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SPEC BUY

Current Price	$0.60
Market Cap.	$38m

Ticker:			HZR.ASX
Sector:			Chemicals
Shares on Issue (m):			64.6
Market Cap ($m):			38.4
Net Debt / (Cash) ($m):			(4.7)
Enterprise Value ($m):			33.8
52 wk High/Low:		0.80	0.26
12m Av Daily Vol (m):			0.26

Key Metrics

	15A	16A
EV/EBITDA (x)	n/a	n/a
EV/EBIT (x)	n/a	n/a
P/E (x)	n/a	n/a

Financials:

	14A	15A	16A
Revenue ($m)	n/a	0.0	0.0
EBITDA ($m)	n/a	-0.5	-1.9
EBIT ($m)	n/a	-0.5	-1.9
NPAT ($m)	n/a	-0.5	-1.8
Net Assets ($m)	n/a	0.5	4.4
Op CF ($m)	n/a	-0.2	-1.5

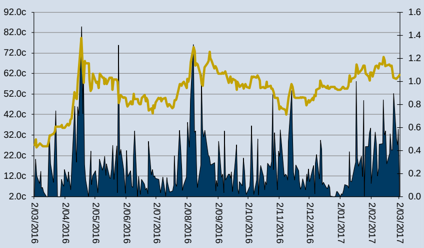
Per Share Data:

	14A	15A	16A
EPS (cps)	n/a	-1.44	-2.86
DPS (cps)	n/a	0.00	0.00
Div Yield	n/a	0.0%	0.0%
NTAPS (cps)	n/a	1.51	6.85
CFPS (cps)	n/a	-0.65	-2.25

Substantial Shareholders:

Board / Management	8.2%
Mineral Resources Limited	3.1%

Share Price Graph



Business Summary: Hazer Group (HZR) has disruptive technology for splitting natural gas into two higly valuable products, hydrogen and graphite. HZR's key differentiator is its use of low cost and abundantly available iron-ore as the catalyst for the methane cracking process.

Thursday, 2 March 2017

Hazer Group (HZR)

Initiation – Cracking the Code

Analysts | Daniel Williamson | Ian Christie, CFA

Quick Read

We initiate coverage of HZR with a speculative buy call. HZR's technology to process natural gas into hydrogen and graphite has the potential to be highly disruptive and presents substantial value if the process can be scaled up to commercial quantities. HZR has advanced down the path to commercialisation, de-risking the technology and unlocking value along the way. The potential reward is large.

View | Plenty of Upside

Highly disruptive technology: If commercialisation of the Hazer process is successful, this disruptive technology has the potential to capture all the value in natural gas and benefit from exposure to a number of high growth markets (including the graphite market for Li-ion batteries and the hydrogen market for fuel cell technology).

Key differentiator: HZR has cracked the code to a viable alternative 'methane-cracking' chemical process. Historically, commercialisation of methane cracking has been inhibited by high cost catalysts. The Hazer process uses low cost and abundantly available iron-ore as the catalyst; further, the carbon is captured "clean" as graphite rather than vented "dirty" as CO_2, as is the case for most current hydrogen production methods.

Global markets: HZR's targeted markets are highly valuable and have strong growth potential. The potential hydrogen fuel cell market is yet to be established but is pegged as a significant growth sector into the future as countries such as Japan target a 'hydrogen society'. Similarly, the battery market (consuming HZR's graphite) is set to take off as batteries become more size and cost effective. The established industrial hydrogen and graphite markets are currently worth over $100bn and $13bn respectively.

De-risking and unlocking value: HZR is currently scaling up the Hazer technology to full commercialisation. The Company's pre-pilot plant facility is under construction, representing the first step in taking laboratory-based standard equipment to a commercial-scale custom designed and constructed plant. CY2017 will see the Hazer process finessed through the pilot plant facility, with an eye to constructing and operating a full commercial-scale plant in CY2018.

Recommendation

Proving the technology can be scaled up from the lab to commercial scale is the key risk and it is premature to forecast earnings and cash flow. However, the potential for the disruptive Hazer technology to provide alternative supply to substantial current markets, in industrial hydrogen and synthetic graphite, is significant. Importantly, it also provides a genuine avenue towards adopting hydrogen as a 'clean energy' source. We initiate coverage with a speculative buy call.

Executive Summary

HZR uses low cost iron-ore as a catalyst to crack methane into hydrogen and graphite

Hazer technology: The Hazer process improves on existing thermocatalytic decomposition of methane, aka 'methane cracking', technology, to break-down natural gas into its constituent components (hydrogen and graphite). The process offers distinct advantages over existing hydrogen production methods because it can produce hydrogen with negligible carbon emissions, making it a potential 'clean energy' source. HZR's key differentiator is its use of low-cost iron-ore as the catalyst.

HZR is progressing along the road to commercialisation

Stage of development: HZR is moving down the path from laboratory scale testing to full commercial-scale industrial plants, de-risking the technology along the way. Construction on the pre-pilot plant facility is underway, expected to finish in March 2017. The pre-pilot facility will remain operational throughout CY2017. HZR expects to complete construction of a full-scale commercial prototype plant in CY2018.

HZR has multiple options for generating revenue from the Hazer process

Revenue model and earnings potential: HZR's business model is focussed on scaling up and commercialising the Hazer process. HZR has three potential business models; build-own-operate their own plant, partnering with clients seeking one of HZR's products (and potentially profiting from the sale of unwanted by-products), or licensing their technology to end users of the Hazer process.

Hydrogen fuel cell technology and Li-ion batteries are expected to drive growth in HZR's key target markets

High growth markets: Whilst there currently exists a very limited hydrogen energy market, there is a large push to adopt hydrogen as a clean energy source of the future, with HZR's technology ideally suited as a negligible emission hydrogen production process. HZR's graphite product has performed on par with existing synthetic graphite in preliminary battery tests, positioning it perfectly to take advantage of the Li-ion battery boom.

The global hydrogen market is valued at over $100bn…

The hydrogen market: The industrial hydrogen market is currently valued at approximately $118bn, with future growth to be driven by higher levels of refinement required of lower quality crude oils and higher demand for ammonia-based fertilisers.

… and the global graphite market is valued at over $13bn

The graphite market: The global graphite market is currently valued at approximately $13bn, with the bulk of graphite consumed in metals processing plants.

HZR has applied for patent protection over the Hazer process

Regulatory: HZR has applied for 3 patents associated with the Hazer process, protecting the Groups IP. HZR also has key strategic partnerships in place to advance the Hazer process through to commercialisation. Importantly, HZR will continue to own all the IP associated with the Hazer process royalty- and encumbrance-free.

Key risks to HZR investors are funding, timing and technical development of the Hazer process

Risks: The key risks to investors in HZR are funding, timing and technical development of the Hazer process. HZR's closing cash balance at the end of the second quarter of FY17 was approximately $3m, and the operating cash outflow for the second quarter of FY17 was $935k. At these cash burn rates, HZR will require further funding during CY2017.

HZR has a strong and diversified board

Board and management: HZR has appointed a strong board with extensive experience and a diverse array of skill-sets. In our view the development and technical staff have the know-how to commercialise the Hazer process.

The Hazer Process

Methane is 'cracked' into carbon (graphite) and hydrogen

The Hazer process improves on existing hydrogen production methods by capturing all the value in the natural gas feedstock, whilst proving superior to other 'methane cracking' processes through the use of a low-cost catalyst. As a result, HZR has made the chemical process of splitting natural gas into its constituent components (graphite and hydrogen) more commercial.

Negligible CO_2 emissions are produced through the Hazer process

Figure 1: The Hazer process explained

Source: HZR releases

Current hydrogen generation technologies produce significant amounts of CO_2

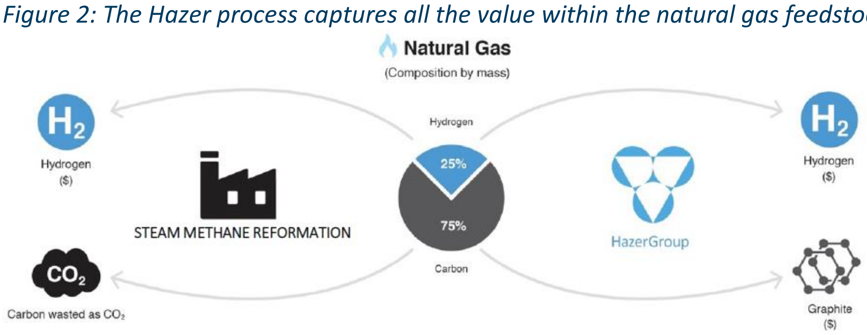
Current hydrogen production methods (namely steam reforming of natural gas and partial oxidation of Hydro-carbons) produce significant amounts of CO_2, mitigating hydrogens potential as a clean energy source. By capturing the carbon as graphite, the Hazer process opens up wider opportunities for the use of hydrogen as a negligible carbon emissions energy source. Additionally, the Hazer process can be adapted to create a range of graphite morphologies, enabling HZR to target multiple specialised markets and end user applications. The graphite produced by the Hazer process is high purity, >90% total graphitic content (TGC), with a highly crystalline structure.

Low cost and abundantly available iron-ore is the catalyst in the Hazer process

Alternative methane cracking processes have not been commercially viable for two main reasons: disproportionately expensive catalysts and until recently a lack of potential markets for the graphite. The Hazer process solves the former by using 'run-of-the-mill' iron ore as the catalyst for the methane cracking procedure. The use of such a low-cost catalyst is the true competitive advantage of the Hazer process. A global market for high purity graphite is rapidly developing with significant growth expected in coming years due to the lithium-ion battery boom.

The Hazer process captures all the value within the natural gas feedstock

Figure 2: The Hazer process captures all the value within the natural gas feedstock



Source: HZR releases

Stage of Development

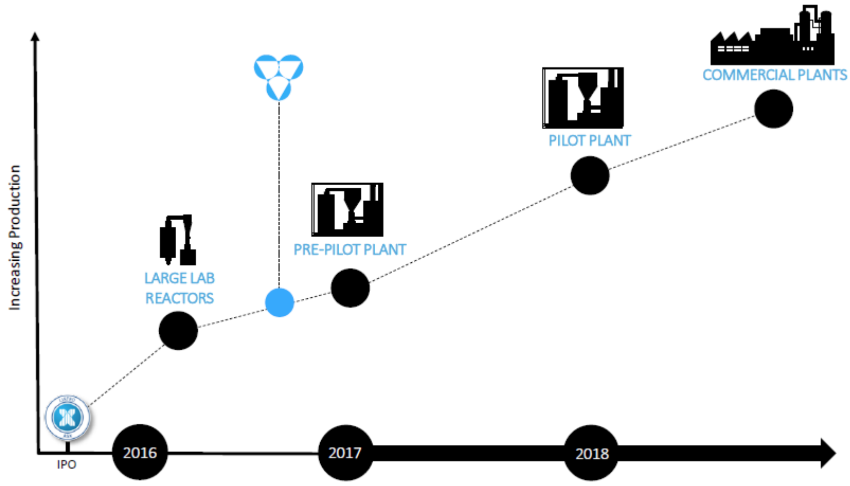
HZR has increased operations from laboratory-scale to the first industrial pre-pilot plant

HZR has proven the Hazer process at the laboratory scale, with further increases in operating scale to pre-pilot plant in early 2017. HZR has successfully increased operating capacity by 3,400x since March 2016, with the latest results producing over 1kg of synthetic graphite in a single batch at an effective graphite production rate of 1.5kg/day. Whilst scaling up the process, HZR has also demonstrated increases in graphite purity to over 95% (up from 86%).

HZR is initially targeting a 100kg/day hydrogen plant

The initial focus of HZR is to develop commercial-scale plants capable of hydrogen production rates of over 100kg/day (graphite production rates are 3 times that of hydrogen). HZR's results to this point demonstrate the technical viability of the process, with pilot plant facilities in CY2017 set to demonstrate the scalability of the process and set it on the path to full commercialisation of the Hazer process.

Figure 3: Scale up roadmap for the Hazer process



Source: HZR releases

HZR's partnerships with key hydrogen plant manufacturers provides a clear path to commercialisation

HZR has finalised a research collaboration agreement with Sydney University, and has an agreement with South African chemical engineering group Kemplant and a MoU with Pan American hydrogen Inc (PAH), a Texas-based global supplier of hydrogen systems. Importantly, HZR maintains all ownership of intellectual property developed through the Sydney University collaboration, and will continue to own all the intellectual property associated with the Hazer process royalty- and encumbrance-free.

Figure 4: HZR collaboration and partnership agreements

Partner	Basis of Partnership
Sydney University	- Continue scale up of Hazer process - Further improve the characteristics of the graphite produced from the process
Kemplant	- Assist with the development of Hazer's pilot plant, to showcase the Hazer techology
Pan American Hydrogen Inc (PAH)	- Jointly develop a technical roadmap for the integration of Hazer technology into standard hydrogen production units designed by PAH

Source: HZR releases

Revenue Model and Earnings Potential

HZR's business model is focused on scaling up and commercialising the Hazer process so as to supply hydrogen gas and high purity bulk graphite to the significant global hydrogen and graphite markets. Initially HZR expects to generate revenue by building, owning and operating their own process plants using the Hazer technology. From these plants, HZR will be a merchant supplier of hydrogen and high-purity graphite products.

HZR envisages a BOO model initially to prove the technology is applicable on a commercial scale

HZR envisages that through this initial build, own, operate phase, the company will demonstrate the commercial viability of the Hazer technology, and from this be able to license or partner the technology to third-party end users. Through this, HZR will generate high-margin income from licensing fees for the use of the Hazer technology. HZR can also share capital and operating costs with partners that are only interested in one product, generating income from the sale of the unwanted product and through licensing fees.

The earnings potential for HZR is significant and the growth potential in its target markets is large. HZR has three distinct markets to target with its technology and the subsequent end products of the Hazer process: industrial hydrogen, the hydrogen energy market, and the graphite market. All of these markets are expected to grow in the short- to medium-term, spurred by developments in the fuel-cell and lithium-ion battery markets.

HZR's target markets are large and will continue to grow

Figure 5: Potential global markets for the Hazer technology

Market	Notes	Size
Industrial H_2	- Oil refining, ammonia production, industrial chemicals - Price sensitive, technology agnostic - Currently addressed by fossil fuel reformation	***$100bn pa***
Graphite	- Industrial materials applications - Growth: energy storage (batteries) - Addressed by mining, synthetic graphite production	***$13bn pa***
H_2 Energy	- Key component of clean energy future - Fuel cell vehicles, stationary power applications ***- Fundamental cost/energy limitations for existing options***	***$? (new market)***

Source: HZR releases

There are three potential scales for a Hazer plant

The Hazer process can be scaled to target each unique global market. The approximate scale and target markets are:

1. Small modular plants capable of producing 100 to 1,000 kg of hydrogen per day, purposed for refuelling fuel cell electric vehicles or for powering small precincts/housing complexes (through hydrogen fuel cells).
2. Mid-sized in-situ plants capable of producing 5,000 to 15,000 tonnes of graphite per year, servicing lithium-ion battery manufacturers. The hydrogen by-product could potentially provide energy to the factory through fuel cells, or simply be vented as waste product.
3. Large in-situ plants capable of producing up to 100,000 tons of hydrogen per year, providing hydrogen to petroleum refineries and ammonia plants. The graphite by-product can be sold off to reduce hydrogen production costs. HZR is exploring options to retrofit their technology to existing hydrogen generation plants as an option for refineries and ammonia plants already in operation.

Cost of Production

Natural gas is the only consequential input cost to the Hazer process

The only input cost of significance to the Hazer process is the cost of the natural gas feedstock. The iron-ore catalyst costs are inconsequential (with 1kg of catalyst consumed for every 15kg of methane feedstock, iron-ore costs approximately 4c per kg of hydrogen produced in the Hazer process). The process heat can be supplied by burning unreacted natural gas. Given that the Hazer process has an approximate 60% conversion efficiency, 6-7kg of natural gas will be required to produce 1kg of hydrogen and 3kg of graphite.

Hydrogen can be produced for ~$2.75/kg and graphite for ~$920/tonne through the Hazer process

Given that 1 tonne of natural gas is equivalent to 56GJ of energy, and assuming that the price of natural gas is $8/GJ (current average industrial price on the East Coast), the cost of natural gas feedstock is 45c per kg. Therefore, the cost of the Hazer process is approximately $2.90 per kg of hydrogen produced or $975 per tonne of graphite produced (ignoring credits for unused by-products). The produced graphite needs to be purified through an acid-based process to qualify as 'battery grade'.

The bulk of hydrogen costs are associated with storage and transportation

Steam methane reforming, by comparison, consumes 4kg of natural gas for every kg of hydrogen. Using the above assumptions for the price of natural gas, steam methane reforming can produce hydrogen at a cost of $1.70 per kg (ignoring the potential cost of CO_2 emissions). The cost of hydrogen is highly dependent on its intended end use and where it is produced relative to its site of end-use. If produced remotely, the storage and transportation costs of hydrogen can be up to $6 to $7 per kg. Pricing in the graphite industry is relatively opaque, but some estimates indicate that battery-grade graphite can sell for upwards of $5,000 per tonne.

Fuel Cell Refuelling Revenue

Hydrogen can be sold for ~$10/kg to be competitive with petrol as a vehicle fuel

In the case of fuel cell electric vehicle refuelling stations, current installed stations in California sell hydrogen for $14-16 per kg. To be on level-pegging with petrol, one kg of hydrogen needs to be priced at the equivalent of approximately 7-8 litres of petrol. In different countries, this will mean a different price per kg of hydrogen. To compete with petrol the approximate price per kg hydrogen in the US is US$6/kg (A$7.80/kg), in Europe is €10/kg (A$13.80/kg) and in Australia is A$12/kg. This indicates that hydrogen refuelling stations will offer relatively high margins for the Hazer process.

High Growth Markets

Hydrogen Fuel Cells

Japan is targeting becoming a 'hydrogen society' by the 2020 Tokyo Olympics

A developing global market is the hydrogen fuel-cell market, driven by the need for cleaner energy sources. Japan is seeking to become a "hydrogen society" by the 2020 Tokyo Olympics, with the Tokyo Metropolitan Government creating a US$348 million fund for setting up hydrogen refuelling stations and other infrastructure. A push towards clean energy will increase the adoption of hydrogen as a fuel source, with the Hazer process perfectly positioned to service this market due to its negligible carbon emissions. It should be noted that many existing hydrogen production methods produce significant amounts of CO_2, making the produced hydrogen inappropriate for use as a clean energy.

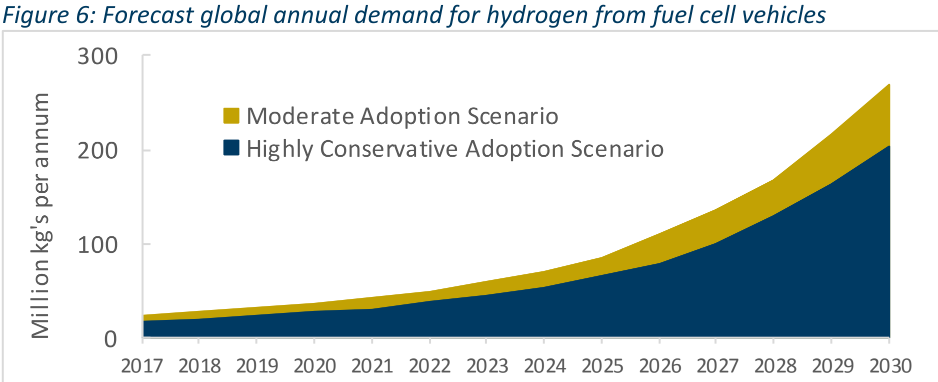
Hydrogen is a commercially viable alternative clean energy source

hydrogen fuel cells have the potential to power small precincts, creating 'green' communities. Targets for such precincts include innovation and tech parks around the world or small business districts seeking to reduce their carbon footprint. One such precinct currently being developed just outside of Liverpool, called Protos, is exploring the use of hydrogen fuel cells as a source of power for the site. AFC Energy, a producer of alkaline fuel cell systems, is proposing a 50MW commercial scale fuel cell power generation plant, providing electricity to Protos.

Hydrogen fuel cell cars are expected to substantially disrupt the global vehicle market

The fuel cell electric vehicle (FCEV) market size is estimated to reach over US$18bn by 2023 with the technology able to power airport tugs, forklifts, heavy duty vehicles and passenger vehicles. China has set the goal of having 50,000 FCEV's on the road by 2025 and 1 million by 2030. Japan plans to deploy 200,000 FCEV's by 2025 and 0.8 million by 2030. Significant hydrogen infrastructure is being developed. In Europe, the number of stations is expected to double biannually, with up to 400 stations in Germany alone by 2023, and California has set the goal of having 100 stations by 2020.

Figure 6: Forecast global annual demand for hydrogen from fuel cell vehicles



Source: 4th Energy Wave: The Fuel Cell and hydrogen Annual Review, 2016

FCEV's are already in production

Major automotive players are pursuing a dual solution for low-emission products. Three leading manufacturers already offer commercially available FCEV's; the Toyota Mirai, the Hyundai Tucson FCEV and the Honda Clarity, with other major car manufacturers set to join the list. FCEV's have a range of 400-600km on a 5kg tank of hydrogen. FCEV's offer a distinct advantage over pure electric vehicles in that they can achieve comparable ranges to petrol cars without the added weight of multiple batteries.

FCEV's can obtain similar ranges as conventional petrol cars

Figure 7: Comparison of FCEV performance

	Hyundai Tucson	Toyota Mirai	Honda Clarity	Petrol Comparison[(1)]
Fuel Consumption (l/100km)	n/a	n/a	n/a	7.7
H_2 Storage Capacity (kg)	5.63	5	5.46	n/a
Range (km)	424	499.2	585.6	785[(1)]
H_2 efficiency (kg/100km)	1.33	1.00	0.93	n/a

[(1)]Based on 2016 Toyota Corolla Sedan, empty tank

Source: Toyota releases, Hyundai releases, Honda releases, Argonaut estimates

Momentum in the FCEV industry will demand new hydrogen processing technology

All this momentum in the hydrogen fuel cell industry demonstrates the potential future growth in adopting hydrogen as a clean energy fuel source. The vehicle industry will provide the volume for adopting fuel cell technology but there is the added potential of large power generation projects using hydrogen as the main fuel source.

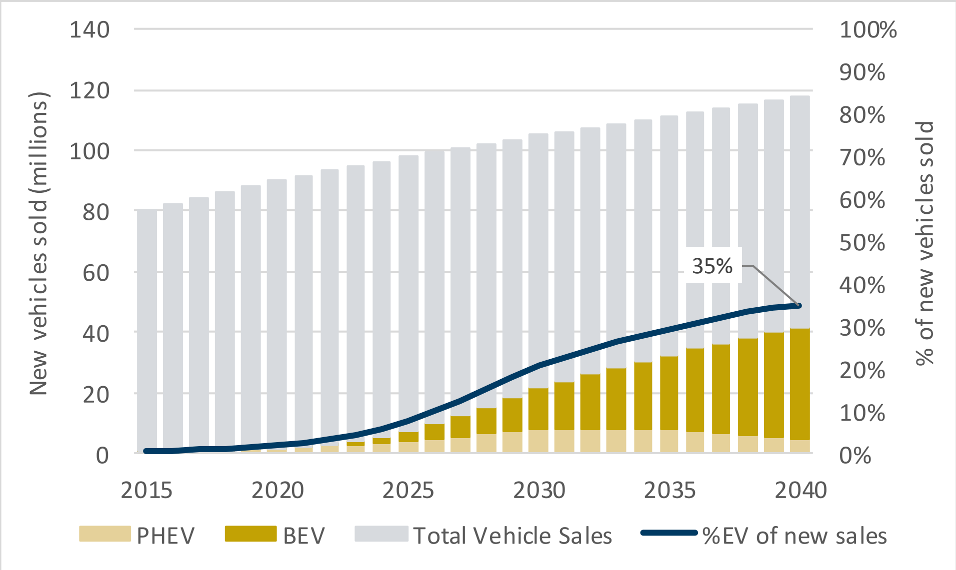
Batteries

High-grade graphite is nearly exclusively preferred as the anode material for Li-ion batteries

graphite, and in particular spherical graphite, is nearly exclusively preferred as the anode material in lithium-ion batteries. Demand for spherical graphite is expected to increase substanitially along with significant advances in the lithium-ion battery market; lead by Tesla and their new 'Gigafactory'. Benchmark Mineral Intelligence forecast an increase in the anode market from 80,000 tpa in 2015 to at least 250,000 tpa by the end of 2020. This equates to a trebling of the demand for graphite from lithium-ion batteries in 4 years.

Battery vehicles, led by Tesla, are expected to grow exponentially in coming years

Figure 8: New battery electric vehicle (BEV) & plug-in hybrid electric vehicle (PHEV) sales



Source: Bloomberg New Energy Finance

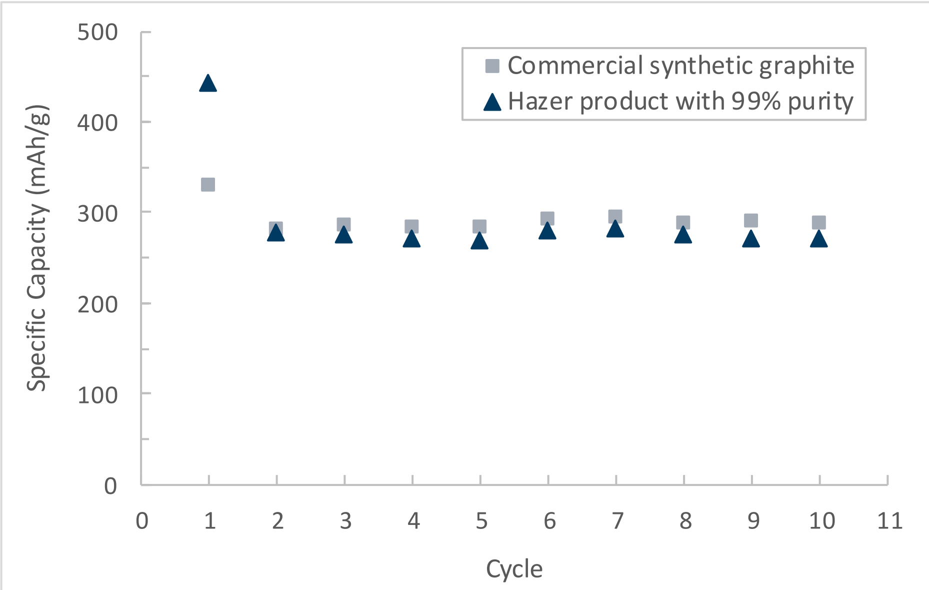
HZR produces high-purity spherical graphite suitable for use in Li-ion batteries

HZR has demonstrated significant increases in raw graphite purity through the scale up of the process. Latest results demonstrate that the Hazer process is capable of generating graphite with raw purity of up to 95% (up from 86%). Single-stage purification can further purify the graphite to over 99%.

Preliminary battery testing has shown that HZR graphite outperforms standard benchmark graphite on initial discharge, and matches the benchmark for subsequent discharges. Increases in performance can be expected with further optimisation of the Hazer process and as purity levels of HZR-produced graphite increase.

HZR graphite, after a single-stage acid-based purification, has been shown to compete with commercial synthetic graphite in initial battery testing

Figure 9: Battery testing results of HZR graphite product



Source: HZR releases

The Hydrogen Market

Demand for Hydrogen

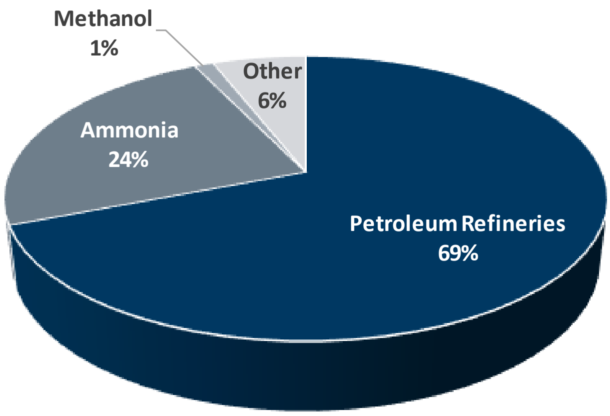
Industrial hydrogen is worth over $100bn with strong growth forecast

The hydrogen generation market is expected to grow from an estimated US$118 billion in 2016 to over US$150 billion in 2021. Market growth will be driven by the demand for cleaner fuels, government regulations for the desulfurization of petroleum products and the general decline in crude oil quality (requiring higher levels of processing, consuming more hydrogen in the process).

In 2014 the US produced over 9 million metric tonnes (MMT) of hydrogen, valued at approximately US$14bn. Over 90% of this hydrogen was consumed for petroleum refinery and ammonia production purposes. Hydrogen is added to crude oil and oxygen to produce refined petroleum products (e.g. diesel, LPG, gasoline). It is added to nitrogen to produce ammonia, which is then used to produce fertilisers and explosives among other products.

The majority of hydrogen is consumed in ammonia plants and petroleum refineries

Figure 10: US hydrogen production by end use for 2014



Source: US Energy Information Administration

As crude oil quality decreases the need for higher levels of refinement increases

Organic growth in crude oil production is expected to be relatively slow at approximately 1% through 2040 (according to the US Energy Information Administration). But, lower quality crude oils into the future will drive growth in hydrogen consumption in the petroleum refinery industry. As the quality of crude decreases, the volume of hydrogen required for the refinement process increases in order to maintain the quality of the end products.

Reduction in available arable land will drive demand for fertilisers, and hence ammonia

Global demand growth for ammonia will be driven by increased demand for fertilisers. Over 80% of ammonia produced is consumed by the fertiliser industry. Arable land per capita in 2050 is expected to be less than half the arable land in 1960, from 4,300m^2 per person in 1960 to an estimated 1,800m^2 per person in 2050. This means that the food yield from the available arable land will have to increase to feed the global population. This will provide greater demand for fertilisers to increase the overall crop yields, and drive the growth of the ammonia production industry.

Current and Future Global Supplies

Current hydrogen production methods release significant amounts of CO_2

Currently the majority of hydrogen is produced through processes that release significant amounts of gaseous carbon into the atmosphere. The most common hydrogen production method is steam methane reforming, where methane reacts with steam to produce hydrogen, carbon monoxide and carbon dioxide. Other commonly used hydrogen production methods include partial oxidation of Hydrocarbons and gasification of coal, both of which produce carbon oxide by-products (carbon monoxide and carbon dioxide).

Current 'clean hydrogen', though electrolysis, is an inefficient means of providing energy

Electrolysis of water is the only current hydrogen production method that has the potential to produce "clean hydrogen", i.e. no carbon oxide by-products. Electricity is passed through water to decompose it into oxygen and hydrogen. When that electricity is supplied from renewable sources (e.g. wind, solar), electrolysis produces clean hydrogen and an overall clean energy source. But, the energy value of the hydrogen produced is always less than the energy required to generate the hydrogen, limiting the application of the approach to systems where there is a surplus of energy or where the hydrogen can be used as an energy transport medium rather than as a primary source of power.

The Hazer process can provide 'clean hydrogen' without energy inefficiencies

In his respect, the Hazer process offers a distinct advantage over other hydrogen production methods in that it can produce clean hydrogen with a higher energy value than what is required to produce the hydrogen. This positions HZR uniquely as a leading contender to service the developing hydrogen energy market. HZR is also looking at ways that its processing plant modules may be retro-fitted to existing hydrogen production plants, offering opportunities for large petroleum refineries and ammonia plants to reduce their carbon footprint. This will become increasingly important as governments strive to meet carbon reduction limits.

The Graphite Market

Demand for Graphite

Graphite has stable core markets as electrodes or for refractory purposes

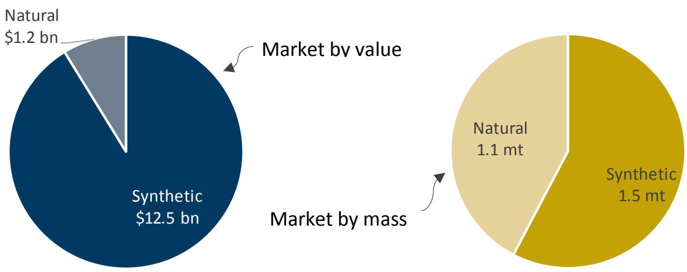
Outside of the booming lithium-ion battery market, the remaining markets for graphite are significantly more subdued. Currently the bulk of graphite is consumed as electrodes or for refractory purposes in industrial metals processing plants. Accordingly, current graphite prices follow the fortunes of global industrial metals, which have suffered significant drops in demand in recent years.

Graphite demand is expected to experience significant near-term growth

According to the US Geological Survey (USGS) global demand for synthetic and natural graphite is projected to grow at a rate of 5.8% per year over the next few years. With future demand growth spurred by increases in manufactured goods shipments, increase in steelmaking and other types of metallurgical activity, and new technologically advanced applications (such as aerospace, fuel cells, graphene, lithium-ion batteries).

Synthetic graphite is substantially more valuable than natural graphite

Figure 11: Global graphite market by type in 2013



Source: US Geological Survey

Current and Future Graphite Supplies

The majority of natural graphite is produced in China

Natural graphite is mined from high-grade metamorphic rocks that are found in abundance in the Earth's crust across regions including China, Canada, Brazil and India. China produces the majority of natural graphite, accounting for over 65% of global production. In 2013, the global graphite market was worth US$13.6 billion. 2013 prices clearly indicate that synthetic graphite (like the sort produced in the Hazer process) is significantly more valuable than natural graphite.

Turkey, Brazil and China hold the bulk of the world's graphite reserves for future production

Figure 12: Global graphite production, by country, from 2009 through 2013

Estimated global graphite production, by country (',000s Metric tons)						
Country	2011	2012	2013	2014	2015[e]	Reserves
Brazil	105	88	95	80	80	72,000
Canada	25	24	20	30	30	(1)
China	800	820	750	780	780	55,000
India	150	160	170	170	170	8,000
Russia	14	14	14	15	15	(1)
Trukey	17	-	5	29	32	90,000
Other	69	64	56	86	83	5,000
Total	1,180	1,170	1,110	1,190	1,190	230,000

[e] *Estimated*
[1] *Included with "Other Countries"*

Source: US Geological Survey – 2016 Mineral Commodity Summaries

Graphite is classified as amorphous, flake or vein in order of increasing value

There are three types of natural graphite – amorphous, flake or crystalline flake, and vein or lump. Amorphous graphite is the lowest quality and most abundant, with large deposits found in China, Europe, Mexico, and the United States. Flake or crystalline flake graphite is less common and higher quality than amorphous, with the foremost deposits found in Brazil, Canada, China, Germany, and Madagascar. Vein or lump graphite is the rarest, most valuable, and highest quality type of graphite, it is only commercially mined in Sri Lanka.

The Chinese Government is protecting supply to encourage international expenditure locally

Since 2014, China, the world's largest natural graphite producer by some margin, has been consolidating graphite mines in Shandong Province in response to high-profile pollution and air quality problems. Analysts estimate that, due to China's focus on less pollution and higher air-quality, up to 90,000 metric tonnes per annum of supply could be under threat. Additionally, China has slapped export duties in the range of 5% to 20% on some raw materials (including graphite). The duties impose higher costs on US and other manufacturers, and are likely an effort to encourage global companies to locate production of technologically advanced products (e.g. lithium-ion batteries) in China. The global supply of graphite is dominated by China, and given China's current focus on pollution reduction in their mining sector, there could be a short-term supply squeeze in the graphite market as demand grows in response to the lithium-ion battery boom.

Regulatory

HZR and The University of Western Australia (UWA) have applied for 3 patents associated with the Hazer process. The original entitlement of Patent Family 1 was to UWA, which has since been assigned to HZR by UWA. The other 2 patent families are entitled to HZR.

HZR has applied for patent protection over the process

It is the intention of these patent applications to protect HZR's intellectual property rights, and hence its competitive advantage. However, there can be no assurance that any patents in relation to the Hazer process will afford HZR commercially significant protection of the Hazer process or that competitors will not develop competing technologies that circumvents such patents. This intellectual property risk represents a key risk to investors in HZR. HZR's patent portfolio are all in the application phase (not yet granted); there is an extensive process for application and the subsequent grant of patent rights, which HZR is currently working through as necessary.

All IP associated with UWA has been signed over to HZR

HZR has two existing agreements with UWA assigning all existing and future intellectual property rights in the process to utilise a catalytic system to produce hydrogen from methane without the production of carbon dioxide. In consideration for the IP rights, HZR issued 5 million shares to UWA and other nominated parties including various inventors.

Figure 13: Protection of HZR's intellectual property rights

Patent families	Jurisdiction
Patent Family 1: A process for producing Hydrogen from Hydrocarbons	US
Patent Family 2: Thermocatalytic Methane Decomposition	International
Patent Family 3: Process of Controlling the Morphology of Graphite	International

Source: HZR releases

HZR has key partnerships with universities and industrial companies

HZR has entered into two key agreements with partner entities to develop the Hazer process further towards commercial viability. HZR has also signed a memorandum of understanding (MoU) with Pan American hydrogen Inc (PAH). Importantly, HZR maintains all ownership of intellectual property developed through the Sydney University collaboration, and will continue to own all the intellectual property associated with the Hazer process royalty- and encumbrance-free. HZR's agreement with Kemplant includes Kemplant accepting a portion of its fees in HZR shares and options to better align Kemplant's interests with HZR and its shareholders.

Figure 14: HZR collaboration and partnership agreements

Partner	Basis of Partnership
Sydney University	- Continue scale up of Hazer process - Further improve the characteristics of the graphite produced from the process
Kemplant	- Assist with the development of Hazer's pilot plant, to showcase the Hazer techology
Pan American Hydrogen Inc (PAH)	- Jointly develop a technical roadmap for the integration of Hazer technology into standard hydrogen production units designed by PAH

Source: HZR releases

Risks

Funding

HZR will require additional funding at some stage in CY2017

HZR's closing cash balance at the end of December 2016 was $3.05m. Operational expenditure has been progressively ramping up to over $930k in the last quarter. The increase in operational expenditure was required to develop HZR's pre-pilot plant. On current forecast cash outflows, HZR will need to raise cash at some point in CY2017.

HZR has $3m in the bank at the end of 2Q17, and burn through nearly $1m per quarter

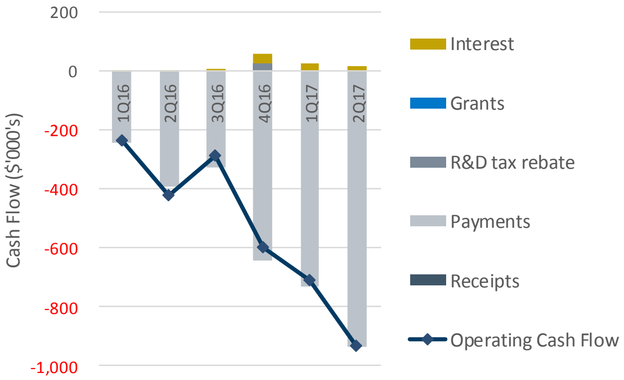
Figure 15: Cash flows – last six quarters

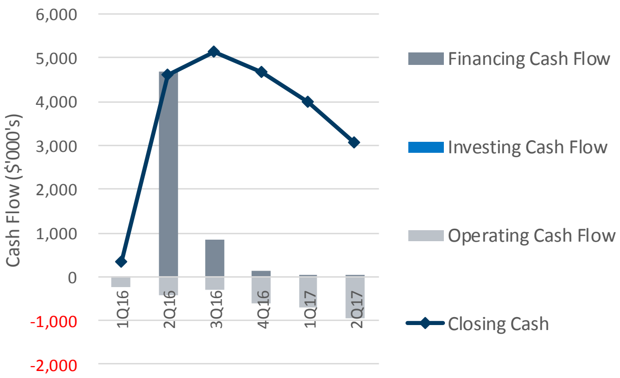
Cash Flow ($'000's)	*1Q16*	*2Q16*	*3Q16*	*4Q16*	*1Q17*	*2Q17*
Receipts						
Payments	-241	-390	-328	-641	-731	-935
R&D tax rebate				24		
Interest	2	2	9	36	27	18
Other	2	-36	31	-18	-7	-18
Operating Cash Flow	*-237*	*-424*	*-288*	*-599*	*-711*	*-935*
Investing Cash Flow						
Financing Cash Flow		*4,693*	*842*	*128*	*13*	*4*
Net Cash Flows	*-237*	*4,269*	*554*	*-471*	*-698*	*-931*
Opening Cash	563	326	4,595	5,149	4,678	3,980
Closing Cash	**326**	**4,595**	**5,149**	**4,678**	**3,980**	**3,049**

Source: HZR releases

Quarterly cash expenditure is ramping up along with HZR's scale up process

Figure 16: Operating and closing cash





Source: HZR releases

Timing

Timing is critical to both funding and cornering the market for the Hazer process

A key to the success of HZR is the timing of both funding and operations. Potential delays to HZR's projected timeline could quickly erode their cash reserves and leave the Company short of the funding necessary to take the Hazer process through to full commercial scale. Similarly, delays in HZR's scale up roadmap could allow potential competitors to progress their designs to a commercial scale and corner the market for methane cracking. It is therefore critical that HZR maintains a strict project timeline to recognise the full potential of their technology and maintain funding for the project.

Competitors

Methane cracking is not a new concept, but commercialising the process has yet to prove viable

Methane cracking is not a new technology, having been researched in academia since the 1960s. The process has been limited by multiple issues, the most severe of which is high catalyst turnover costs. However, given the recent focus on climate change and carbon emissions reduction, there has been numerous research facilities investigating the commercial viability of methane cracking.

IASS-KIT Project: The Institute for Advanced Sustainability Studies (IASS) in Potsdam and the Kalsruhe Institute of Technology (KIT) have been researching an innovative technique to extract hydrogen from methane in a clean and efficient way.

IASS and KIT have teamed up to invent a viable methane cracking process

The research focuses on a novel reactor design, as proposed by Nobel Laureate Carlo Rubbia, based on liquid metal technology. Fine methane bubbles are injected at the bottom of a column filled with molten tin. The cracking reaction happens when these bubbles rise to the surface of the liquid metal. Carbon separates on the surface of the bubbles and is deposited as a powder at the top end of the reactor when they disintegrate.

In the most recent experiments in April 2015, the reactor operated without interruptions for two weeks, producing hydrogen with a 78% conversion rate at temperatures of 1200°C. Whilst these remain laboratory scale tests, the continuous operation is a decisive component of the kind of reliability that would be needed for an industrial-scale reactor. The IASS/KIT process only produces amorphous graphite, however, that is not suitable for battery anodes and has little value in the market.

BASF/Linde Engineering/Thyssenkrupp Steel Partnership: BASF, in conjunction with Linde Engineering and ThyssenKrupp Steel, has been working on a pilot methane cracking plant that uses more efficient heat recycling to reduce the energy load of the process.

BASF have worked on a project to crack methane without a catalyst, recycling heat more efficiently

The process of cracking methane without the use of a catalyst requires high temperatures that comes with a high-energy load, and subsequent carbon dioxide emissions. BASF has found better ways to recycle heat within the system, greatly decreasing the amount of energy needed. The BASF project is funded in part by the German Government.

Similar to the IASS/KIT project, the BASF project produces low grade amorphous graphite that isn't suitable for Li-ion batteries. The BASF project also has significantly higher energy loads than the Hazer process, even with their efficient use of energy recycling.

Figure 17: Comparison between Hazer technology and potential competitors

	Hazer Group	IASS & KIT Project	BASF Project
Stage of Development	Pre-pilot plant	Lab-scale tests	Pre-pilot plant
Capital Markets / Funding	Listed on ASX, access to equity markets	University-level study (not publicly listed)	Government funding, access to capital through BASF
Graphite Product	Spherical Graphite (Battery-Grade)	Amorphous Graphite	Amorphous Graphite
Methane Conversion	55%-65%	~78%	Unknown
Operating Temperature	~800°C	~1200°C	1200-1700°C(1)
Inputs / Catalysts	Iron Ore Catalyst (low cost)	Molten Tin (relatively low cost)	No Catalyst

(1) Argonaut estimates

Source: HZR releases, Kalsruhe Institute of Technology (KIT) media releases, MIT Technology Review

HZR's competitors produce a low value amorphous graphite product

HZR has cost advantages with lower energy loads than its competitors

The big advantage of the Hazer process over its competitors is the production of battery-grade spherical graphite which has a significantly higher value over the amorphous graphite produced in both the IASS/KIT project and the BASF project. Amorphous graphite is most commonly used in steel-making. The Hazer process also has cost advantages over its competitors due to lower operating temperatures and as such a lower energy load.

Technical

HZR's value to investors is solely reliant on the scale up of the Hazer process

HZR's value relies solely on the success of the scale up of the Hazer process. Any road-block to the scale-up process will mean that HZR has no alternate avenues for generating cash. Therefore, the technical success of the scale up of the Hazer process to commercial scale plants is key to the value of HZR shares and represents the sole source of returns to shareholders.

Key Personnel

Board of Directors

HZR has appointed a strong board with extensive experience and a diverse array of skill-sets

Mr Rick Hopkins, Chairman: Mr Hopkins is a partner at PKF Lawler Chartered Accountants, advising a wide range of clients on Australian and International taxation and business matters. He has substantial director experience in public and private entities. Mr Hopkins currently sits as an Executive Director of Pendragon Capital. He is a fellow of the Institute of Chartered Accountants and a fellow of the Financial Services Institute of Australasia.

Ms Danielle Lee, Non-Executive Director: Ms Lee is currently Special Counsel at Jackson McDonald corporate advisory team. She has broad transactional and regulatory experience and advises on a range of corporate transactions and projects. Ms Lee has 20 years' experience as a lawyer, including 9 years as legal counsel at ASX Sydney and Assistant Manager at ASX Perth.

Mr Terry Walsh, Non-Executive Director: Mr Walsh is a senior commercial lawyer with more than 20 years' experience in project development and general commercial law. Most recently, he was the General Counsel of Hancock Prospecting Pty Ltd and Corporate Counsel with Rio Tinto. Mr Walsh has previously been involved with the legal and commercial aspects associated with the development, funding and operations of major mining and engineering projects.

Mr Andrew Harris, Non-Executive Director: Mr Harris is a Lead Director of the Engineering Excellence Group within Laing O'Rourke. He is a Professor of Chemical and Biomolecular Engineering at the University of Sydney. Mr Harris was previously the Chief Technical Officer at Zenogen, a hydrogen production technology company, and a co-founder of Oak Nano, a start-up commercialising novel carbon nanotube technology.

Mr Geoff Pocock, Managing Director: Mr Pocock is a Director of Mac Equity Partners and has significant experience as a corporate advisor and strategy consultant advising companies on commercialisation and IP management, business development, mergers and acquisitions. He has over 15 years' in the West Australian corporate market and management consulting firms. Prior to his corporate advisory experience, Mr Pocock spent several years as a research scientist in the biopharmaceutical industry in Australia and the United Kingdom.

Key Management and Technical Staff

HZR's development and technical staff have the know-how to commercialise the Hazer process

Dr Andrew Cornejo, Chief Technical Officer: Mr Cornejo has a PhD in Mechanical Engineering from The University of Western Australia (UWA), acting as a key researcher on the initial Hazer project. He has over 10 years' experience as a mechanical engineer, working at Hatch and Rio Tinto. Mr Cornejo is the lead inventor on a number of patents.

RESEARCH:

Ian Christie | Director, Industrial Research
+61 8 9224 6872 ichristie@argonaut.com

Matthew Keane | Analyst, Metals & Mining Research
+61 8 9224 6869 mkeane@argonaut.com

James Wilson | Analyst, Metals & Mining Research
+61 8 9224 6835 jwilson@argonaut.com

Helen Lau | Analyst, Metals & Mining Research
+852 3557 4804 hlau@argonaut.com

Daniel Williamson | Analyst, Industrial Research
+61 8 9224 6831 dwilliamson@argonaut.com

INSTITUTIONAL SALES - PERTH:

Chris Wippl | Executive Director, Head of Sales & Research
+61 8 9224 6875 cwippl@argonaut.com

John Santul | Consultant, Sales & Research
+61 8 9224 6859 jsantul@argonaut.com

Damian Rooney | Senior Institutional Dealer
+61 8 9224 6862 drooney@argonaut.com

Ben Willoughby | Institutional Dealer
+61 8 9224 6876 bwilloughby@argonaut.com

Phil Russo | Institutional Dealer
+61 8 9224 6813 prusso@argonaut.com

INSTITUTIONAL SALES – HONG KONG:

Travis Smithson | Managing Director - Asia
+852 9832 0852 tsmithson@argonaut.com

CORPORATE AND PRIVATE CLIENT SALES:

Glen Colgan | Executive Director, Desk Manager
+61 8 9224 6874 gcolgan@argonaut.com

Kevin Johnson | Executive Director, Corporate Stockbroking
+61 8 9224 6880 kjohnson@argonaut.com

James McGlew | Executive Director, Corporate Stockbroking
+61 8 9224 6866 jmcglew@argonaut.com

Ian Dorrington | Director, Corporate Stockbroking
+61 8 9224 6865 IDorrington@argonaut.com

Geoff Barnesby-Johnson | Senior Dealer, Corporate Stockbroking
+61 8 9224 6854 bj@argonaut.com

Rob Healy | Dealer, Private Clients
+61 8 9224 6873, rhealy@argonaut.com

Tony Locantro | Dealer, Private Clients
+61 8 9224 6851, tlecantro@argonaut.com

Cameron Prunster |Dealer, Private Clients
+61 8 9224 6853 cprunster@argonaut.com

James Massey |Dealer, Private Clients
+61 8 9224 6849 jmassey@argonaut.com

Chris Hill | Dealer, Private Clients
+61 8 9224 6830, chill@argonaut.com

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