Hydrogenus Energy News

HYDROGENUS
the future of power
ABN : 56 163 460 884

WHAT'S NEW

Our 100% Hydrogen powered engine and associated generator (Genset) is now running reliably, producing electricity on demand, and commercially available.

On 13 March our patent application was lodged

Australian Provisional Patent Application No. 2024900658

"Internal Combustion Engine and electricity generation system"

While we do not have signed contracts, we have signed Letters of Intent / MoUs with 2 parties for projects that will use our engines and Intellectual Property.

We also have propositions with 2 more parties to trial our IP and others who have expressed an interest in doing so.

We are in discussions with a number of parties for pilot project funding.

Patent Application Lodged

In October, we began the process of engaging with Patent Attorneys, leading to an agreement on 1 December, Patent first draft 1 February and final 5 weeks later.

Our application has been forwarded to the Australian Patent Office to conduct an International Type Search and the first response can be expected in about 4 weeks.

Competing technologies

Hydrogen Fuel Cells (HFCs) claim to achieve up to 55% efficiency, but in the field HFCs respond very poorly to changes in load. A demonstration at Denham (WA), by Horizon Power, with funding from ARENA and the WA Government, achieves, in practice, just under 35% (see : https://www.horizonpower.com.au/your-community/getting-future-ready/denham-hydrogen-demonstration-plant/)

Other Hydrogen Powered Internal Combustion engines are available. These use high pressure injection, in the order of 200 atmospheres, which offers good engine power but at the cost of :

- added complexity for pressures of storage and injection (as fuel is used, storage pressure falls and the level of compression needs to increase);
- added cost for compression;
- added cost of materials with hydrogen embrittlement exacerbated with pressure.
- In field maintenance far more complex and costly c.f. Hydrogenus Energy engines.

Hydrogenus Energy advantages

The Hydrogenus Energy engine out-performs other engines in terms of :

- The fuel consumption : our engine, peaking at 42% of electrical output compared with energy in the fuel consumed, is superior to any diesel of comparable size.
- Superior Block Load Response, coping better with both increases and falls in load than other engines; and
- Maintaining stable output, at 1,500rpm, far better than other engines.

This performance, plus familiarity of the engine componentry for mechanics, makes our engine very attractive to technical and operational people we demonstrate to.

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Probable Projects

We have 2 Letters of Intent with internationally recognised project engineering firms, one with a background in mining plant, engineering, projects development and commissioning, and the other which has a strong non-mining client base.

While these agreements have been in place, they are "in the back pocket" and plan to be used at the appropriate time.

Pacific Islands

We have executed a Letter of Intent with IDA Pacific to use Hydrogenus Energy IP and the supply of appropriate engines, for 2 projects in Fiji. The first is for 300kW and the second for 100kW.

The CEO recently returned to Melbourne from 2 months in Fiji progressing these projects. While there is agreement on what is to be done, when and how, and indicative funding approval, there is more detail required before we move to contracting.

In addition, there is the prospect of many more projects, of similar size, as the Hydrogenus Energy system provides electricity on demand at a lower cost.

Telecommunications

We have executed an agreement with a company that provides services for telecommunications.

That company has investigated batteries and fuel cells to provide back-up power, and their negative experiences with these technologies has brought them to deal with Hydrogenus Energy.

Possible Projects

Lease Engine IP

The link below is a YouTube clip demonstrating our engine.

https://www.youtube.com/watch?v=0216UrCFVLI

This clip was sent to the company that supplied our test engine. Their response was to request our agreement for them to manufacture engines for the Chinese market. Discussions are underway.

Ammonia

We have been introduced to a company, Kraktek, that has developed technology that splits Hydrogen from ammonia (NH_3) at 95% - 98% efficiency.

We were advised that the basic unit

- produces 6kg/hr of H (ie. consumes about 35kg NH_3)
- is expected to cost about $50k; and
- is expected to be commercially available in about September 2024.

We have verbally agreed to investigate development of a demonstration unit comprising :

- Hydrogenus Energy 100kW engine;
- Kraktek unit; and
- Ammonia supply

on a 5t truck.

The concept is to demonstrate this unit at Agricultural field days, supplying the show's electricity needs, and take orders to sell the unit.

We need to progress our verbal agreement into a true commercial agreement.

About 190Mt of ammonia is produced each year globally and the fuel cost of electricity produced by the Hydrogenus Energy engine fuelled by Hydrogen sourced from ammonia, is about the same, or a little less, than electricity produced using diesel fuel.

The commercial attraction is to later produce the ammonia on the farm, supplying nitrogen needed for crops and potentially power plant, dramatically reducing operating costs.

The CEO of Kraktek, Phil Matthews, explained he had spent 20 years working on Hydrogen Fuel Cells, which is why he is interested in talking with us.

Back-up generators

We received an enquiry from a representative of a Government authority who recently attended a demonstration at our workshop.

The enquiry was about the cost of an electrolyser and associated equipment (storage and controls) required for an extended simulation test of our engine; the first step towards a commercial engagement.

Discussions include the Government authority paying for the required equipment and for the testing to be done by an independent testing authority.

We also had a similar conversation with a different Government authority, asking about producing the required fuel on site.

Economics

The following table is from our current presentation, which is available at https://www.hydrogenus-energy.com/investors :

AUD / MWh	Diesel	Diesel-Solar	HYE, 2023	HFC	Batteries	HYE, 2026
Upfront Capital	71	183	255	277	674	152
Sustaining Capital	4	11	23	71	92	13
Operating Cost	348	132	44	40	25	37
	422	**325**	322	**388**	**790**	201
CO2 emitted (kg/MWh)	720kg	238kg	0kg	0kg	0kg	0kg

Explanation

The values in the table show the cost, in $A / MWh of electricity, for the supplier to earn a fair return.

Diesel generators have a low up-front cost, but high operating costs and the "green" systems have low operating costs.

The values represent a particular case in terms of

- System size : 5MW, which is about the size required for an open cut mine, processing about 1.0Mt/yr of ore;
- Utilisation : 65%, which is high for a remote community, but a little low for a mine;
- Primary Energy is a yield of 35% from solar panels and 32% from wind turbines, though only 60% in total; optimised operations in outback Australia expect to achieve up to 80% of their electricity needs from wind + PV;
- 3 days of energy is stored.

The operating cost for the HYE system includes a fee paid to us for the supply of our IP and for on-going management.

HYE also secures revenue through the supply of services and engines to the project, but our major return is the IP fee.

Impact

Hydrogenus Energy system is the lowest cost provided of electricity on demand.

In 2026, we expect that the costs of our system will be significantly lower, at $201/MWh.

This fall in costs is due to lower prices and better performance of:

- Solar panels, by about 10%;
- Wind turbines, by 20%; and
- Electrolysers.

These improvements are developments that have already been demonstrated but are not yet commercially available.

Markets

As costs are reduced, the potential market increases.

Using 2023 costs, we are much cheaper than diesel generation, and slightly cheaper than diesel-solar hybrids, though without the pollution nor the on-going need to truck in fuel.

In 2022, globally 720m MWh of electricity was generated from liquid fuels. Of this, we estimate that as a reasonable upside our system could reach 40%, or 300m MWh.

However, if our costs can be reduced to $A 200/MWh, then our system is competitive with distributed, grid supplied electricity (our retail bill is $450/MWh, with transmission being the largest single charge, and the cost will continue to rise as transmission construction is the greatest difficulty in the energy transition).

Globally, electricity demand is about 28,500m MWh, of which about 17,500 is fossil fuelled and we estimate that our system would be cost competitive with about 24% of this market.

Hydrogen

The biggest cost for the Hydrogenus Energy system, and for ammonia, is producing hydrogen.

Current electrolysers require about 55kWh for 1.0kg of Hydrogen (about 10% less for us as we do not need high purity).

Electrolysers currently developed but not yet commercial require about 38 to 40kWh. This is the basis of our HYE 2026 estimate.

We have been introduced to new technologies that promise to require as little as 10kWh for 1.0kg H, by using other forms of energy in addition to electricity; one being heat potentially from our engine.

This will make hydrogen cheaper than gasoline and natural gas supply in most areas globally.