Fuel cells in Australia

(and why it isn't happening)

By Adrian Horin

What are fuel cells?

- Similar to batteries, they have an anode and a cathode
- There are differences though:
  - Fuel cells require a fuel input
  - Fuel cells produce usable heat as well as electricity
  - Fuel cells are nowhere near as well known (especially in Australia)
- There are many different types of fuel cells

Types of fuel cells

- Two main types:
  - Those that are fuelled by pure hydrogen (99.99%)
  - Those that are fuelled by methane or alcohol

The pure hydrogen fuel cells tend to be in configurations of 30kWs or less and are used for mobile as well as stationary applications

The alternative larger fuel cells tend to start at 100kW in size and can have configurations up to 20MW. These are used as grid replacements

Hydrogen fuel cells

- The main type that runs on pure hydrogen is the PEM fuel cell.
  - These are used for:
    - Battery back up e.g. data centres
    - Transport i.e. cars, trucks, trains, fork lifts
    - Replacement of diesel generators
  - Widely available and used throughout the world
  - Manufacturers include: Ballard, Altergy, Intelligent Energy, Plug Power and Idatech
  - Can be used with natural gas or LPG reformers

PEM fuel cells - technical

- The exhaust heat is approximately 75-100°C
- Exhaust gases is water vapour
- Lighter than equivalent powered batteries
- Materials are totally recyclable
- No moving parts
- Electrical efficiency
  - Stationary 25-35%
  - Transportation 53-58%

Plug Power GenSys fuel cell system

Runs on LPG

Large (hot) fuel cells

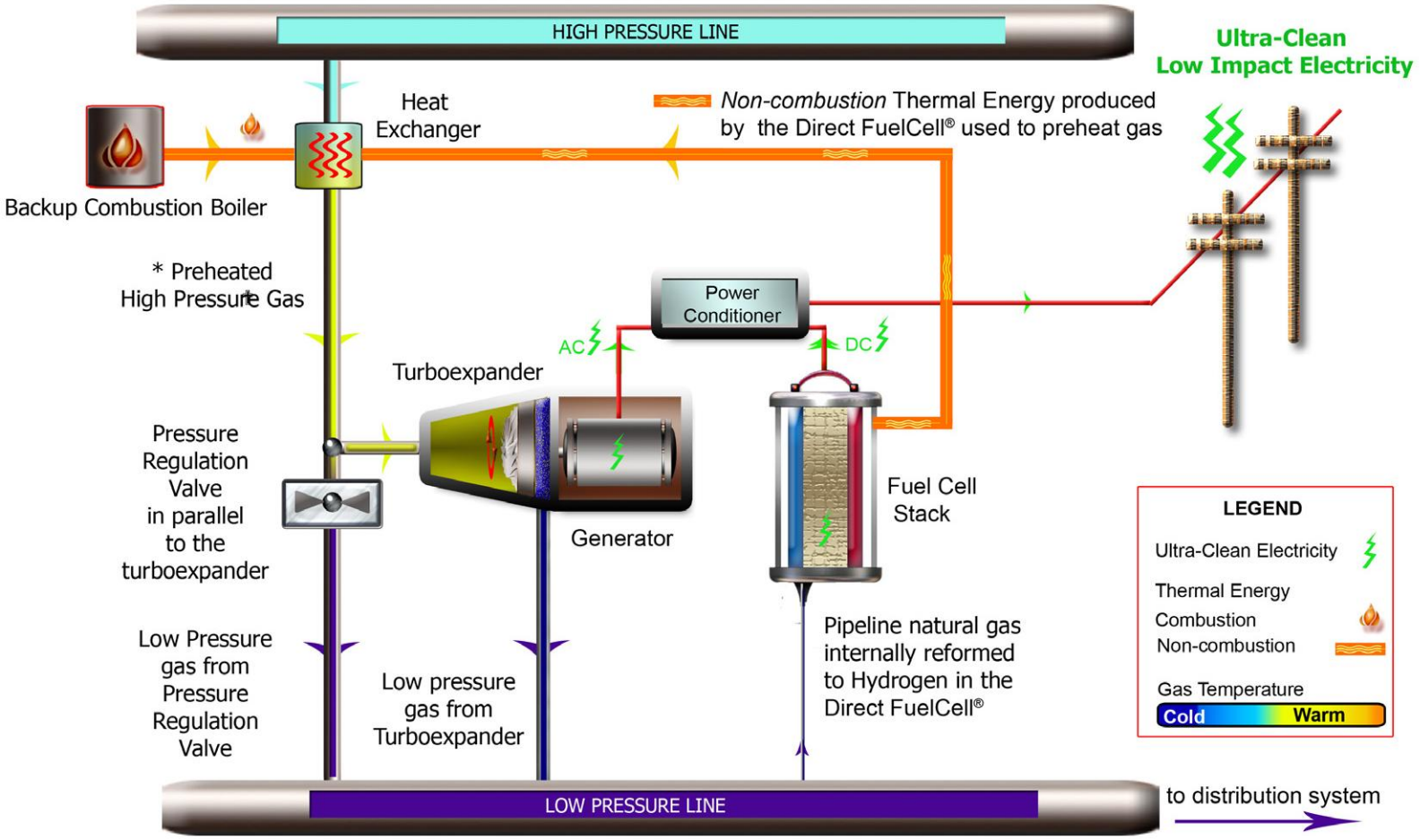
- There are three main types of fuel cells in this category:
  - Molten carbonate
  - Solid oxide
  - Phosphoric acid
- Electrical efficiency varies
  - Molten carbonate – 45-47%
  - Solid oxide – 35-43%
  - Phosphoric acid ~ 40%

Commercial applications

- Large fuel cells are used throughout the world to provide a primary power source to:
  - Hospitals
  - Gas pipeline let down stations
  - Prisons
  - Waste water treatment plants
  - Data centres
  - Defence applications
  - Power utility companies

Sierra Nevada Brewery fuel cells

DCF-ERG: PIPELINE TO ULTRA-CLEAN GENERATION



* Pre-heating is required because gas cools as its pressure is reduced. The Direct FuelCell® provides thermal energy for pre-heating and therefore the boiler is only required for backup.

Fuels that can be used

- Natural gas
- Coal bed methane
- LPG
- Butane
- Hydrogen
- Methane from anaerobic digesters or waste water treatment plants
- Solar gas

Cogeneration

- Exhaust heat from these large fuel cells ranges from 150 - 650°C
- Used in conjunction with an absorption chiller, heat can be turned into air conditioning
- The heat can also be used directly for heating water, space, or other commercial applications
- One such application is the heating of gas pipes prior to pressure let down
- Combined efficiency if the heat is used can be as high as 70%

Lower carbon emissions

- Fuel cells have a much higher electrical efficiency than most gas turbines or internal combustion engines
- As the exhaust temperature is also higher than the other options, the overall efficiency is therefore enhanced further
- This higher efficiency, by definition, means less carbon dioxide per kilowatt produced – 7 times less carbon emissions than diesel generators

In Australia

- Ceramic Fuel Cells
  - An Australian company that has received funding from the Queensland and Australian Governments
  - Developed solid oxide fuel cells for the residential market
  - They have produced a 2kW fuel cell providing power with 60% electrical efficiency and heating
  - Designed for cold climates – selling into European and Japanese markets

MTU Detroit Diesel

- The German MTU company have offices throughout Australia
- Their product range includes gas recip. engines and a product called the Hot Module which is a hot fuel cell
- Although the product is still on the price list here, the indications are that the company is not pursuing sales in Australia
- Price is also a real issue

FuelCell Energy

- FCE had been negotiating with a Queensland company, Leslie Consulting Pty Ltd, for sales representation in Australia until late last year when negotiations fell through
- The initial reaction of the company to the possibility of selling here was:

  "Why would we go all the way out to Australia to make a loss when we can do it just as easily at home"

Sales representation

- K D Fisher in Adelaide have access to Idatech PEM fuel cells – currently being trialled by a telecommunication company (runs on a methanol / water)
- SEFCA (Melbourne and Sydney) represents Jadoo, Plug Power, Relion & Smart Fuels
  - Plug Power have a plug in natural gas / LPG reformer

Government support (?)

- No Self Generation Incentive Program (California)
- No feed-in tariff (gross or net) for hydrogen or fuel cell technologies
- No classification for low carbon technologies in funding programs

Hydrogen delivery and storage

- Two major suppliers of hydrogen in Australia
  - BOC / Linde
  - Air Liquide
- No hydrogen delivery infrastructure
- No distributed hydrogen storage infrastructure

AAHE

Australian Association for Hydrogen Energy

This association has been formed this year with the express purpose of supporting:

- The development of hydrogen technology in Australia
- The use of hydrogen technology in Australia
- The Association is looking for new members now from:
  - Individuals, industry and government

Contact information

Adrian Horin JP (Qual.)

Manager: dinkum energy

Director: AAHE Australian Association for Hydrogen Energy

Email: adrian@dinkumenergy.com.au

Mobile: 0400 715 799