Pure Hydrogen Corporation (PH2)

Building an integrated Hydrogen business

July 2022

Oil & Gas Team
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www.breakawayresearch.com

Company Information

ASX Code	**PH2**
Share Price (EOT 7/07/22)	$0.26
Ord Shares (M)	343.2
Market Cap (fully diluted)	**A$89**
Cash (31/3/2022)	A$11.8M
Debt	A$0.0m
Enterprise Value	**A$77M**

Directors: Refer to page 16

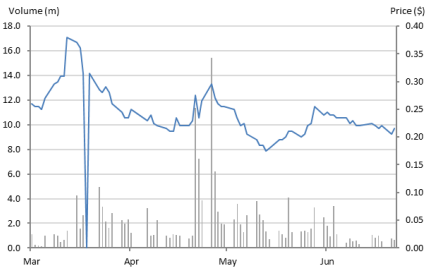
Company Details.

Location:

Level 3, 32 Walker St, North Sydney

Website: purehydrogen.com.au

Price Chart



Source: ASX

Key Points

- ***PH2 is planning an integrated Hydrogen (H2) business from production through to the supply of fuel-cell powered vehicles. Underpinning this is a large contingent gas resource, partnerships with other corporations specializing in various parts of the supply chain, and rising interest from transport and power companies seeking to reduce their carbon emissions.***
- ***Natural gas is a key ingredient & PH2 has 3 projects:***
  - ***Prospective resources of 11.8 Tcf and 2C Contingent resources of ~600 PJ including equity in associate company volumes, in Queensland and Botswana.***
  - ***20% shareholding in soon-to-list Botala Energy. (ASX:BTE)***
- ***Hydrogen production:***
  - ***Collaboration with French high-tech company Plenesys for commercialization of methane pyrolysis plants to produce "turquoise hydrogen", and exclusive rights to commercialize in Australia, sub-sahara Africa and selected south east Asian countries.***
  - ***JV with bio-waste treatment specialist CAC-H2 to develop bio-waste to Hydrogen projects in eastern Australia.***
- ***Hydrogen fuel cell & FCEV vehicle development:***
  - ***PH2 owns 24% of Australian company H2X Global, which plans to produce a range of FCEV light commercial vehicles and fuel cells power units, with manufacturing planned to commence in late 2022 in Australia.***
  - ***Agreements with several heavy vehicle truck fleet operators for FCEV vehicles & associated H2 supply.***
  - ***JV with Indian auto component maker Advik to roll-out the H2 supply-vehicle strategy in India.***
- ***PH2 had $11.8M cash at March 31, 2022, and an R&D tax refund due of ~$5.9M, and no debt. Coupled with investments being made by partners, PH2 is well funded to advance development on a number of fronts.***

PH2 offers exposure to the rapidly growing H2 industry, with H2 potentially a source of "green" energy for transportation, power generation and gas reticulation. Our valuation range is 32c to 90c. with a best estimate of 54c..

Integrated Hydrogen strategy coming together

PH2 has built a portfolio of hydrogen assets in the past two years since making a strategic shift to focus on clean energy ahead of natural gas production. While natural gas still underpins PH2's development plans and anchors value, it is clear the fossil fuel industry in general is pivoting to "clean" energy. PH2 plans carbon-free production of Hydrogen (H2), and its distribution, and application to vehicle fleets.

The investment case for PH2 is anchored by its large gas resources, intellectual property, strategic investments in other corporations and partnerships with other specialist companies. Figure 1 outlines various elements of the integrated nature of PH2's business model. These segments are core to our valuation and are addressed further in this report.

Natural gas as feedstock	**2C- PJ**
100% Windorah Trough BCG resource.	330
100% Venus CSG	130
30% Serowe CSG Botswana	101
19.9% shareholder in Botala Energy	47 (indirect)

Hydrogen production & Sales	**Key activity**
Turquoise H2 production & supply	Plenesys H2 (2)
H2 production from bio-waste	TS with CAC-H2 (2)
PH2 (49%)/Advik Hi Tech (51) JV (3)	H2 production, supply & transportation: India

Mobility: Fuel cell generator & vehicle supply	**Key activity**
23% share-holder in H2X (5)	FCEV build: Australia
PSA to BLK Auto (1)	FCEV bus, H2 supply & vehicle reseller
Binding TS with JJ Waste (2)	Trial FCEV garbage truck
PSA with Bucher Municipal	Supply FCEV waste collection bodies & fuel
H2X (49%) & Advik Hi-Tech JV (51%) (4)	Supply of FC generators
TS with AKM Earth	7-12 FC "skip" trucks + H2 supply

(1) PSA: Preferred Supplier Agreement (2) TS: Term Sheet (3) JV: Joint Venture
(4) PH2 exposure to this JV via its shareholding in H2X (5) PH2 has option to increase to 48%
Figure 1. Source: Breakaway Research

Valuation: 32-90c with best estimate 54c.

We value PH2 in the range 32c to 90c, as shown in Figure 2. Refer to pages 11-13 for analysis, assumptions and discussion.

SoP valuation	**Best est**	**Low**	**High**	**Method**
Gas resources (Venus/Botswana/Windorah	0.33	0.23	0.52	EV/2C -3C
Equity in Botala	0.02	0.02	0.02	IPO low-high
H2 Production (CAC, Plenesys)	0.15	0.03	0.31	Peer group
Mobility solutions	0.01	0.01	0.01	H2X BV
Cash	0.03	0.03	0.03	At 31/March
Total	0.54	0.32	0.90	

Figure 2. Source: Breakaway Research

Asset snapshot.

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- **CSG Queensland.** Project Venus (100%) is a coal seam gas project in eastern Queensland. The gross prospective resource is 694 PJ (best estimate) and 2C resource is 130 PJ. In 2021 Venus#1 was drilled and tested but initial results were considered non-commercial. Work continues to identify technical solutions to enhance flow rates.
- **Serowe CSG** gas project in Botswana, in JV with Botala Energy in which PH2 has a 19.9% shareholding. Botala has raised $5M via an IPO and will fund a multi-well CSG program at nil cost to PH2 under an earlier farm-out transaction. The Serowe CSG project has 2C gas resource of 318 Bcf, and a Prospective Resource of 8.008 Tcf (100%).
- **Windorah gas project, Qld Cooper Basin** (100%). Gas resources are assessed at 330 PJ (2C) in a "basin-centred" gas play, defined by 4 wells drilled and tested from 2015 to 2019. The best estimate of prospective resource is 8800 PJ. Test wells flowed gas at high rates but could not be sustained and work continues to identify optimal drilling technologies.
- **Hydrogen hubs and hydrogen production**. PH2 plans to participate in various ways, with other companies seeking to establish a range of Hydrogen production projects, from small scale modular to serve local markets, up to very large scale export-oriented projects. Some of these are concepts requiring further definition, but at this time the more advanced initiatives are:
    - MoU with Singapore-based bio-waste gasification specialist **CAC-H2**, to partner in building up to three bio-mass to Hydrogen plants on the east coast, with PH2 managing storage, offtake and marketing of H2. The first, to be located at Caboolture, Qld is in the FEED and planning phase.
    - Binding term sheet with French technology provider **Plenesys** to collaborate on commercialisation of Plenesys' patented technology for the conversion of methane to Hydrogen and solid carbon with zero CO2 emission, via a technique known as "methane pyrolysis". A pilot plant is planned to be built in Brisbane. PH2 has rights to commercialise in Australia, southern Africa and selected south east Asian counties.
    - A 49%/51% JV with Indian auto component maker, **Advik Hi-Tech**, to produce and sell H2 in India.
- **Mobility.** PH2 has various MoU's and Term Sheets with transportation companies seeking ways to reduce their CO2 footprint. These include supply of FCEV's, supply of Hydrogen fuel, and supply or hydrogen power cells.
    - **Vehicle supply via H2X.** PH2 has invested $1.05M in private company H2X and has a 23% shareholding. H2X plans to produce a range of hydrogen fuel cell (HFCEV) light commercial vehicles and buses, from a facility established at Sale, Victoria and another planned in Sweden.
    - Separately, H2X has a binding agreement with **Advik Hi-tech**, to establish a 49/51 JV, for the production of fuel cell generators in India.
    - **Several agreements** with heavy vehicle fleet operators for the supply of FCEV vehicles, along with Hydrogen re-fuelling and ancillary services.

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Natural gas is a key feedstock in the production of Hydrogen, and currently, around 97% of all Hydrogen is derived through reforming of natural gas, and other fossil fuels such as coal, and bio-waste. Production from natural gas dominates global production of Hydrogen and the most wide-spread production technology is a process called "steam methane reforming" or SMR.

SMR uses high temperature and a catalytic process to convert the methane (CH4) into its basic elements, carbon and hydrogen. However, Co2 is produced as a by-product and in order to avoid carbon emissions, then it must be captured and stored.

PH2's strategy is to produce hydrogen from natural gas by methane pyrolysis, in which the carbon is produced as a solid which can be stored and sold, thus avoiding CO2 emissions. This and similar pyrolytic processes are referred to within the industry as "turquoise hydrogen" and this is described further in this report, the key point being that this technology is ideally suited to utilise PH2's very large gas resources in Australia and Botswana, as a feedstock for H2 production. In total, PH2 has 2C gas resources of 608 PJ in three projects in Australia and Botswana. Refer to figure 3.

Pure Hydrogen contingent gas resources (PJ)	1C	2C	3C
100% Project Venus	88	130	158
100% Windorah Trough	118	330	770
30% Serowe CSG Botswana-core area	76	101	126
Indirect exposure: 20% Botala	35	47	58
Total	317	608	1112

Figure 3. Pure Hydrogen contingent gas resources.

"Project Venus". (PH2: 100%)

Venus is a gas project located in Queensland's prolific Surat Basin coal seam gas fairway. Refer to figure 4 for location. In March 2021, the Venus#1 exploration well was drilled and tested. The well reached a gas flow of 84 Mcfd demonstrating that the coal seams can produce gas but this rate is not commercial. A 2C contingent gas resource has been independently assessed at 130 PJ (gross), with a Best Estimate of prospective gas resource of 694 PJ. PH2 are evaluating drilling and completion methods to maximise well productivity and inform commercial development.

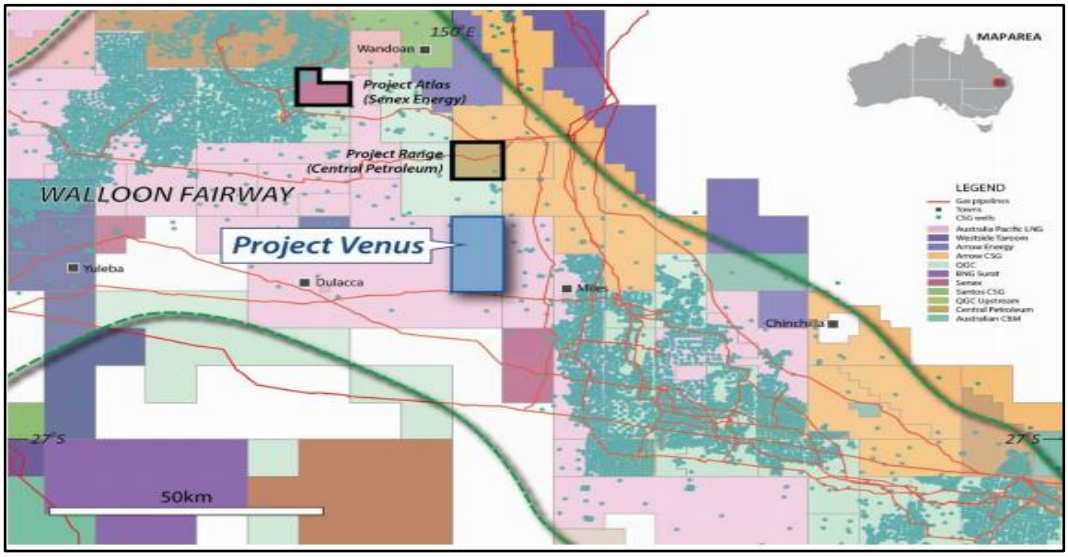

Figure 4. Location of "Project Venus" acreage in the Surat Basin, Qld. Source: Pure Hydrogen March 2022 quarter report

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

The Windorah Trough gas project 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. 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, namely Queenscliff-1, and Tamarama 1,2 & 3 between 2014 and 2019. Flow-rates on test were very encouraging at > 2MMcfd from T2 & T3, however could not be sustained. Work to date underpins contingent gas resource bookings in the range 118 PJ (1C), 330 PJ (2C) and 770 PJ (3C).

The next steps to unlocking the potential in this acreage is to understand the "basin centered gas" (BCG) geological model, which is only partially proven by the well results. Work is ongoing to evaluate drilling, completion and production technologies appropriate to a commercial development.

Serowe CSG project, Botswana (PH2 30%, Botala Energy 70%)

Botswana, and other countries in southern Africa are energy short. Botswana sources electricity from South Africa as well as its own generation which is predominantly from coal-fired power plants. PH2 & Botala are endeavouring to produce gas from coal seams in order to provide gas for in-country power generation and for renewable energy.

In 2016, PH2's precedent company Strata-X acquired acreage in the Karoo Basin in Botswana. In 2020, Strata-X merged with Real Energy Corp to become PH2.–Between 2019 and 2021, Strata-X drilled 5 exploration wells, Serowe 1-5, with encouraging results.

Farm-out to advance appraisal activity

In order to facilitate funding and accelerate activity, Strata-X/ Real Energy sought a farm-in partner and on March 23, 2020 announced a farm-out to private company "Botsgas", which has been subsequently renamed Botala Energy Ltd. Botala is a Perth-based company, with its core asset the Serowe CSG project in Botswana.

Key elements of the farm-out deal when announced were:

- A 4-stage farm-out funded 100% by Botala, for up to 19 wells drilled and tested, including 7 appraisal wells, and 3 multi-well pilots.
- If all stages are completed, then Botala will earn 49% in the tenements, and upon a successful ASX listing, PH2 will transfer an additional working interest of 21% to Botala taking Botala's interest to 70% and reducing PH2's to 30%

The investment required to complete all 4 stages and for Botala to earn its working interest, is A$6.1M of which $3.8M remains to be spent, which Botala will fund from proceeds of an Initial Public Offering (IPO). In May 2022, Botala lodged a prospectus for an IPO to raise between $5 and $7M. Details can be found in the Prospectus, available through the Botala website, Botalaenergy.com. On June 21, 2022 PH2 advised that Botala had successfully raised $5M and that trading on the ASX is expected to commence in mid to late July. This de-risks the funding of balance of the drilling and testing activities.

A comprehensive description of the geological setting, and key coal seam characteristics as determined from the 5 wells to date, is contained in the Botala Prospectus and is not summarised here brevity. In any event the appraisal program planned for the next 2 years will define many of the key parameters and inform optimal development drilling and completion technologies.

Based on the wells drilled to date, resources were independently audited, and released to the ASX on April 12, 2022.

The Contingent Gas Resources are assessed to be 237 Bcf (1C), 317 Bcf (2C) and 396 Bcf (3C)

Commercial considerations.

PH2 and Botala have a Term Sheet to establish the Serowe Hydrogen Hub renewable energy business targeting 50 MW of power generation in Botswana. PH2 will provide support drawing on its partnerships established in Australia. Currently, Botswana is dependent on power imports from South Africa and coal-fired generation for electricity. In April 2021, the Botswana Government unveiled a National Energy Policy, to reduce its dependence on imported power, and targeting 15% of installed capacity coming from renewables by 2030, rising to 50% by 2036. Currently, Botswana's annual power demand is 4500 GWh and this is forecast to grow at ~4% cagr through to 2040. In addition to declining availability of power from South Africa, one of two coal-fired power generators is planned to be decommissioned in 2026, necessitating additional capacity. In addition, there is diesel-fired power generation capable of running on natural gas, should gas become available.

Strategic implications for PH2

The Botala initial public offering will result in a paid-up capital of 137M shares, and at an issuance price of 20c will result in an equity market value of $27.4M. PH2's 19.9% shareholding would have a market value of $5.4M, at the issue price. Importantly for PH2, a Botala listing enables (1) a market value for PH2's equity holding and look-through value for its 30% direct interest in the project (2) funding from Botala to continue the ongoing appraisal and testing activity, with PH2 free-carried through the remaining farm-in expenditures.

Hydrogen Production & Sales

PH2 has been engaging with various technology organisations over the past 2 years, to advance its strategy of producing Hydrogen, and in particular "Turquoise Hydrogen".

"Turquoise" Hydrogen technology & Plenysis.

In March 2022, PH2 announced it had signed a binding collaboration and licence term sheet with French technology company, Pleneysis, to commercialize Pleneysis patented technology in Australia, southern Africa and specific south east Asian nations.

Plenesys has a patented process, "HyPlasma" the core of with is a "plasma torch" which breaks the methane (CH4) into its atomic components, H2 and Carbon (C), with the carbon formed as a solid which can be stored. Production of solid carbon eliminates gaseous CO2 emissions, and in addition, there is a growing market for solid carbon for use in batteries and other applications.

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. This takes place at very high temperatures, up to 2000 C in the case of plasma pyrolysis and the process is ideal for small scale production.

Capture of the carbon from the cracking methane, in a solid form eliminates CO2 emissions from the use of gas (methane) as a feedstock and allows the carbon to be stored or sold. However there are still emissions from the source of energy required to drive this high temperature process. If the energy input is from renewable electricity, then this hydrogen production process will be CO2 emissions free. In the renewables industry this is termed "turquoise hydrogen" to differentiate the process from other processes which produce H2 from various fossil fuels including coal and bio-waste, or from Hydrogen produced by electrolysis of water.

PH2 and Plenesys plan to develop modular H2 plants designed to fit into a 40-foot shipping container as shown in figure 5. Inputs required to produce H2 are pure methane, from a natural gas source, and electricity to fire the plasma torch. The only outputs are Hydrogen, and solid carbon.

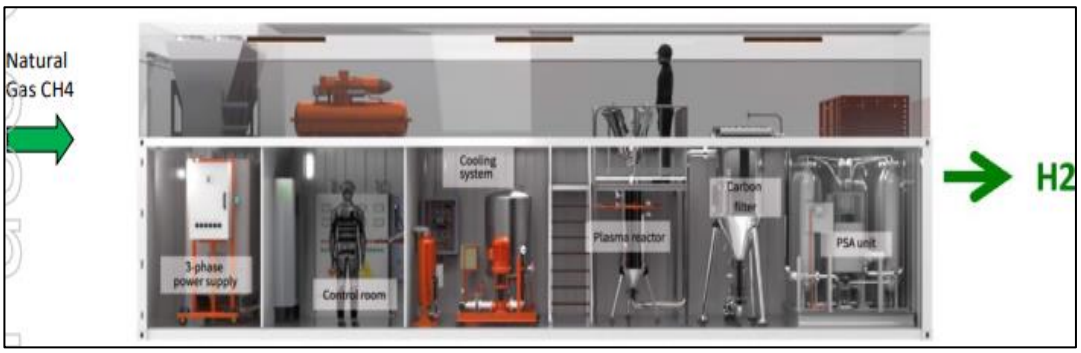

Figure 5: Conceptual methane pyrolysis production module

The modular concept is important in the development of a Hydrogen industry because it can be scaled and located near demand epicentres to minimise Hydrogen distribution and storage. Alternatively, the plant could be located near fuel sources such as gas or bio-mass that would otherwise be stranded. PH2 have chosen this process ahead of other technologies which are available because (1) it does not require any water for H2 production (2) it consumes one-fifth the power of other green hydrogen technologies such as electrolysis (2) there are no gaseous CO2 emissions from the pyrolysis (4) Carbon is captured in a solid form and can be sold

Plenesys claims the plasma production process is 50-60% cheaper than hydrogen production from electrolysis, and the plant can be run 24/7 from AC grid power eliminating the need to convert the electricity input to DC. As the key input is methane, quality of the gas and where it is sourced will dictate the extent of pre-treatment required to remove non-methane impurities at the front-end of the process.

The next steps are

- Secure a site for a pilot plant, with Brisbane targeted. Environmental, council & regulatory approvals will be required.
- Procure HyPlasma components, with Plenesys to engineer and construct the plant on-site.

For financing, PH2 are paying Plenesys $1M for the pilot equipment, from existing cash resources. In addition, PH2 will pay day rates for Plenesys engineers mobilised to the project. PH2 and Plenesys are negotiating payments for each HyPlasma module, comprising a licence fee and costs for component supply.

Commercial production is planned with capacity from each module in the range 1500-5000 Kg/day, and at current H2 prices of ~A$12/kg, revenue generation in the range A$9-31M p.a. is feasible. At this time we are unable to form a view on operating costs as these will eventually be location specific, with key variables being the availability and price of natural gas, and electricity either grid-derived or renewable.

East Coast Hydrogen hubs & CAC-H2 transaction

In November 2021, PH2 announced it had signed a term sheet with private company CAC-H2 for the construction of up to 3 “waste-to-hydrogen” plants, with the first to be built at Caboolture in Qld. CAC-H2 will finance, build and operate the plants, and PH2 will provide storage and load-out facilities, and market the Hydrogen. CAC-H2 is a Singapore-based company that specialises in the gasification and conversion of waste bio-products, and claims over 30 years of building and operating plants in south-east Asia.

The production process uses bio-waste, mostly wood that would otherwise go to landfill. The process involves gasification of the waste and then pyrolysis of the gas. In addition to H2, the process also produces other valuable by-products, namely wood vinegar, bio-fuel and bio-carbon.

PH2 that FEED and various approvals needed are progressing for the first project to be built at Caboolture in Queensland, targeting an initial production capacity of 2500 Kg/day tonnes per day of H2.

Hydrogen Mobility

PH2 has established a "mobility" business, targeting the supply of hydrogen fuel cell electric vehicles (HFCEV) 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 "Letters of interest" which are necessary building blocks for commercial operations.

Operators of large fleets of commercial and heavy-haul vehicles are under pressure to reduce their carbon emissions. Manufacture of hydrogen fuel cell electric vehicles (HFCEV's) is gaining momentum on a global scale and a number of specialist companies have emerged to produce such vehicles. What has yet to follow, to enable broad take-up, are the refuelling systems required. Until then, vehicle fleet owners which have opted for FCEV's usually operate on a back-to-base route, for example in waste collection, municipal bus fleets, and mining, where refuelling can be centralised at the end of a shift.

Building an electric vehicle capability

PH2 have progressed a number of strategies over the past 2 years to build an FCEV capability.

Key achievements have been:

- **H2X-Global:** PH2 has invested in and owns 23% ofH2X. H2X plan an IPO in 2023. Refer to the next page.
- **JJ's Waste**: Binding term sheet signed with this waste collection company, to trial Australia's first ever hydrogen fuelled garbage truck. A truck has been delivered to H2X's Sale manufacturing plant where H2X will install the hydrogen fuel cells, tanks and control systems.
- **BLK Auto**: signed a Preferred Supplier Agreement (PSA) with this bus and light-heavy commercial vehicle supplier, for the supply of Hydrogen and a reseller of FCEV's.
- **Bucher Municipal:** signed PSA for supply of waste collection bodies integrated for FCEV to PH2 customers.
- **AKM Earths Raw Skips**. PH2 has signed a term sheet with "AKM Earth" for the supply of 7 fuel-cell powered "hook-bin" trucks, with potential future orders of another 5 vehicles. The contract term for supply of Hydrogen is 7 years. The vehicles will be branded "PureX Mobility". PureX is a wholly-owned subsidiary of PH2.

Hydrogen Highway

A constraint on market for hydrogen fuelled vehicles at this time, is the availability of hydrogen and refuelling. PH2 has a visions to create an east coast "hydrogen highway and states it is in discussions with petrol retailers

H2X- Global

In late 2021, PH2 issued 8.6M shares to acquire an initial shareholding in Australian based FCEV vehicle developer H2X-Global, and more recently contributed $1.05M of a $3M raising undertaken by H2X. Currently PH2 has a 23% shareholding in H2X. According to PH2, H2X is seeking an IPO in 2023.

H2X's focus is on the small-to-medium size light commercial delivery vehicle, with operational range 300-600Km which are common in built up areas, and buses for urban use.

Pictured in figure 6 is one of three transportation variants that H2X seeks to manufacture, the "Warrego" This is built around a Ford chassis, with the internal combustion engine removed and replaced by fuel cells. This, and other vehicles in its product range are effectively existing chassis and drive-train from mass producers, minus the diesel or petrol engine, which are replaced by H2X fuel cells and electric generators.

H2X claim a ~500 Km range, and re-fuelling time of 3-5 minutes, a clear advantage over battery electric vehicles, however a detraction at this time, is a lack of hydrogen refuelling network. Until refuelling distribution networks expand, FCEV's are likely to be restricted to back-to-base fleet owners, which would fuel the entire fleet from the one location.

This is H2X's Warrego. The chassis is common, a Ford Ranger, with H2X replacing the power train with Fuel cells.

There are 3 variants, with quoted range 500-750Km, motor power 200-220Kw, and load capacity 1000 Kg.

Figures 6: H2X Warrego light commercial vehicle

H2X expect to build the Warrego at a manufacturing facility it has established in Sale, Victoria, with a vehicle launch planned for Q4 2022. H2X's website notes it has 250 "order-interests" from Australia, Germany, Malaysia and Netherlands. Currently, a garbage truck chassis has been supplied by **JJ Waste** to the Sale plant, where H2X will fit the fuel cells, hydrogen tanks and control systems. This vehicle is planned to be operated as a demonstration vehicle.

In Malaysia, H2X has an MoU with the Economic Development Corporation of Sarawak, (SEDC) Malaysia for the development of a range of FCEV vehicles and H2 power generators. The state of Sarawak has been an early adopter of Hydrogen powered vehicles, and has built a number of Hydrogen refuelling stations.

In Sweden, H2X has MoU's with the cities of Gothenburg and Trelleborg for supply of FCEV's from 2023.

As these vehicles are being assembled on a small scale at this time, we expect the basic product will be more expensive than petrol or diesel versions initially, however a key sales attribute is the zero emission, and we expect early adopters will be fleet owners endeavouring to lower their carbon footprint. Longer term, it's likely that Hydrogen prices and vehicle manufacture costs will trend lower as take-up rates grow and economies of scale become available.

Advik- JV

India is a large market for "green" vehicle makers, with >10 million heavy vehicles and buses. PH2 and H2X have established a joint venture with Indian auto component maker, Advic-HiTech, with Advik owning 51% in both, and PH2 and H2X the remaining 49%. Advik is a private Indian company and claims a $100M revenue stream from sale of engine and drive train components for two-wheel and 4-wheel mass produced vehicle makers.

The PH2-Advik 49/51 JV was announced in May 2022. PH2's principal objective is supply of Hydrogen fuel, but may include opportunities to supply FCEV vehicles to Advik.

The H2X-Advik 49/51 JV initially aims to supply H2X's range of fuel cell generators. Two of these units have been deployed to Advik's Pune factory for stationary power generation. The JV targets production of 10,000 power units within 5 years, with an expected price equivalent to A$28,000 per unit. If so, this represents a revenue opportunity of A$280 million. These power units come in sizes ranging from 5 Kw to 100 Kw, and are suitable for use in stationary applications such as farms, mines, factories, large commercial premises.

Finances & capital structure

Financial position

PH2 has no revenue from operations and is reliant on external funding, investments in private companies, strategic partners and share-holders to fund ongoing activity.

At March 31, 2022 PH2 had $11.8M in cash, and nil debt. In addition, a $5.9M R&D tax refund is due which would increase PH2's cash position to ~A17.7M when received. This is sufficient to enable work programs in the upstream gas fields as well as advancing hydrogen initiatives.

To enable material growth and capture of value PH2 will require additional external funds in the future, as large scale gas and hydrogen production plants are capital intensive. Importantly some capital commitments for ongoing activity are being carried by independently financed associate companies, specifically Botala and H2X

Funding options include:

1. Raising additional equity. PH2 and its precedent company Real Energy have financed their exploration activities to date from funds raised from equity investors.
2. Farming-out, or selling interests in the 100% owned Windorah Trough, or Venus, or both.
3. $5.9M R&D tax refund following a settlement reached with the ATO and announced on June 23, 2022, arising from R&D tax incentives for the years 2014-2019. In addition, a claim from the ATO for $7.2M has been extinguished.
4. Attraction of funds from venture capitalists, "green energy" sponsors, Government agencies, or strategic partners to advance the Hydrogen initiative.
5. Potential sale of equity in either of Botala, or H2X, depending on the future value of these entities in the private and public domain.

Capital structure

The capital structure as at April 29, 2022 is set out in figure 8.

Securities	**Code**		Expiry	Ex. Price (A$)
Ordinary shares quoted (million)	PH2	342.088		
Unquoted	PH2AK	1.088		
Total Ords. Quoted & unquoted (million)		**343.176**		
Options	PH2AM	9.832	Various	
Options	PH2AQ	15.994	30/03/2023	0.45
Options	PH2AP	4.408	30/09/2022	0.12
Options	PH2AR	9.191	30/09/2022	0.12
Options	PH2AS	0.5	31/03/2023	0.42

Figure 8: PH2 capital structure. Source: ASX disclosures

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Valuation: 32-90c with best estimate 54c.

PH2 is focused on the "Hydrogen economy" and it is invested in various parts of the supply chain from hydrogen production, through to supply of hydrogen power celled vehicles and re-fuelling systems. This integrated approach is rare to date in Australia, and from a valuation perspective, favours valuing the various parts along the value chain, and our principal valuation method at this time is to identify value for each of the key elements along the value chain.

Further supporting this, is the way that PH2 has structured some of its activities through investments in other companies which may become stand-alone entities attracting independent capital and public market valuation.

Our valuation building block are as follows:

- Commodity input to H2 production, underwritten by PH2's gas assets, with a large peer group of ASX-listed gas companies to reference.
- H2 Production: Using PH2 own gas or alternatives, via its JVs with Plenesys and CAC-H2. An emerging peer group of ASX-listedH2-focused companies provides a reference.
- Mobility: via JVs with fleet owners, and investment into H2X. At this time, we ascribe book value which is trivial, until the pathway to sales revenues becomes clearer.

We summarise key components of our valuation in Figure 9.

SoP valuation	Best est	Low	High	Method
Gas resources (Venus/Botswana/Windorah	0.33	0.23	0.52	2C -3C average
Equity in Botala	0.02	0.02	0.02	IPO low-high
H2 Production (CAC, Plenesys)	0.15	0.03	0.31	Peer group
Mobility solutions	0.01	0.01	0.01	H2X BV
Cash	0.03	0.03	0.03	At 31/March
Total	0.54	0.32	0.90	

Figure 9: Source: Breakaway Research

Valuing the gas: 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 valuation for peers revolves around 2C and 3C contingent resources, as the peer group is predominantly exploration phase companies with no proven or probable reserves.

Figure 10 shows 2C and 3C resource enterprise values for ASX listed, CSG companies with enterprise values of A$300M or less. These companies are all in the exploration phase and have no production. It is evident that the capital market values undeveloped resources. A widely applied valuation measure is enterprise value per molecule of 2C and 3C resource, EV/2C and EV/3C respectively.

The peer group is trading at an EV/2C of 30c/GJ (average), excluding PH2 which is currently impounding ~16c/GJ. The peer average EV/GJ for 3C is 11.7c/GJ compared to 8.3c/GJ for PH2

There is a wide range of resource valuations across the peer group and this does not take into account numerous small exploration companies which have acreage and no contingent resources. The higher values are attributed to "basin specific" companies.

There has been significant investor interest in companies with acreage in new areas opening up to production, in particular in central and Northern Queensland and the Northern Territory which we think is very relevant to PH2 given two of its gas assets are in Queensland.

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CSG: Market value of resources							
Company	**Type/ region**	**Price**	**EV**	**2C**	**3C**	**EV/2C**	**EV/3C**
Blue Energy (BLU)	CSG/ Bowen	0.071	**100**	1313	4476	0.08	0.02
Comet Ridge (COI)	CSG/ Bowen	0.165	**144**	355	2456	0.41	0.06
Pure Hydrogen (PH2)	**CSG/ Aust, Botswana**	**0.29**	**88**	**561**	**1054**	**0.16**	**0.083**
Talon (TPD)	CSG/ Mongolia	0.006	**35**	1093	0	0.03	
Galilee Energy (GLL)	CSG, Galilee B	0.3	**78**	2508	5314	0.03	0.01
Empire Energy (EEG)	Shale, NT	0.215	**121**	587	1809	0.21	0.07
Tlou (TOU)	CSG, Botswana	0.028	**15**	228	3237	0.07	0.00
State Gas (GAS)	Conv/ CSG, Qld	0.19	**34**	217	384	0.16	0.09
Armour Energy (AJQ)	Conv, Aust	0.007	**44**	46	0	0.95	
Elixir (EXR)	CSG, Mongolia	0.165	**122**	0	0		
Jade (JGH)	CSG, Mongolia	0.052	**60**				
Red Sky (ROG)	Conv, Aust	0.006	**26**	80	71	0.32	0.36
NuEnergy (NGY)	CSG, Indonesia	0.016	**24**				
TMK Energy (TMK)	CSG-Mongolia	0.1	**345**				
Tamboran (TBN)	Shale, NT	0.23	**116**	153	362	0.76	0.32
Average EX- PH2			**90**	**6580**	**18109**	**0.300**	**0.117**
Median ex PH2			**78**			**0.181**	**0.063**

Figure 10. Australian gas exploration and production companies, as at EOT July8, 2022.

Gas resource valuation: 23-52c. Best estimate 33c

Excluding the Hydrogen assets, we value PH2's gas assets at 33c, on the basis of peer group median EV/2C. Low and high values are constrained by 2C and 3C median and average figures as shown in figure 11.

Valuation of 2C and 3C resources	**2C**		**3C**	
	Median	**Average**	**Median**	**Average**
Peer group EV/GJ Ex PH2	0.181	0.3	0.063	0.117
PH2 2C	561	561		
PH2 3C			1054	1054
EV	**102**	**168**	**66**	**123**
Plus cash	11.8	11.8	11.8	11.8
Equity value	113	180	78	135
Shares on issue	343.2	343.2	343.2	343.2
Equity value per share	**0.33**	**0.52**	**0.23**	**0.39**

Figure11: Gas resource valuation.

Botala Energy: 2 cps at expected issuance price

On June 23, 2022, PH2 advised that Botala Energy raised $5M by way of equity issuance and propose to list on the ASX mid to late July. At the issue price of 20c, Botala's initial value would be A$27.4M with PH2's ~20% holding valued at A$5.4M (1.6 cps). We adopt this value in our sum-of-parts valuation.

Valuing Hydrogen production: 3-31cps, best estimate 15c.

Several companies are listed on the ASX focused on various parts of the Hydrogen production and supply chain, and these are shown in figure 12.

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Unlike the gas production industry, where the geological risks are generally known, and markets for the product are known, and extraction costs are known, the Hydrogen supply chain costs and economics are not readily discoverable.

The companies we reference lack revenue, and are dependent on equity finance, partner finance or Government support to advance their various strategies. None have production operations and all at in the pre-commercial phases.

This makes valuation of these companies very challenging, and speculative given the early-stage nature of their activities, some of which are conceptual or experimental. In addition, there is little detail to be discovered publicly with competing companies keeping their technologies and finances proprietary, or commercial in confidence.

Nevertheless there is a growing peer group which in total are attracting public investment and in this context we can "book-end" value for PH2's activities. Refer to figure 12.

Hydrogen peers	ASX	Last	Shares	Mkt cap	Cash	EV	Type
Hexagon	HXG	0.023	560	13	3	**10**	
Hazer Group	HZR	0.8	165	132	24	**108**	Methane pyrolysis
Province Res	PRL	0.091	1170	106	21	**85**	Wind/solar/electrolysis
Frontier Energy	FHE	0.21	271	57	6	**51**	Wind/solar/electrolysis
Provaris	PV1	0.055	547	30	2	**28**	h2 shipping from Tiwi Is.
TNG Ltd	TNG	0.068	1388	94	2	**92**	Vanadium project
Sparc Tech	SPN	0.64	79	51	3	**48**	H2 prod / Photo-catalysis
Median						**51**	

Figure 12: ASX listed Hydrogen companies. Share prices at EOT, July 8, 2022

From a competing technology point of view, Hazer is "closer" to PH2 in terms of its chosen H2 production technology of methane pyrolysis, however Hazer has completed a commercial demonstration plant in Western Australia and so relative to PH2 is more advanced in demonstrating its particular technology relative to PH2 and hence would be more highly valued in the market. However there is a very wide range of market valuations and it is beyond the scope of this report to compare and contrast each specific company, but it is evident the capital markets are assigning value to these companies in the concept and development phase. For benchmarking, we assign the average market value of $51M (15 cps) with a low and high range of $10M to $108M

Valuing Mobility Small for now

Vehicle & system manufacturers, Hyzon, Plug, Rivion for example**,** while materially more advanced as businesses, these hydrogen and vehicle production companies have large valuations. In the case of Hyzon Motors, which manufactures fuel cell powered buses, around US$1B. In the USA Rivion Inc IPO'd in mid-2021 at ~$35B, and is in another league with significant production of passenger and light commercial battery EV segment, which is quite different to Hydrogen.

In our view there is a large value opportunity if PH2 and H2X can progress to manufacture and sales of vehicles.

Financial information specific to H2X and the Advik-JV is scant, and there are no obvious small peers, so at this time we assign value only to PH2's equity investment in H2X. This is a small value at this time, and does not reflect future potential if H2X and Advik deliver their strategies.

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Key risks

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

Windorah trough & Project Venus

The key risk is in understanding the geology and finding solutions to drilling and extraction of gas from low permeability BCG reservoirs and CSG reservoirs. The test results have not been at commercial rates. More data is required to find engineering solutions which will require more wells and more testing. A key risk is securing capital to drill and test enough wells to fully understand the commercial value of these large resources.

Serowe CBM project. There are 5 wells drilled to date in the project's core area. The farm-in partner Botala Energy is required to fund an ongoing work program, at nil cost to PH2 however activity is subject to geological and technical risk and there is no certainty of a commercial outcome.

Financial. All of PH2's projects are in the pre-commercial phase and require ongoing funds for appraisal and development. PH2 will need access to capital if it undertakes large scale gas production or hydrogen manufacturing for export. Without a revenue stream, it's likely that capital will be sourced from equity capital markets and dependency on this source of funding in volatile markets is risk.

Hydrogen production & sales. 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 from the intention to use Hydrogen production processes which are not yet common and are not yet proven on an industrial scale.

Carbon product market risk. PH2's planned large scale hydrogen plants will produce substantial volumes of carbon products. The market for these products is opaque in terms of product quality and price. The Carbon market is not large and may become over-supplied if Hydrogen production generates Carbon products in excess of demand. 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.

Technology risk. PH2's planned Hydrogen production from methane pyrolysis has not been demonstrated in a commercial setting. There are significant risks that the process wont work reliably, or deliver products to the specifications required for off-takers. We are unable to form a view as to operating and capital costs as there are no operational analogues.

Joint venture & strategic partner risks. Plenesys is a relatively new "start-up" technology company in France, and both H2X and CAC-H2 are private entities. We are unable to independently verify these entities financial and operational capacity to meet joint venture objectives, due to limited public domain information

Competition. We note there are many public and private companies endeavouring to produce hydrogen from various means, and /or position as suppliers. There is no certainty that PH2 can sell what it produces

Economic risks. There are very few genuinely 'green" hydrogen projects in operation around the world, and information on capital and operating costs is either not available or a proprietary. There are many variables that will determine the economic viability of production, including but not limited to scale of plant, price and availability of inputs such as electricity and methane, plant location, hydrogen prices and carbon prices.

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Hydrogen production: State of play

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

There are two basic ways to produce hydrogen.

1. **Electrolysis of water (Green Hydrogen)**. Electricity is passed through fresh water splitting the H2O into Hydrogen and Oxygen. 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, electrolysis is very expensive. It is energy and fresh water intensive. 1 Kg of Hydrogen production requires 39kWh of electricity and 10 Kg of fresh water. For this reason, only ~1% of all hydrogen is manufactured in this way and usually only in specialised settings. However the process is gaining investor support because if the electricity is sourced from renewables such as wind and solar, then Hydrogen manufactured from electrolysis is almost entirely carbon free.

The cost of making Green Hydrogen is 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. To achieve this, significant cost reductions are required for Electrolysers, and for power required to run the process.

2. **From the conversion of fossil fuel**, commonly natural gas or coal. According to the IEA, 76% of Hydrogen produced today is derived from natural gas, and 23% from coal.

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.

The use of fossil fuels in the combustion and conversion process, leads to significant production of CO2. In time, 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 are pursuing this in South Australia, and there are numerous examples in the USA and Europe. In some locations, there may be commercial value in selling food grade CO2 which are common in carbonated beverages.
- **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 market for such products, thus creating a revenue stream. Alternatively, the solid waste can be stored.

Turquoise Hydrogen

This process uses natural gas (methane) as an input to a process which "cracks" methane at very high temperatures in a process that is called "Pyrolysis". There are technologies that do this, and many are operating at small scale because the plasma torch which is core to the process can only make small amounts of H2.

PH2's use of a the Plenesys technology aims to crack the methane into H2 and solid Carbon. Success in the process requires the CH4 feedstock does not bring other elements that need to be stripped out. That can be done but it adds to cost. Other complexities are control of the carbon purity.

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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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