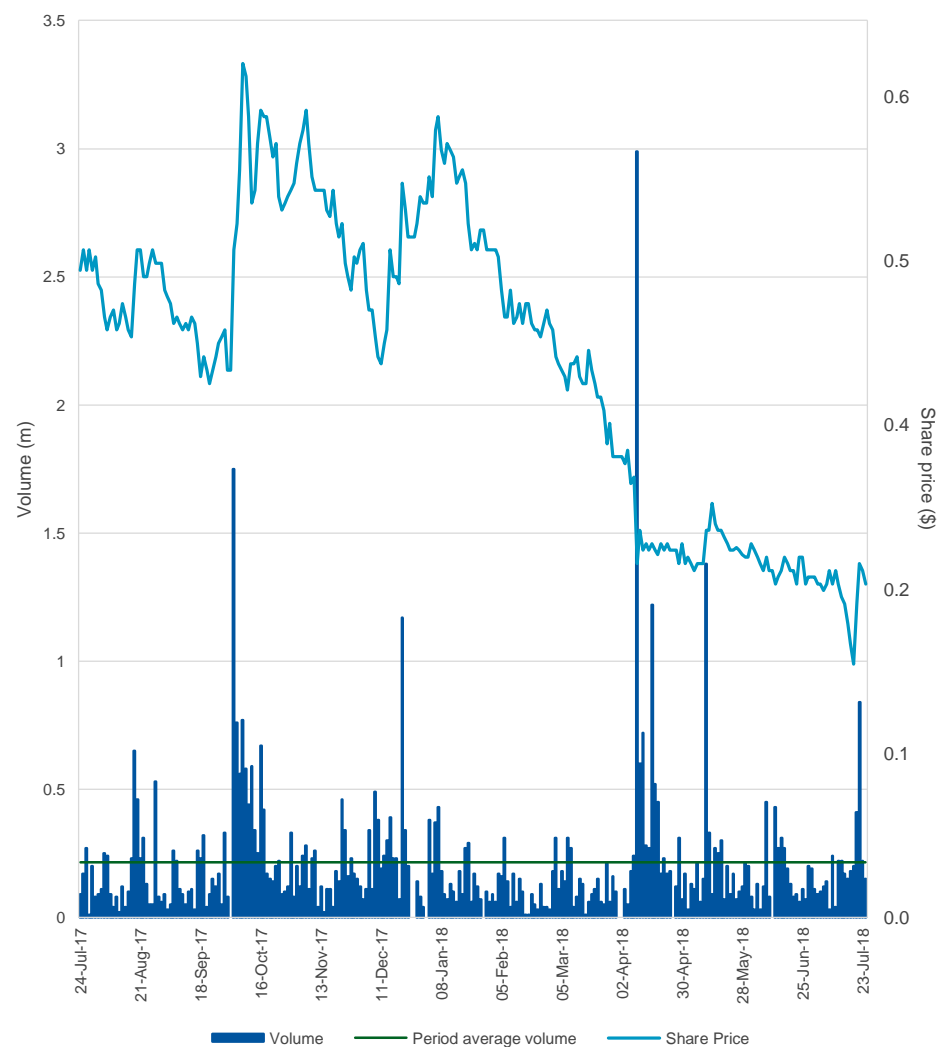
Current Shares on Issue	88.3m
Market Capitalisation @\$0.265	\$23.4m
Cash @ 31 March 2018	\$7m
Total Options	68.4m
<\$0.30 Options Exercise Dec 2018	30.2m
Diluted Market Cap (<\$0.30 options)	\$31.4m
Total Cash From <\$0.30 Options Exercise Dec 2018	\$8.8m
Total Cash From all options	\$33.6m

## Substantial Shareholders



- Top 20 ex substantial shareholders holding >5%
- Mineral Resources Ltd
- Geoff Pocock Entities
- Andrew Cornejo
- Other

## Share Price & Volume



# Why Invest?



**Disruptive, global and scalable low cost low energy solution to a Decarbonised hydrogen future.**



**Technical development successfully progressed to enable transitioning into commercial phase with a strong focus on additional partnerships and offtake**



**Multiple potential revenue streams.**



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# HAZER GRAPHITE SHOWS PROMISE IN LI-ION BATTERIES



Preliminary testing of Hazer graphite in coin cell Li-ion batteries show equivalent performance to commercial synthetic spherical graphite.

