

HYDROGEN ENERGY

Power to Gas

Sustainable power systems such as Solar PV and Wind create power from sustainable sources but the production is variable.

What happens to the excess power that is not immediately used? The current options include being stored as heat in a saline solution or in lead acid or lithium ion batteries.

However, there is another way, which is more environmentally friendly and more efficient.

Excess Power to Hydrogen



This graphic illustrates the problem. The blue line is the power produced from a source like Solar PV or Wind over a period of time. The green line is the power drawn from this source. What happens to the power created above the green line?

The power to gas process utilises this excess power to create hydrogen gas.

Hydrogen and Oxygen: the Working Gases

Both hydrogen and oxygen are working gases. Each is used for a number of industrial, manufacturing and medical purposes. Another key use is the production of electrical power with a fuel cell.

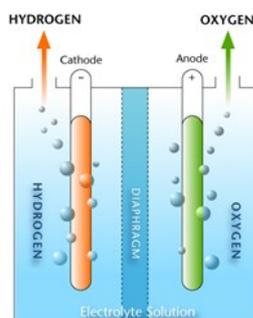
Utilising the excess power from Solar PV and wind can create subsidiary commercial opportunities in the supply of industrial gases and power generation.

The Hydrogenics electrolyser gas production system can be fine-tuned to provide high purity hydrogen and oxygen for medical and other specialised uses.

What is Electrolysis?

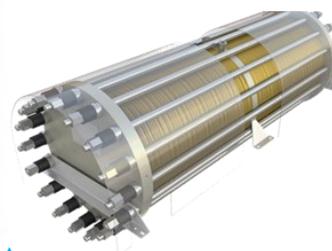
Electrolysers are devices that produce hydrogen and oxygen through the process of electrolysis.

Electrolysis is an electrochemical reaction that splits water into Hydrogen and Oxygen, using electricity. It is a 100% emission free and carbon-free process.



Electrolysis - the process

The electrolyser



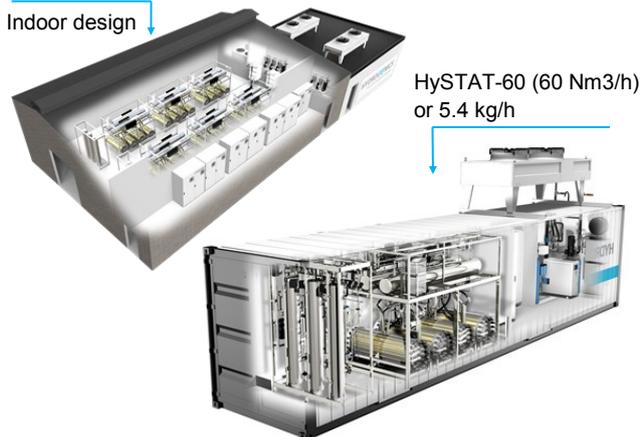
On-site and Containerised Facilities

The containerised package requires an incoming power source from either grid or a sustainable source to provide power for the electrolyser plus a regular water supply.

The production system will firstly remove any minerals or contaminants in the water before the electrolyser creates the hydrogen.



The hydrogen then goes through a cleaning process which creates a gas with of 99.995% purity. With the addition of an oxygen clean and capture system it is possible to create and store oxygen at a medical grade level.



The addition of fuel cells into the system creates a self-contained power supply for remote power supplies.

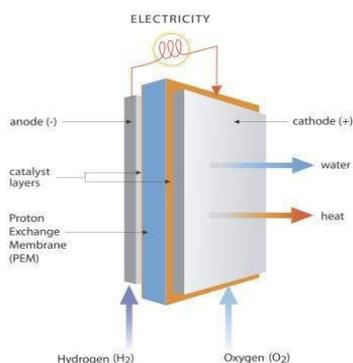
All of the Hydrogenics containerised systems are designed and customised to a client's particular requirements.

Hydrogenics can provide assistance with the layout of a hydrogen production facility in an existing building or provide designs for purpose built rooms or buildings.

Hydrogen for Power: What is a Hydrogen Fuel Cell?

Hydrogen Fuel Cells (HFC) are devices that use hydrogen to generate electricity. With very high rates of efficiency and zero emissions, HFCs are an excellent sustainable energy solution.

How Does it Work?



The Fuel Cell

A fuel cell is a compact device that is manufactured to provide specific energy outputs. The fuel cells are incorporated into a fuel cell stack as a scalable power system from 1.5kW up to 30kW of capacity.



The fuel cell is water cooled, compact and incorporates the primary operating systems on the unit.

The fuel cell offers an instant start in case of an emergency and will start first time even if it has not been used for a prolonged period. The hydrogen gas does not degrade over time and is stored in containers that meet international safety standards.

The Fuel Cell Stack

One fuel cell can be turned into many. The Hydrogenics systems are scalable. A number of fuel cells can be combined into a stack to provide the amount of power output required for each project.

The fuel cell stack power system has a small footprint and can be installed inside a building or outside a building in a purpose built cabinet.



The hydrogen gas supply can be a direct connection to the electrolyser output or in smaller installation from gas bottles which are fitted externally and piped into the system.

Hydrogen gas does not degrade over time so in a backup power system it provides an instant start every time.

Full online monitoring technology ensures maintenance requirements are advised in advance.

Power to Gas - System Design

The electrolyser package is designed and built to meet a client's specific production needs. This requires an evaluation of type of application, gas purity, maximum and minimum output requirements, pressure requirements and other site operating considerations.

Gas storage and compression systems are available to utilise the gases produced and store and distribute them at a commercial level.

A fuel cell power system is designed to utilise the gas produced and optimised for the system for

electrical production.

Utilising all of the produced gases requires a complete design process. This design process requires good information to allow the designers to meet all of the system and project requirements.

Hydrogenics are the world leaders in the design and application of power to gas systems.

Alberfield their engineering expertise and local knowledge to this design team to provide clients with the best possible outcome for their need.

Please see our Power to Gas Questionnaire and complete the information for a preliminary assessment of a design and a working cost. A hard copy is included with this information plus a "soft" copy is available on request to info@alberfield.com.au

Standards & Codes

Hydrogenics Europe NV — manufacturers of HySTAT electrolyzers are certified to the following Bureau of Veritas Standards:

- ISO 1400:2004 [cert No BE008440-1];
- OHSAS-18001 2007 [cert no BE008441-1];
- ISO9001:2008 [cert no BE008349-1].

They are compliant with European Directives and international codes & standards. A copy of the full document (HySTAT™ Electrolyser Codes & Standards) is available on request from info@alberfield.com.au

Hydrogenics Corporation (Canada) — manufacturers of the HyPM fuel cell comply with the following codes & standards:

- Module designed to comply with UL FC1, IEC 62282-2;
- Module designed to comply with NEBS GR-1089-CORE (Tests As Per 3.1.3 – FCC Part 15, 3.2.1 - Radiated Emissions, 3.2.2 – Conducted Emissions);
- NEBS GR-63-CORE R4-66 R4-68 R4-72 R4-81-83;
- RoHS Compliant.

Installation and Maintenance

Installation is carried out by a Perth-based team trained in all aspects of the work.

Maintenance is minimal and Alberfield will provide a service contract to ensure maintenance is carried out correctly and on time.

Alberfield also offers training to maintenance teams operating in a remote environment so the procedures can be carried out during regular maintenance operations on other equipment.

Alberfield Plus+

As a technical consultancy, Alberfield can assist with assessing existing power consumption, and work with you to design the best system for your current and future power needs.

WA Contact Details

Contact: Harry Porrins
Mob: +61 451 284 043
harry.porrins@alberfield.com.au

Alberfield

Level 29, 221 St George's Tce,
Perth WA 6000

Tel: +61 8 9288 0682
Fax: +61 8 9480 3705

www.alberfield.com.au