Pure Hydrogen Corporation (PH2)

Going beyond natural gas, and going up in value

June 24, 2021

Oil & Gas Team
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www.breakawayresearch.com

Company Information

ASX Code	**PH2**
Share Price (EOT 23/6/2021)	$0.21
Ord Shares	313
Market Cap (fully diluted)	**A$66M**
Cash (31/3/2021)	A$11.2m
Debt	A$0.0m
Enterprise Value	**A$55M**

Directors: Refer to page 19

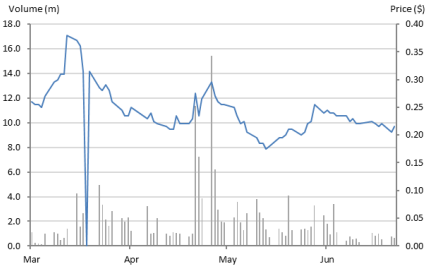
Company Details.

Location:

Level 3, 32 Walker St, North Sydney

Website: purehydrogen.com.au

Price Chart



Source: ASX

Summary of Valuation	**Cents/ Sh.**
Gas assets	**47**
Hydrogen assets	**16 – 32**
Total	**63 - 79**

Key Points

- ***Pure Hydrogen Corporation was created by the merger of Real Energy Corporation Ltd and Strata-X Energy Ltd in March 2021 and has moved rapidly to build a Hydrogen business in tandem with appraisal of its Australian and Botswana gas discoveries. This unique combination of assets exposes PH2 to value-add in the conversion of natural gas to Hydrogen.***
- ***Gas appraisal and commercialization:***
  - ***Portfolio of discovered coal seam gas resources in Australia and Botswana***
  - ***Prospective resource of 11.8 Tcf, and 2C Contingent gas resources of 472 Pj.***
  - ***Drilling and testing activity has recommenced after Covid-hiatus, comprising a 6-well free-carried appraisal program in Botswana, and flow-testing at the Venus project (Qld)***

  Building a Hydrogen business. Hydrogen has emerged as a fuel of the future in a de-carbonizing world and PH2 has announced a number of initiatives this year including:
  - ***Planning for 4 large scale Hydrogen plants at various ports with a view to future exports.***
  - ***MoU's with partners for storage and refueling systems.***
  - ***A 50/50 JV with private company Synergen Met to produce emissions free Hydrogen using methane pyrolysis technology (so-called "Turquoise hydrogen") using Venus gas, and producing valuable solid carbon by-products***
- ***PH2 had $11.2M of cash at March 31, which is sufficient to complete Venus testing and undertake further Hydrogen work.***

The Hydrogen economy has arrived and many companies are working on economic production, storage and distribution of emissions-free Hydrogen. Methane contained in natural gas is a critical input to the most common hydrogen production methods, and PH2's combination of gas ownership and strategies to capture value-add in conversion of gas to Hydrogen, is unique on the ASX. PH2 gas projects alone are undervalued compared to peers, with the Hydrogen business a free option with huge future upside potential. We estimate fair value for the gas at 47c, with the hydrogen business potentially separable and worth another $50-100m or 16-32 cps.

Why Hydrogen ?

Hydrogen production has been around for a long time (>100 years) and mostly manufactured by industrial gas specialists, for use in various industrial applications. It can be used as a fuel source too, and when combusted generates no emissions, however as a fuel, Hydrogen is substantially more expensive than the fossil fuels it aims to substitute, mainly coal and natural gas.

However, the world is rapidly aiming to de-carbonize and this can only be achieve if hydrogen is used to displace fossil fuels, particularly in transportation, power generation and industry. Burning hydrogen is carbon free, but making hydrogen is energy (and fresh water) intensive and if that energy is generated by burning fossil fuels then large volumes of Co2 are created.

The solution is two-fold. The first is to capture the associated Co2 emissions and either sequest back into the ground, or convert to solid carbon products. The second is to produce hydrogen from electrolysis driven by renewables such and wind or solar. This latter method is a very expensive way to manufacture hydrogen and at this time, only ~2% of all hydrogen made is via electrolysis.

Cost disadvantages, which at this time are significant, are expected to be overcome in time, as R&D into new technologies mushrooms, production scale grows in transport systems, storage, infrastructure and refuelling systems brings down costs, and as renewable power prices continue to fall. Imposition of carbon "tax" or the price of carbon offsets, help to close the gap.

Currently, approximately 70 MTPA of hydrogen is produced in pure form, plus another 40MTPA as ammonia or methanol. Demand projections vary, depending mostly on how quickly refuelling and storage infrastructure networks are built, but thematically all show ballistic growth. Some independent forecasts are for hydrogen demand to be as high as 500 MTPA by 2040, driven by substitution of hydrogen into natural gas distribution networks, and use in fuel-celled electric vehicles.

Methane (CH4) contained in natural gas or coal is the dominant basic ingredient in the production of hydrogen. Numerous commercial conversion processes exist to convert methane from coal or natural gas to hydrogen and these are the cheapest.

The problem to be over-come in a de-carbonizing world is the avoidance of Co2 emissions, which result from field production of natural gas or coal and its combustion or conversion in the process of making hydrogen. Approximately 10 tonnes of Co2 is generated in converting gas to hydrogen, and about 19 T in converting coal to hydrogen. Capture, sequestration, or conversion of the carbon in Co2 created in the production of hydrogen is critical to any hydrogen project going forward.

PH2 plans to deploy relatively new, but demonstrated "methane Pyrolysis" technology, co-located in the first instance at the Venus gas field, to manufacture hydrogen. This process produces hydrogen with by-product solid carbon products such as soot, carbon black, graphite or graphene and some of these are commercially very valuable but all can be stored, avoiding atmospheric Co2 emissions. In tandem, PH2 has progressed a number of strategies for large scale hydrogen production, storage, and re-fuelling in less then 6 months.

Our valuation assessment is that the company's tangible gas assets are trading at a discount to peer companies for no obvious reason, and there is nil value to the hydrogen strategy.

We assign 47c to the gas resource, which we think is reasonable referencing a very deep peer group of gas exploration companies.

We assign an additional 16-32c for the hydrogen related assets, but with a higher degree of subjectivity due to uncertainty around valuation benchmarks for hydrogen related companies, as detailed in this report.

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Pure Hydrogen: Asset snapshot.

- **Project Venus**, a coal seam gas project in eastern Queensland. The gross prospective resource base is 694 PJ (best estimate) and 2C resource is 130 PJ. In early 2021 Venus#1 was drilled, and is currently de-watering ahead of expected gas production.
- **Serowe CSG** gas project in Botswana, currently 100% owned by PH2 but reducing to 51% post farm-out to a private company, Botsgas if key farm-in milestones are met. A 6-well drilling program has commenced, funded by Botsgas. The gross prospective gas resource is 2380 PJ (best estimate) in a small portion of the acreage, which is considered to be a high- grade area, with an additional 3700 PJ outside the core area.
- **Windorah gas project** in the Cooper Basin, currently owned 100% by PH2. Gas resources are assessed at 330 Bcf (2C) in a "basin-centred" gas play, defined by 4 wells drilled and tested from 2015-2019. The best estimate of prospective resource for the whole block is assessed at 8800 PJ.
- **Hydrogen hubs**. PH2 aims to build 4 large scale hydrogen production hubs at various ports for the production and export of Hydrogen, and associated by products for domestic and export sales. To do this, a JV has been established with Liberty Hydrogen, a private company.
- **A 50/50 production joint venture with Synergen Met,** to install modularised methane pyrolysis hydrogen production systems, initially at the Venus gas field, to produce ~1300 Kg/day.
- **MoU's and terms sheets** with refuelling equipment suppliers and potential customers to establish a distribution chain for the end product

Natural gas: Three large assets undergoing appraisal

PH2 has been progressing gas exploration and appraisal in three separate prospective gas basins, in Botswana, the Surat basin in Eastern Qld, and the Cooper Basin in western Qld.

In total, these three assets have a combined 2C gas resource of 472 PJ. Refer to figure 1.

Pure Hydrogen contingent gas resources (PJ)	1C	2C	3C
100% Project Venus	88	130	158
100% Windorah Trough	118	330	770
51%% Serowe CSG Botswana-core area		12	
Total	206	472	928

Figure 1. Pure Hydrogen contingent gas resources. Assumes Botswana gas asset working interest reduces to 51% after completion of farm-in obligations

#1. "Project Venus". (PH2: 100%)

Project Venus is a 153Km2 exploration permit which was awarded in October 2019, following a Queensland Government gazettal. The permit ATP2015 is located is shown in Figure 2, near Miles, and the prolific QGC and APLNG central Surat basin CSG fields supplying the LNG market which have been under intense development since 2010. Other nearby projects which have had recent success are Central Petroleum's "Project Range" and Senex Energy's "Project Atlas".

Prospective recoverable gas resource estimates within ATP2051 have been independently assessed by MHA Petroleum Consultants and are shown in figure 3. The "Best estimate" of recoverable gas resource is 658 Bcf (694 PJ), on 100% basis.

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In March 2021, a pilot well Venus#1 was drilled in the north -east corner of the block, where the coals appear to have the best potential. The testing phase commenced in late March, and is expected to run for several months to de-water the coals. Establishment of sustainable gas rates will allow the conversion of some of the 2C to 2P. Planned testing and pilot production will inform how much of this can be commercialised and booked to reserves.

In May 2021, contingent resources were independently assessed by Sproule. Contingent resources are follows: 88 PJ of 1C, 130 PJ of 2C, and 158 PJ of 3C.

On June 3, PH2 announced that initial gas break-out was achieved at 80 mcfd (which is a small rate) but is highly encouraging as the de-watering phase has only recently commenced. Rates should increase as the reservoir is de-pressured in a controlled manner.

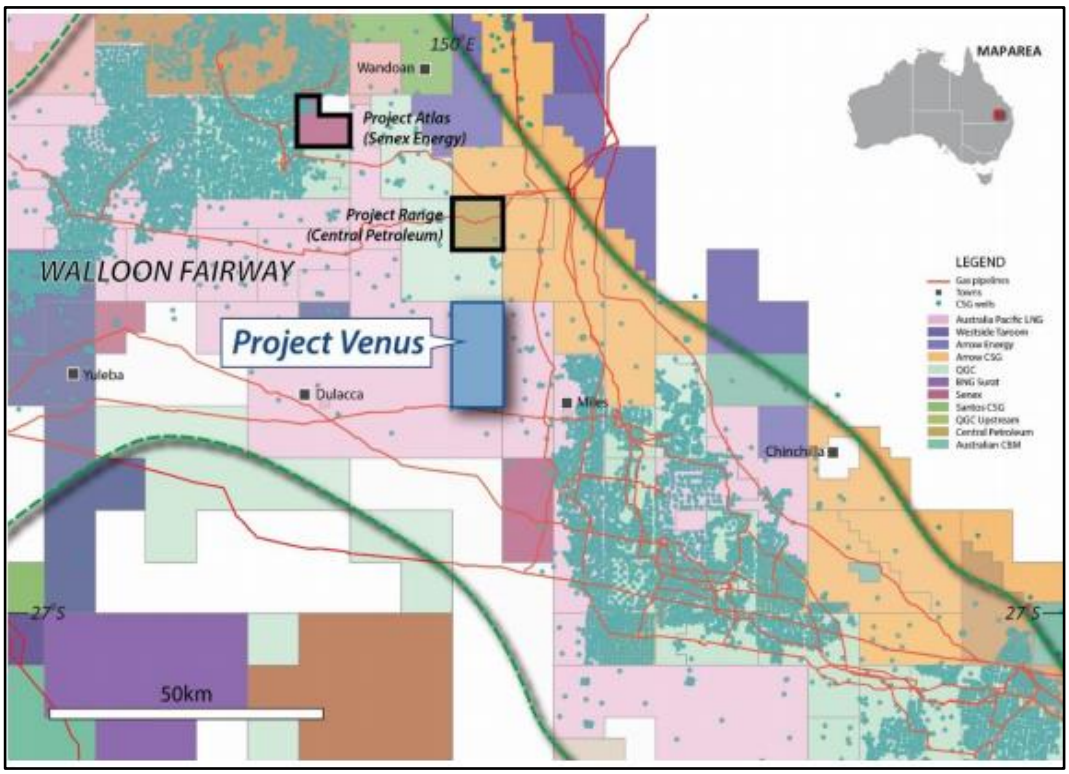

Figure 2. Location of "Project Venus" acreage in the Surat Basin, Qld. Source: Pure Hydrogen March 2021 quarter report

Reserves and resources

Venus Contingent resources (PJ)	1C	2C	3C
	88	130	158

Figure 3. Source: PH2 ASX report May 2021

Geology

Four CSG wells have been previously drilled in the permit by QGC commencing in 2008. The first, Connor#1, reached a total depth of 850m. The well intersected 31m of net coal pay comprising 18.7m in the Juandah coal, 10.2m in the Taroom coal and 2.3m in the Tangalooma sand. In total, four wells (Connor#1-4) were drilled and identified gas-saturated coal sequences at depths ranging from 350m in the northeast to 700m in the south west. Seam thickness ranges from 34m in the north, to 22m in the south.

Gas contents are assessed to range from ~7 Bcf/km2 in the north of the permit, to ~5 Bcf/km2 in the south. These are similar to gas contents in other fields exploiting the Walloon coals. Permeabilities are very low, in the 0-10mD range and this will pose a development challenge.

Production will require natural cleating, careful management of well design and pressure draw-down to keep the cleats open and the wells flowing, and drilling techniques to minimise formation damage at the wellbore.

If commercial flow rates can be approached during the testing phase, then PH2 aim to fast track the project into production.

#2: Cooper Basin: Windorah Trough project (PH2: 100%)

The Windorah Trough gas project acreage ATP927 is located in western Queensland and forms part of the regionally extensive Cooper Basin. The acreage is surrounded by gas fields and process infrastructure owned and operated by Santos and others. The location is shown in Figure 3.

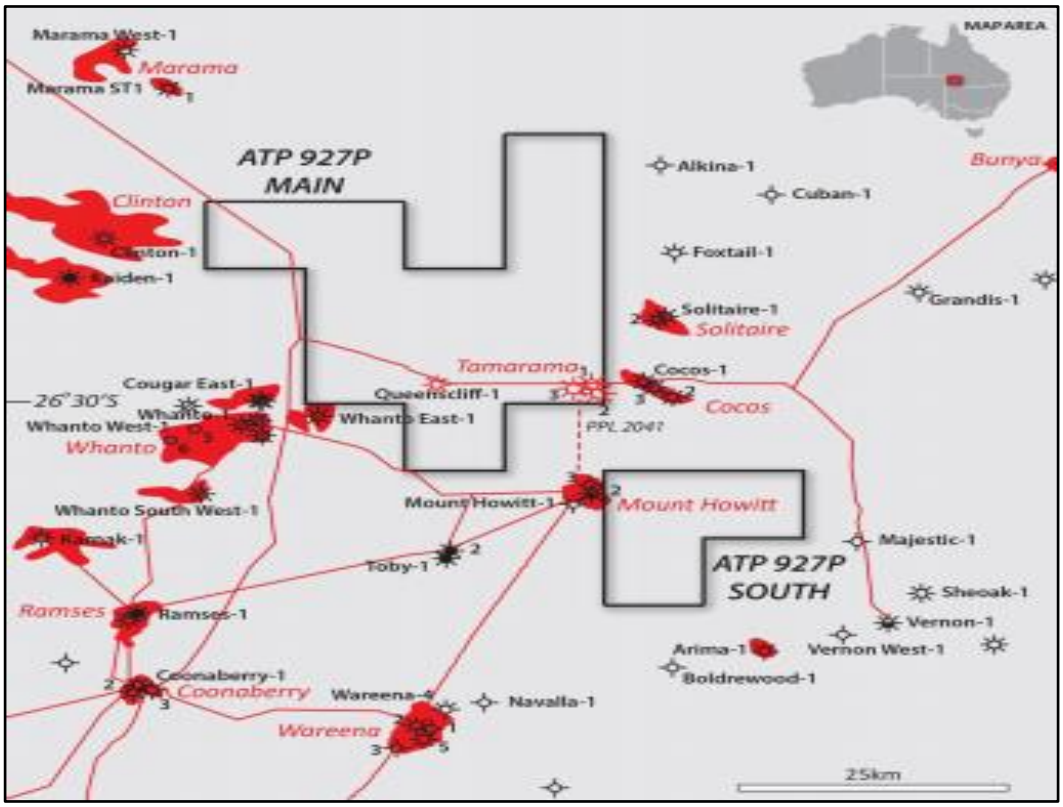

Figure 3. Location of Windorah Trough project. Source:PH2 March 2021 quarterly activity report.

The acreage has an independently audited "Best Estimate Prospective gas resource" of 8.8 Tcf, with contingent resources to date defined by 4 exploration wells drilled and tested.

Since establishing the Windorah Gas project in 2014, PH2's precursor Real Energy invested ~$31M into understanding what is required to commercialise gas, by drilling 4 wells, confirming the geology, flow-rate testing three wells, and putting in place gas processing and land-owner access agreements and being awarded a license to install a short pipeline to connect to the Santos system at Mt. Howitt.

The first two wells were drilled during 2014 and 2015, Queenscliff#1 and Tamarama#1 both of which encountered gas-bearing reservoirs outside of any structural closure and thus validated the "basin-centred gas" (BCG) geological concept. During 2018 and 2019, two more wells were drilled at Tamarama #2 and #3. Flow rates of 2mmcfd and 2.5MMcfd respectively, were achieved in February 2019, after stimulation of a number of low permeability sands.

These rates could not be sustained. In the second quarter 2019, both wells were re-tested. Real Energy reported that Tamarama#2 flowed at 0.4-1.3mmcfd over a 2- week period, through a range of small chokes, and the results from Tamarama#3 were lower. Based on these test results, contingent gas resources have been determined by Aeon Petroleum consultants. Figure 4.

In the March 2021 quarter, PH2 announced it would likely apply for a retention lease, of "Potential Commercial Area". The current focus is a review of development and funding options.

Contingent resources (PJ)	1C	2C	3C
Tamarama/ Queenscliff	118	330	770

Figure 4. Contingent gas resources. Source: Pure Hydrogen

#3. Serowe CSG gas project, Botswana (PH2 100%, potentially reducing to 51%)

Botswana, and many other countries in southern continental Africa are energy short. Historically, Botswana sourced its power needs from South Africa but with power supply in the latter becoming constrained, Botswana experiences shortages, and high prices. It has no indigenous energy sources and has been forced into building power stations fired by imported, expensive diesel.

Botswana has significant CSG resource potential, and to the east, gas potential in conventional but very deep reservoirs. A number of E&P companies recognise the Botswana's CSG prospects and are or were active in Botswana, including ASX-listed Tlou (ASX: TOU), and previously Origin Energy, and South Africa's SASOL. As with PH2, these other operators mostly gained their CSG expertise in eastern Queensland.

In 2016, Strata-X (SXA) acquired 4572Km2 of acreage in the Kalahari Basin in Botswana, which is believed to be prospective for CSG. The tenements are located on flat land, approximately 60 km from Serowe (Population ~60,000). See figure 5. The acreage is currently in an exploration phase, with the primary exploration term extending to 2025, and in perpetuity in the event of production. Currently, PH2 owns 100% but this will reduce to 51% in the event a recently concluded farm-out and work program is completed in full.

The resource is very large

The acreage potential has been assessed by MHA Petroleum consultants. Key metrics are:

- 6.08 Tcf total prospective Resources (100%).
- 2.38 Tcf of Prospective Resource (100%) within an interpreted high-grade area.
- A 2C contingent resource of 23 Bcf, (100%) immediately around exploration well 19B-1 which was drilled by SXA in March 2019. The well was drilled and cored to 474M, and intersected 18m on net coal. Key results reported were (1) gas contents ranged from 2.2-5.8 cubic meters per tonne (2) 100% gas saturation and (3) coal seam permeabilities up to 100mD. These are considered to be excellent geological parameters in CSG geology.

Farm-out to advance appraisal activity

Following the encouraging 19B-1 core hole results, SXA sought a farm-in partner to share risk, provide funds and move to an appraisal phase.

On March 23, 2020 SXA announced it had farmed out the acreage to private company "Botsgas". Key elements of the deal are:

- A 4-stage farm-out funded 100% by Botsgas, for up to 19 wells drilled and tested.
- If all stages are completed, then Botsgas to earn 49% in the tenements.
- The 19 wells to include 7 appraisal wells, and 3 multi-well pilots.
- As a minimum, Botsgas will drill one vertical well, "Botsgas-19-B-2" at an approved budget of up to US$300,000. A short test is planned to determine water rates and induce gas flow. This stage is designated as Stage 1A. Subsequent stages are Stage-1B (6 appraisal wells), Stage2 (production pilot, 4 wells), stages 3 & 4, each consisting of two 5- well pilots.

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- Each stage is to be fully funded by Botsgas, up to an agreed cap after which cost overruns are to be split 51/49 PH2/Botsgas. Botsgas will not earn an equity in the tenements unless it completes Stage-1B.
- The investment required to complete all 4 stages and Botsgas to earn-in, is A$7M.

For more details of the farm-out and sequencing of activity, refer to SXA's market announcement and Botsgas Letter to Shareholders" posted on their website dated 2/9/2020. The objective of the appraisal program is to establish commercial reserves and for that, the production pilots need to be successful. A key market for the gas is the 90 MW Orapa power station 90km to the north which is currently fired by diesel, and would require a gas pipeline to be built.

In the interim, the JV plan to produce "compressed natural gas "(CNG) using Serowe gas, and transport the CNG by road to Orapa, and other local gas markets such as mines.

On 9/1/2020, SXA announced the Serowe project Environmental Impact Assessment had been approved by the Botswana Department of Environmental Affairs. The approval grants SXA the right to drill and test 75 wells in the 2.38 Tcf "high-grade" area.

Activity has commenced after Covid delays

Following more than a year of Covid-related travel restrictions, work is now underway. On May 31, 2021, PH2 announced that Botsgas was scheduled to spud the first of 6 wells in coming days. The campaign will be in two phases, the first being the drilling of Serowe#2, #3 and #4. Two of the wells are planned to be production wells, while the third is planned to be an exploration core-hole in an outlaying region to test the extent of the coals.

The second phase of 3 wells is planned for later in 2021, to allow analysis and capture learnings from the first phase.

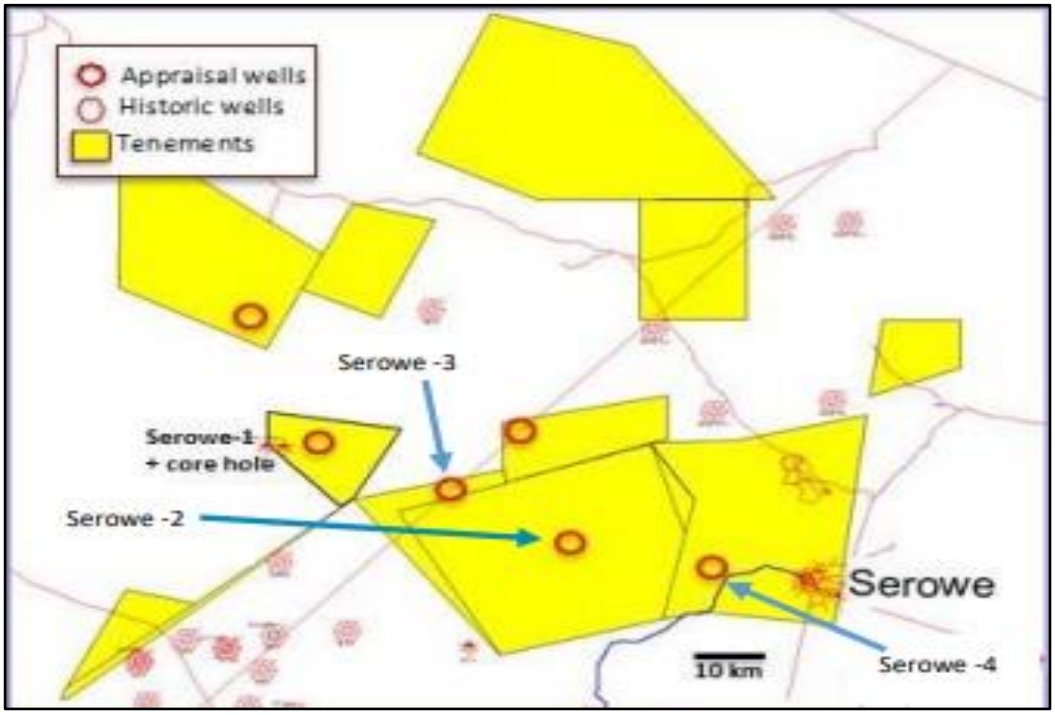

Figure 5: Botswana acreage. Source: PH2 March 2021 quarterly activity report.

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Pure Hydrogen: building a new business

On May 20, 2020 the precursor to PH2, Real Energy, announced a strategy to pursue opportunities in hydrogen energy, and established a wholly-owned subsidiary Pure Hydrogen Corporation. Since then, PH2 has entered into several strategic relationships with potential customers, equipment suppliers, fuel distributors and hydrogen manufacturers. At this time, these relationships are via terms sheets, MoU's or similar. Equity investors tend to discount such agreements, viewing such as intangible, however it is a critical initial starting point in building this business.

As an aside, there are several ASX listed entities with business plans focused on various parts of the Hydrogen value chain, all have attracted meaningful risk-equity capital, but none have any revenue generating plant. Market valuations for some of these are high, and must be viewed as driven by speculative capital flow.

Key announcements:

- In January 2021, Real Energy subsidiary, Pure Hydrogen, announced an MoU to collaborate with Hyzon Motors for development of a hydrogen refuelling locations.
- On 20 January, 2021, Pure Hydrogen announces signing of a term sheet with Liberty Hydrogen to establish a JV to develop 4 large scale Hydrogen hubs at ports on the east coast. These are to be located at Mackay, Gladstone, Newcastle and Port Arthur, Victoria. The concept behind locating at a port is to enable exports.
- On March 17, 2021, completed a merger with Strata-X, which resulted in Real Energy being de-listed and the merged entity renamed "Pure Hydrogen", with ticker PH2.
- May 20, 2021, announces MoU with H2H Energy Pty Ltd, for the supply and maintenance of mobile hydrogen refuelling outlets. The target mark for deployment of these units, are centralised heavy haulage (trucks) refuelling locations. H2H is a private, Australian owned company established in 2009 and over that time has established a number of hydrogen refuelling solutions and related vehicle testing services. Figure 6 shows a portable dispenser.

Figure 6: From H2H website, picture of portable fuel dispensor

- On 25 May 2021, announces signing of a term sheet for Hydrogen transport, with Pure Haul Pty Ltd. The concept being to take Hydrogen from various production points, at pressures of 250 bar or higher, into cylindrical pressure vessels for delivery by truck to customer refuelling points.

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- On April 6, announces a term sheet with "Synergen Met Pty Ltd" to form a 50/50 JV to produce "turquoise" hydrogen and value-added solid carbon products, from a plant to be located adjacent to the Venus CSG gas field. Refer to next section for more details. Potentially, this critically provides a significant value-adding opportunity for Venus gas on-site, and at the same time avoiding costly Co2 abatement and gas transmission infrastructure.

"Turquoise" Hydrogen technology & Synergen Met.

The Synergen technology for turning natural gas into pure hydrogen, is based around pyrolysis of methane contained in natural gas (methane pyrolysis) using very high temperature and catalysts to decompose the methane (CH4) into hydrogen, and solid carbon products such as graphite, graphene or carbon black. Methane pyrolysis is not widespread yet and is a relatively new technology, compared to the traditional SMR technology which also converts methane to hydrogen. Synergen states it has been working on this technology for 12 years, and has developed modular, shipping container sized modules which can manufacture 1500 Kg of hydrogen per day. A number of these modules have been installed in Australia and NZ. The modular approach ensures production can be scaled up, or the equipment re-located for any reason, if for example feed-stock of gas runs low.

The gas decomposition takes place at very high temperatures and Synergen states can be powered by renewable or fossil fuels. If the power required to drive the process is sourced from renewables, then the entire hydrogen production process including the upstream gas fields would be carbon free. In the case of applying this technology to PH2's Venus field, it is intended that the CO2 contained in the CSG feed is converted to carbon solids, which could be sold, or stored, but in the very least, not emitted atmospherically in the form of CO2.

Figure 7: 1350 Kg/d hydrogen production module. Source: Synergen Met Pty Ltd website

The term sheet with Synergen is in 2 stages, the first to build a shipping container sized module. At this time, what this will cost and how it is funded is not clear. Synergen's business model is to build and operate the equipment, and charge a tolling fee.

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Financial position: strengthened in the past quarter

At March 31, 2021 PH2 had $11.32M in cash, and nil debt. A equity capital raising was undertaken in the March 2021 quarter raising ~$9.2M.

We estimate this is enough to enable work programs in the upstream gas fields as well as advancing hydrogen initiatives but it is not enough for either of upstream gas production plants or large-scale hydrogen production plants. To enable material growth and capture of value PH2 will require additional external funds.

Funding options include:

1. Raising additional equity. Over time, this will depend on capital markets, but at this time we believe investors a allocating significant speculative capital to gas and hydrogen related companies.
2. Farming-out, or selling working interests the 100% Windorah Trough, or Venus, or both.
3. Potential recovery from the ATO of up to $7M related to R&D claims from drilling and testing in the Windorah trough since 2014.
4. Attraction of funds from Government, venture capitalists, “green energy” sponsors, or strategic partners to advance the Hydrogen initiative.
5. Potentially, if valuations for fossil fuel and green companies continue to diverge, then in the future PH2 could spin-off the upstream natural gas business and then be re-positioned in the ASX as a pure play hydrogen company. There are already a small number of ASX-listed “hydrogen” companies, most of which are in a concept or pre-development phase but which have market values which are meaningful. Speculative equity investment flows into purposed vehicles may enable PH2 to separate the upstream gas business from the hydrogen asset portfolio, with value captured as each asset is re-priced to peers in the equity market.

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Valuation under-written by gas resources: 47 cps

PH2's most tangible asset is its gas resource, which can be valued similarly to sub-$200M market cap exploration peers, set out if figures 8 & 9.

Peer Group of small explorers

PH2 has a very large prospective resource base (11.8Tcf), but this attracts little value in the equity market, in the order of cents-per-gigajoule. The investment case, and growth in value revolves around what can be converted to 2P reserves and 2C resources, and Pure Hydrogen already has some 2P and 2C which appear to be heavily discounted, when compared to peers with larger market capitalisations.

Figure 8 shows 2C resource versus enterprise value for ASX listed, gas-focused companies with EV's of A$300M or less. All of these companies are in the exploration or pre-development phase and haver no production. It is evident that the capital markets are prepared to value undeveloped resources.

In the first instance, we value PH2's contingent resource, in line with peer group average of EV/(2P+2C). This is a commonly accepted valuation methodology practiced by investors. **The peer group is currently trading at 28c/GJ, excluding PH2 which is currently impounding ~12c/GJ.**

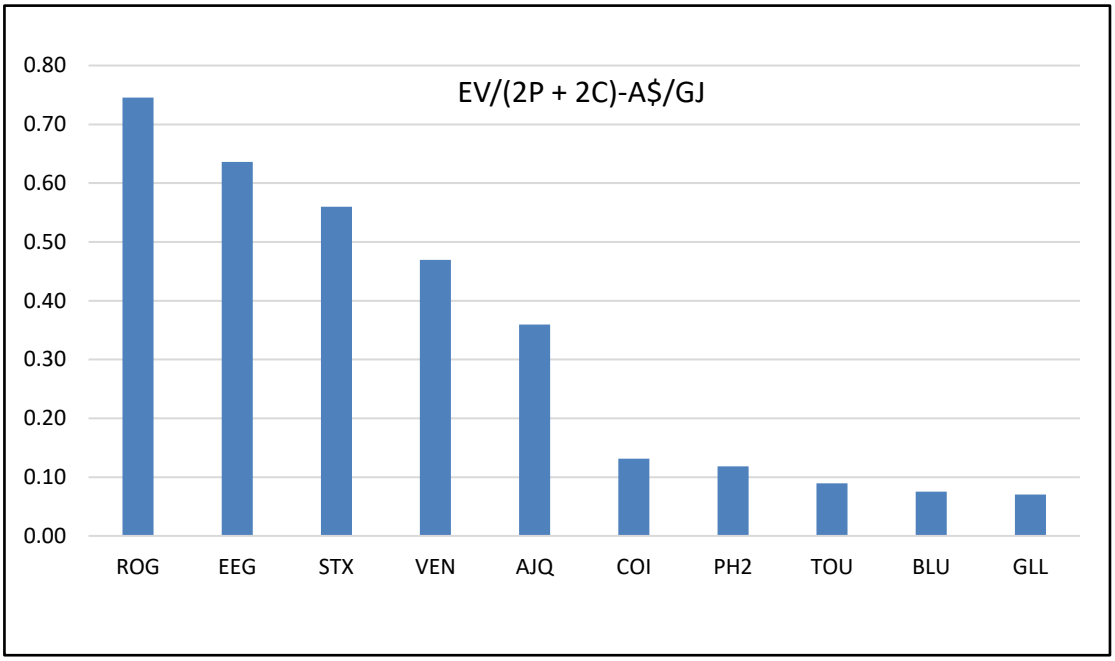

Figure 8: Peer group resource valuations.

There is a very wide range of resource valuations, and this does not even take into account numerous small exploration companies which have acreage and no contingent resources. It is beyond the scope of this report to assess individual companies.

However, we make some observations.

1. The higher values are "basin specific". There has been a lot of press about new basins opening up, and that flows into speculative exploration companies with assets within the region.

2. There is a lack of market under-standing regarding CSG assets outside of Australia. We calculate that CSG assets in Botswana are heavily discounted, where-as similar CSG assets in Mongolia are valued 10x greater. This is not driven by geology, in our view.

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Reserves & Resources (PJe)										
Company / Region	**Price**	**EV**	**2P**	**3P**	**1C**	**2C**	**3C**	**EV/2C**	**EV/3C**	**EV/(2P+2C)**
Blue Energy (BLU)										
Bowen, Galilee, Wiso	0.073	**93**	71	298	158	1166	4179	**0.08**	**0.02**	**0.08**
Comet Ridge (COI)										
Qld, NSW	0.068	**49**	106	183	0	263	2790	**0.18**	**0.02**	**0.13**
Pure Hydrogen (PH2)										
Qld, Botswana	0.21	**55**			206	472	928	**0.12**	**0.06**	**0.12**
Strike Energy (STX)										
Cooper, Perth Basin	0.365	**612**				1093	0	**0.56**		**0.56**
Vintage Energy (VEN)										
Galilee, Otway, NT	0.07	**29**	15	43	17	46	125	**0.62**	**0.23**	**0.47**
Galilee Energy (GLL)										
Galilee Basin- Qld	0.68	**177**	0	0	308	2508	5314	0.07	**0.03**	**0.07**
Empire Energy (EEG)										
NT- McArthur	0.34	**93**	0	0	48	147	413	**0.64**	**0.07**	**0.64**
Tlou (TOU)										
Botswana CSG	0.043	**24**	43	454	5	228	3237	**0.11**	**0.01**	**0.09**
State Gas (GAS)										
Surat Qld	0.56	**84**	0	0	0	0	0			
Armour Energy (AJQ)										
Kincora field, Surat	0.03	**78**	170	370		46	0	**0.46**		**0.36**
Elixir (EXR)										
Southern Mongolia	0.29	**232**	0	0	0	0	0			
Warrego (WGO)										
Perth Basin	0.23	**194**	0	0	0	0	0			
Blue Star										
Helium, USA	0.035	**40**	0	0	0	0	0			
Red Sky (ROG)										
Gas, Cooper Basin	0.007	**29**	0	0	16	39	71	**0.75**	**0.41**	**0.75**
Total		**1789**	**406**	**1349**	**758**	**6008**	**17057**	**0.30**	**0.10**	**0.28**

Figure 9. Australian gas exploration and production companies considered to be peers of Pure Hydrogen.

The results of a resource-based valuation, for the gas only, plus cash assets are shown in figure 10. This excludes any consideration of the value for the Hydrogen initiatives, which we consider in the following section.

Gas resource valuation: 47 cps. Upside from Hydrogen

Excluding the Hydrogen assets, we value PH2's gas assets at 47c, which reflects the peer group average value as documented in Figure 9.

Valuation based on EV/(2P+2C)	
Per unit value/ GJ (A$)	0.28
2C - PJ	472
EV or reserves	132
Cash (31/3/2021)- A$M	11
Total equity value- A$M	143
Value per share	**0.47**

Figure 10: Gas resource valuation.

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Valuing the Hydrogen business: another 16-32cps

In this report, reference to a number of companies that have listed on the ASX in recent years to exploit the Hydrogen opportunity. Hazer, Hexagon, Province Minerals as well as Infinite Blue at pre-IPO, with a combined equity valuation of ~$440M are referenced here. All of these have various agreements in place for technology, and procurement of critical inputs such as feedstock, electricity, and water. None have an operational project yet. The exception is Hazer, which has captured significant Government and green-shareholder support for a 100 tpa demonstration plant, which is under construction. We post a brief description of each below.

1. Hexagon Energy Materials Ltd (ASX: HXG). Market capitalisation @11/6/2021 A$36M. Owns a portfolio of graphite, gold and base metal exploration assets in the USA and Australia. Strategic focus is on the Pedirka "Blue Hydrogen" project. The aims to exploit a large coal resource in the Pedirka Basin in the south of Northern Territory. This coal is low quality, underground, distant from transportation infrastructure so has low alternative commercial opportunities. The proposed Pedirka project would generate ~4 MTPA of Co2. HXG claims this will be captured and potentially sequested in depleted oil or gas fields, or re-processed to generate additional H2 via NCF processes. The core technology is coal gasification. There are ~300 coal gasification plants in commercial operation, 80% of them in China leveraging cheap and abundant coal. Critical to this project is conversion and capture of the carbon. In terms of status, $8.5M in equity capital was raised in May 2021, of which $3.75M is allocated to a pre-feasibility study for the Pedirka project.

2. **Hazer Group Ltd (ASX: HZR). Market cap @11/6/2021 $151M**. HZR is building a 100 TPA commercial demonstration plant at the Woodman Point waste water treatment plant in WA, utilising biogas produced at the water treatment plant as a feedstock, to produce hydrogen and graphite. The basic process is methane pyrolysis, using iron ore as a catalyst. The company calls this the "Hazer process" and appears to be unique. The demonstration plant being built at a cost of ~$18M, aims to demonstrate scale-up, and has received significant financial backing from ARENA and dedicated green investment funds.

3. Province Resources (ASX: PRL). Market cap @11/6/2021 A$162M. PRL plans a green hydrogen electrolytic plant near Carnarvon, WA. PRL has MoU's in place with Total-eren to build, own and operate dedicated wind and solar generation plant, and a 50/50 JV with Total-eren to build, own and operate a downstream hydrogen / ammonia plant. Scoping studies are underway for a 180,000 tpa hydrogen plant. The choice of site on the WA coast is driven by an expected abundance of sunshine and consistent winds, to power solar and wind-farms.

4. Private company **Infinite Blue Energy (IBE)**. Pre-IPO monitor "Stockhead" posted on April 26 that IBE had secured a pre-IPO fund raising of $10m and plans to build an electrolytic plant at Arrowsmith, 270 Km north of Perth, also utilising ideal wind and solar conditions. The initial stage 1 plant is costed at ~$420M. Initial production is 5 tpd in 2022, scaling up to 25 tpd by 2024. The hydrogen has been pre-sold to satisfy local heavy haulage refuelling stations. According to the company website, the pre-IPO offer price values the equity at ~$90M

It is worth noting that all of these companies are in a pre-development phase, as is Pure Hydrogen. None have revenue and will require support from capital markets, government agencies or strategic partners to move into a commercial phase. All post presentational material which we asses as general and lacking economic and technical information. There may be good reasons for keeping the intellectual property away from the public (and competitors), but there is no real data to independently assess economic viability and whether equity market valuations are reasonable.

Within this context, it would be reasonable to ascribe $50-$100M to PH2's stand-alone hydrogen assets, which equates to 16-32 cps.

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Key risks

Pure Energy is an exploration phase company and there are technological, geological and financial risks. Asset specific risks are documented as follows.

Windorah trough.

The key risk is in understanding the geology and finding solutions to drilling and extraction of gas from low permeability BCG reservoirs. The test results to date show high initial gas flows but rapid decline. More data is required to resolve the reasons why and find engineering solutions and that will require more wells and more testing. Unlike CSG wells in Qld, Windorah Trough wells are relatively deep and expensive. A key risk is of insufficient capital to drill and test enough wells to fully understand the geology and how best to develop it.

Project Venus.

There are operational and geological risks. The operational risks relate to the drilling of a new well. The geological risk is that associated with the reservoir quality. The Walloon coals are geologically well understood across a broad region but quality varies from block to block and the low permeability which is interpreted in this block may render gas production unviable. Water flow and pressure regime in the well need to be carefully controlled to preserve cleating and mitigate fines which could block up the cleats and pores and inhibit production.

Serowe CBM project. It is early days in the appraisal program, and one successful well drilled to date is a very limited data set. Multiple wells need to be drilled and tested before reserves can be booked and the gas commercialised. In addition, PH2's JV partner "Botsgas" is a small private company and it will need to raise additional funds from its shareholders as it progresses through the various phases of the agreed work program. If reserves can be proven, the JV still need to find gas customers in Botswana, in competition with other E&P companies active in the country.

Financial. All of PH2's projects are in the pre-commercial phase and require ongoing funds for appraisal and pre-development activity. Pure will need access to capital in order to deliver its strategy beyond 2021.

Hydrogen. The key risks are technical and commercial. Commercial risks are on the various MoU's which may not convert to binding commercial arrangements. Technical risks arise in the intention to use Hydrogen production processes which are not yet common and are not yet proven on an industrial scale compared to numerous commercial processes and plant that are currently operating.

Strategic relationships. PH2 has several term sheets and MoU's out with strategic partners, but all of these are private companies. Beyond self-endorsing web-sites, its very hard to vet partner company financial and technical capability in addition, we have no way of determining PH2's financial commitments and legal exposure to these various agreements.

Carbon product market risk. PH2's planned large scale hydrogen plants will produce substantial volumes of caron products (carbon black, graphite and graphene). The markets for these products are opaque and fickle in terms of product quality. PH2 may not be able to find reliable buyers for its carbon products, which would result in zero by-product revenue and additional costs for physical storage.

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Australian East Coast gas market state-of-play.

East coast gas prices crashed in mid-2020, due to (1) Covid19 economic effects in Asia impacting regional demand for LNG, and depressed LNG spot prices (2) reduced domestic gas demand and (3) diversion to the domestic gas market of LNG otherwise destined for the Asia spot markets. See figure 11.

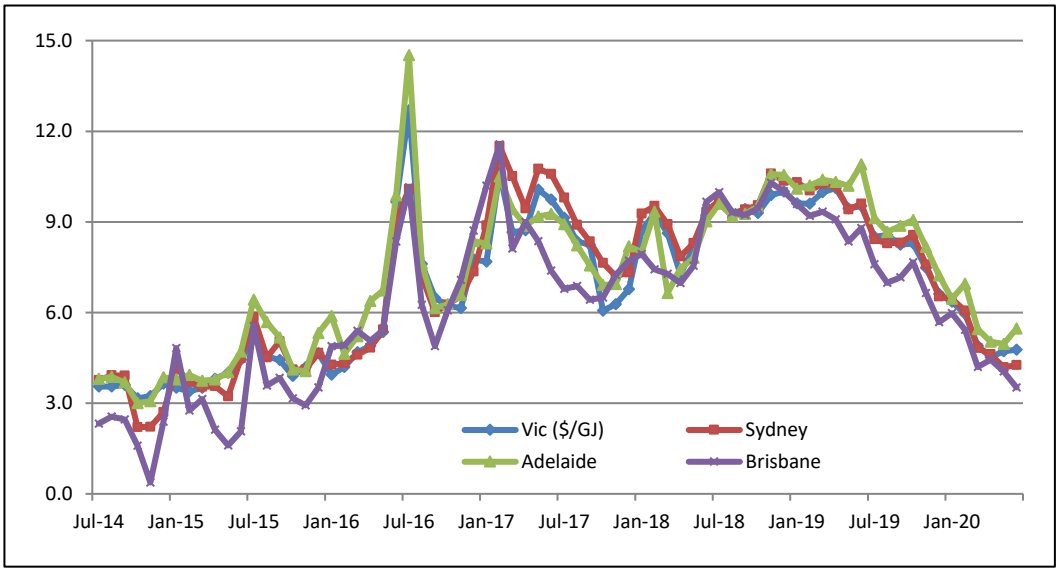

Figure 11. Monthly average gas price, in A$/GJ, delivered to "City gates".

The most recdent "Gas Statement of Opportunities" from AEMO, released in March 2021 shows a market shortfall from mid-2023, as a base case. Refer to figure 12. However, there are three critical assumptions regarding future supply. The first is that a number of projects move from planning into production, which requires an upfront investment. The second is that the Queensland LNG industry continues to divert spot LNG volumes into the domestic market. The is a tenuous assumption as it only makes sense when the Asian spot LNG market is low. If LNG markets tighten mid-decade as some observers believe, then excess local LNG production will be re-directed back to exports. The third is an assumption than an LNG import terminal will be built in Newcastle with start-up ~2023.

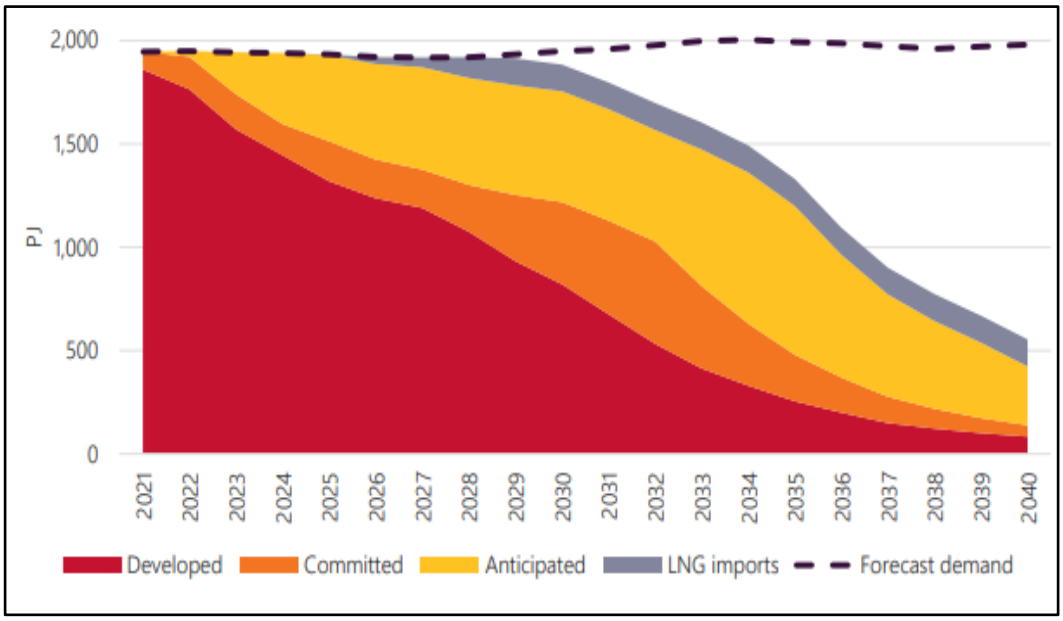

Figure 12: Source AEMO March 2021 Gas Statement of Opportunities

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East coast gas prices are now firming. The ACCC latest forecast of LNG netback prices in 2022 is to be in the $8-12/GJ range. (ACCC June 1, 2021) Refer to figure 13. The sharp move up expected in the second half of 2021 and into 2022, is driven by underlying strength in crude oil prices, with Brent crude now over US$70/bbl, the highest since November 2018.

In the third week of June, as domestic demand approaches a seasonal peak, gas prices at the Wallumbilla hub have reached the $14-15/GJ range.

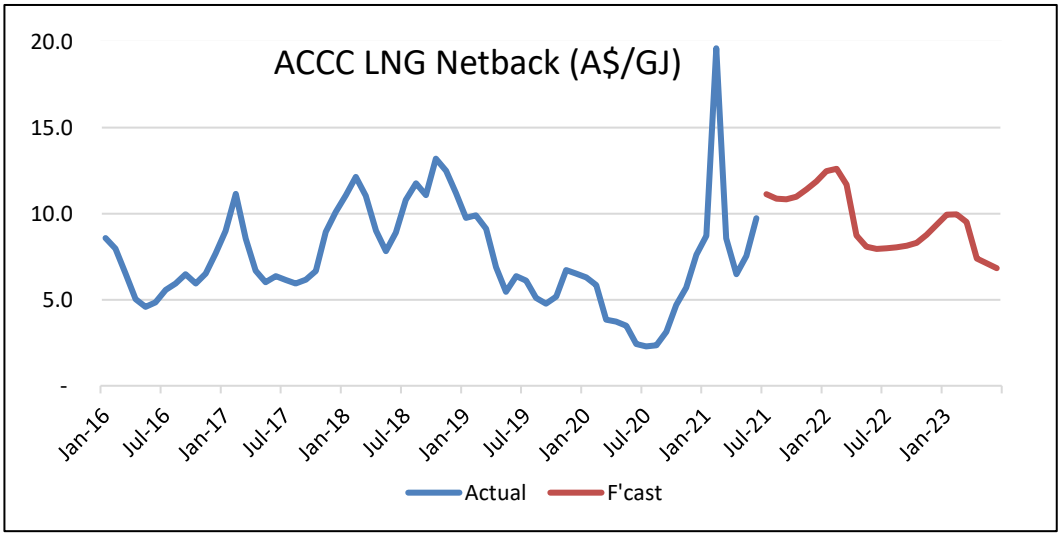

Figure 13: Source ACCC LNG Netback Price series, June 1, 2021

Federal Government Backs Natural Gas

A number of energy policies were unveiled by the Prime Minister in September 2020. The over-arching strategy recognises the importance of gas as a critical "transition" fuel, and the importance of long-term supply for an "gas industry lead recovery". Key parts of the strategy and funding are:

- Unlocking new gas basins in central Qld (Bowen) and northern Qld (Galilee Basin) and the NT (Beetaloo) at a cost of $28M.
- Identifying critical new pipeline infrastructure, as part of the inaugural National Gas Infrastructure Plan (NGIP), worth $10.9M. This comes on top of a Qld Government initiative to fund $5M for studies on a pipeline route from Moranbah in the Bowen Basin to Wallumbillah.
- Reforming pipeline regulations to promote competition.
- Establishing the Australian Gas Hub at Wallumbillah in Qld. The intention is to create more transparent pricing, and facilitate trading to allow smaller producers to enter the market.

The Federal Budget delivered in May, 2021 contained further funding initiatives. Specifically:

- $38.7M for early works to support critical new infrastructure.
- $5.6M to further develop the NGIP in 2022.
- $6.2M to accelerate the design and implementation of the Wallumbillah Hub.
- $4.6M to develop initiatives for gas-reliant industries to negotiate competitive outcomes.
- $3.5M for development of a long term "future gas infrastructure framework".
- $15.7M over three years for developers engaging in field trials in the Galilee and North Bowen basins. The grants will be directed to companies engaging in field works to improve geological understanding, address technical drilling issues and better understand gas deliverability.

- An additional $5M to match the Qld Government's $5M, into the pre-feasibility study for a single, large capacity pipeline from Moranbah to the east coast.

Ph2 does not have exposure to some of the gas basins targeted, such as the Galilee and Beetaloo. However, expansion of infrastructure in southern Queensland, and a trading hub at Wallumbillah may create additional gas market opportunities for Venus gas, in addition to Hydrogen production

Federal Government "renewable" initiatives

In May 2021, the Federal Government launched the "Australia National Hydrogen Strategy" with the objective of making Australia a major player by 2030. According to the CSIRO, there are already 67 separate projects being contemplated or operating across various parts of the value chain, and one of the Governments objectives is to ensure development takes place in an efficient and so-ordinated way, with production and storage standardised. The strategy supports the creation of "hydrogen hubs" and the Government has allocated $276M for the advancement of up to 10 such hubs.

In addition to this, the "Australian Renewable Energy Agency" (ARENA) has been sponsoring research & development since 2018, and in March 2021 lists 16 projects which have received funding to date. These projects are all located at university research facilities, but all of these university research centres have co-operative relationships with industry eager to access the technologies that offer commercial potential

Hydrogen production: State of play

The basic chemistry: "Green, Blue & Turquoise" hydrogen

There are two basic ways to produce hydrogen

1. **Through electrolysis of water**. Electricity is passed through fresh water splitting the H2O into Hydrogen and Oxygen. The only products are Hydrogen and Oxygen, however alkaline or other additives are required to make the water conduct electricity, and expensive Platinum Group Metals are required for anode and cathodes.

Relative to other ways of making Hydrogen, it is very expensive. It is very energy and fresh water intensive. 1 Kg of Hydrogen requires 39kWh of electricity and 9 Kg of fresh water. Only ~2% of all hydrogen is manufactured commercially in this way. However, if the electricity is sourced from renewables such as wind and solar, then Hydrogen manufactured from electrolysis is almost entirely carbon free. **Hydrogen manufactured from emissions free electricity is labelled "Green Hydrogen".**

Various think tanks assess the cost of making Green Hydrogen in the range $6-$9/Kg, depending on location and price of local power, and scale of operation. The Australian Government cost objective for commercial and cost-effective hydrogen production < $2/Kg.

2. **From the conversion of fossil fuel**, commonly natural gas and coal. According to the IEA, 76% of Hydrogen produced today is derived from natural gas, and 23% from coal. In these fossil fuels, Hydrogen is bound to carbon (Methane = CH4) and splitting it off requires a high temperature catalytic reaction.

There are ~100 documented technical variants on the basic concept, but the commonest and widely applied for commercial mass production is "Steam methane reforming" (SMR). In SMR, natural gas supply and cost is critical, as gas is used as the feedstock for Hydrogen as well as a combustion source for the conversion reactor to reach the high temperatures the process requires.

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For conversion from gas, the IEA estimates that 45-75% of production cost is from the price of gas, hence hydrogen produced via SMR is concentrated in countries where natural gas is abundant, cheap or possibly stranded, notably North America, the Middle East and Russia. Production costs in these countries before considering Co2 abatement or capture is in the order of $1-2/Kg.

If coal is used as a feedstock, it first needs to be combusted to generate a gaseous mix of Carbon, Hydrogen and Oxygen atoms (a "Syngas") and this involves more processes and usually higher plant capex, potentially offset where coal can be sourced cheaply. Coal gasification has been used for many decades for Ammonia and fertiliser production. Globally there are >130 plants, 80% of them in China leveraging that countries abundant and cheap coal.

Unfortunately, the use of fossil fuels in the combustion and conversion process, leads to significant production of CO2. In the future, such emissions will either be taxed, or disallowed. There are avenues for abatement. The production of 1 ton of Hydrogen from natural gas results in production of ~10 tons of CO2.

- **Capture, sequestration and storage of the CO2 (CCS)**. Natural gas plants commonly vent CO2 to air and in time, this will either be taxed, or forbidden. Captured CO2 can be injected back into depleted oil or gas fields (Santos pursuing this in South Australia, numerous examples in the USA and Europe). In certain areas, there may be commercial value in selling food grade CO2. Food grade Co2, common to "carbonated beverages", is both a very large and very valuable market.
- **Production of solid carbon**, in the form or Carbon Black, Graphite, Graphene, thus eliminating venting or the need to capture gaseous CO2. There is a commercial market for such products, thus creating a potential revenue stream. Alternatively, the solid waste can be stored. However, the processes required are complex and operationally challenging in a commercial setting.

Next: Turquoise Hydrogen

Cracking (or pyrolysis) of methane is an emerging and promising technology as it splits the CH4 (methane) molecule into Hydrogen and solid carbon, with no gaseous CO2 emissions. Both products are valuable. This chemical reaction takes place at very high temperatures, between 600 and 1200 degree C in a catalytic reactor, and up to 2000 C in the case of plasma pyrolysis.

Capture of the carbon that naturally occurs in the natural gas stream, eliminates CO2 emissions from the use of gas (methane) as a feedstock, however there are still emissions from the source of energy required to drive the this very high temperature process. If that energy input is from renewable electricity, then this hydrogen production process will be very close to being CO2 emissions free.

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Board members: Pure Hydrogen.

The board and senior management team have been with Pure Hydrogen since the inception of Real Energy, and Strata-X. The Board and executive team are sourced from both companies at merger.

Ron Prefontaine, Non-Executive Chairman

Ron graduated from the University of British Columbia in 1979 with a degree in Geophysics, and worked in Calgary before being recruited by Santos in 1981. At Santos, Ron worked on projects in the Cooper, Bowen, Surat and Canning Basins and subsequently had careers with OCA and Pancontinental Petroleum. Recognising the potential of the Surat Basin Walloon acreage, between 1994 and 2001 Ron's private company applied for several million acreage which was subsequently farmed out or acquired by Arrow Energy. In 2001, Ron became Executive Director of Arrow Energy, running the de-risking of the E&A program. (Arrow Energy was acquired by Shell in 2010 for A$3.5B). In 2005, Ron co-founded Bow Energy, another Queensland CSG specialist. In 2011, Bow was acquired for $550M. In 2012, Ron co-founded a specialist well service company, Wellpro, based in eastern Qld and providing specialist completion and well equipment to the Qld CSG industry. In 2015, Ron founded Strata-X and in 2020 was instrumental in the merger with Real Energy

Lan Nguyen, Non-Executive Director

Mr Lan Nguyen holds a Bachelor of Science (mining engineer-geologist) degree majoring in petroleum exploration from the Institute of Oil and Chemistry, Baku, Azerbaijan, and a Master of Science degree in petroleum geology from the University of New England, Australia. He is a member of the Petroleum Exploration Society of Australia (PESA), the American Association of Petroleum Geologists (AAPG) and the Society of Petroleum Engineers (SPE).

Lan is a professional petroleum geologist and engineer with over 25 years of experience in petroleum exploration, development and production in Australia and internationally including 15 years at Mosaic Oil N.L. ('Mosaic'), an ASX listed petroleum exploration and production company, where he played a leading role, initially in technical and middle management positions and in the last 4 years, as Managing Director, in transforming Mosaic from a speculative petroleum explorer to a successful petroleum exploration and production company with growing production revenues, petroleum reserves/resources and profitability. Lan is credited with the discovery and development of many oil and gas fields in the Surat-Bowen Basins through his innovative introduction of various exploration, drilling and completion technologies to Australia.

Lan is currently a principal/director of Tanvinh Resources Pty Ltd and Latradanick Holdings Pty Ltd, which provide services to energy and resources companies in Australia and Asia-Pacific region.

Scott Brown, Managing Director

Mr Scott Brown holds a Bachelor of Business and a Master of Commerce and is a member of the Institute of Chartered Accountants and the Petroleum Exploration Society of Australia (PESA).Scott was the Chief Executive Officer and co-founder of Real Energy Corporation Limited and was instrumental in the merger with Strata-X to create Pure Hydrogen. He is currently CEO & MD of Pure Hydrogen

Prior to this, he was the Chief Financial Officer of Mosaic Oil NL (ASX: MOS), a listed petroleum production and exploration company with an extensive range of oil and gas production and exploration permits in Queensland, New Zealand and offshore WA. He is also a non-executive director of Trisil Group Limited.

During his time with Mosaic, he was involved in the acquisition of production properties and the growth of its business and profitability. He was instrumental in putting together a Scheme of Arrangement with AGL Energy Ltd to acquire Mosaic for consideration of $142 Million.

Scott has an extensive background in finance and management of public companies including guidance through the listing process. Prior to Mosaic Oil NL, Scott was Finance Director of Objective Corporation Limited ('Objective'), an enterprise content management (ECM) software company that established itself as one of the leaders in the ECM market.

Scott was also formerly the Chief Financial Officer and Company Secretary with a number of public companies including Turnbull & Partners Limited, Allegiance Mining NL, FTR Holdings Limited and Garratt's Limited. Scott also worked at accounting firms, Ernst Young and KPMG

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Analyst Verification

I, **Stuart Baker** as the Research Analyst, hereby certify that the views expressed in this research accurately reflect our personal views about the subject securities or issuers and no part of analyst compensation is directly or indirectly related to the inclusion of specific recommendations or views in this research.

Disclosure

Breakaway Research Pty Ltd (AFSL 503622) and its associates, or consultants may receive corporate advisory fees, consultancy fees and commissions on sale and purchase of the shares of ***Pure Hydrogen Corporation Limited*** and may hold direct and indirect shares in the company. It has also received a commission on the preparation of this research note.

We acknowledge that Senior Research analyst, Stuart Baker, holds no shares in Pure Hydrogen Corporation Ltd

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