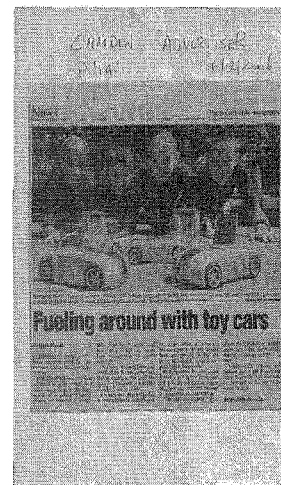
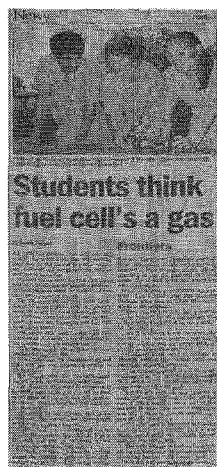
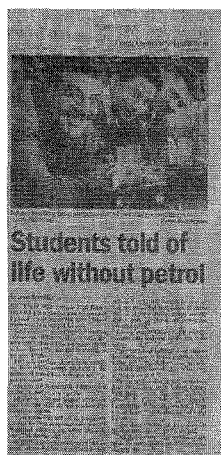


National Hydrogen Institute of Australia

<http://www.hydrogen.asn.au>

Submission No. 13



About the Author:

- ~Twenty (20) reports had been written on integrating new greenhouse reducing technologies since year 2002.
- Approximately seventy (70) letters at ministerial level have receipted these.
- No reports except "The National Hydrogen Report" - Jun 03, were issued to Canberra.
- Formed The National Hydrogen Association of Australia Pty Ltd (2001).
- Formed Fuel Cell Institute of Australia Pty Limited (2003).
- Formed National Hydrogen Institute of Australia (2004)
- The "Smart House" report issued to NSW DEUS Minister D. Beamer in Aug.2003, critically warned on power and water infrastructure issues coming to NSW (New housing). The report as well informed of solutions on self-power and water for housing and industry that must be so by 80% by year 2020. The power solution involved solar energy, hydrogen fuel cell, and energy storage device all "smart" switched by controller and computer software. The large rainwater water harvesting (20,000L-50,000L) tank system purified the rainwater in cycle without chlorine salts.
- Pages "17", "53", "68", "80" and "81" of "Australian Hydrogen Activity May 2005" book produced by The DITR, contain the five (5) projects created by the author.
- In June 2004 created Australia's first Hydrogen and Fuel Cell Science/Technologies education pilot program.
- In 2005 built Australia's first twenty (20) model hydrogen fuel cell powered cars for as many NSW state high schools in SW Sydney; influenced commercial products in Shanghai China by Horizon Fuel Cell company, resulting in products world wide being 200%-300% cheaper including Australia of course.
- In 2006 built the World's first 12watt radio controlled Hydrogen fuel cell powered car for <US\$600; influenced commercial products in Shanghai China by Horizon Fuel Cell company, resulting in products world wide being 200%-300% cheaper including Australia of course.
- In 2006 displayed in an educational program as above, before students at Fairvale High School NSW The World's smallest hydrogen fuel cell commercial model car and its solar hydrogen refueling station. This was a world first in demonstration-education.
- The author seeks to take the above program with help, to China's World Expo in year 2010, called "Moonshot 2010 -World Hydrogen and Fuel Cell Science Technologies Education Program". This would represent Australia as a leader in Science and Technology showing how through science/technologies, we can combat global warming through education. Federal and State help is urgently needed if this is going to happen. Will you help? Please see <http://www.fuelcells.org.au/cluster.htm>

The purpose of this short report is to provide directional guidance for Australia's future renewable energy electricity production and transmission.

Electricity cannot technically be stored so I correct the original letter issued by the committee immediately, but am of course aware of the intent of the communication.

"If a technology led approach towards future sustainability should ever get complemented by the "push" of carbon trading administrative systems, we change the world forever"-sz05.

A global carbon constrained manufacturing sector is less than a decade away, and if not facilitated now the cost will be much higher then. It is further anticipated that the social driver will demand further government action sooner than later after year 2010. Political force is thus anticipated at greater strength before year 2015. Stationary power supplies for a future growing global demand will not be met as currently thought. Decentralised power producing technologies which are as well greenhouse gas reducing technologies will supersede traditional centralised stationary power stations by year 2020.

There is a high degree of certainty that given the current rate of hydrogen and fuel cell technologies cost reduction rates, the fuel cell will go beyond the implantation of micro-fuel cells for electronic devices starting from year 2007. Fuel cells by their tens of millions are expected to be implanted into whitegoods by year 2015 and beyond, dispensing of the need for a power socket for ever. This scenario "wildcard" could have major consequential impacts on the magnitude of central stationary power supply by year 2020, and in fact curb and flatten the expected global energy supply equation as a result to year 2050. It as well should be seen as an attractive product improvement to many future "Green" consumers of whitegoods and other electronic devices.

The politics of nuclear energy is powerful in certain countries like the US and Australia. I would anticipate that nuclear energy would in fact be used again but not to produce electricity as an energy carrier, but rather hydrogen as an energy carrier. This scenario has been put forward already with a new breed of nuclear reactor which is much safer than past models. The reactor is a high temperature reactor processing water to produce hydrogen. Nuclear energy producing hydrogen also allows for a mass production supply scenario which will be needed during years 2015-2020. Nuclear energy being applied this way allows for large production of hydrogen 24/7, whilst renewable energy hydrogen production will invariably be intermittent.

Nuclear energy has the real capacity to augment the mass production of hydrogen until renewable energy hydrogen and other distributed domestic types can easily satisfy demand (2020-2030). I would expect the first demonstration nuclear reactor of this type by ~year 2015.

Wind turbine and solar technologies have had "double digit" growth last year and the same is expected this year. Costs are coming down as predicted and in the area of solar technology new discoveries have been made. The ANU as well produced the largest paraboloid in the world (400m²) called "Big Dish", and it has already been built and is awaiting customers. Renewable energy technologies can work with other technologies in hybrid applications. We should see more solar/fuel cell hybrid power plants by example between years 2010-2015.

The way we extract energy from fossil fuels will differ from the current method of combustive processes. Existing processes are becoming intolerable from a pollution perspective, and will be socially unacceptable by year 2015. The gasification of coal creating a feedstock for a 200⁺ MW plant operating on MCFC fuel cell design with turbine/s in full oxygen blown mode, would be the technology of the power stations of the future to build upon. This technology could then be improved to year 2020, to reduce carbon dioxide completely in conjunction with sequestration, by forming carbon black (soot) through new technology. Additional benefit is gained from these types of plants as they can as well produce large quantities of hydrogen from the gasification of coal. I have full confidence in these new technologies as they will not only improve the quality of life for the free world, but also liberate billions of people in the third world this century.

Large centralised coal fired electricity power stations (~1500MW), apart from the pollution for just say carbon dioxide at ~. 9T CO₂/MW, as well consume up to ~1000litres of water per second (similar for nuclear plants) for cooling. Central Queensland coal fired powered stations by example in the current drought, now face shut down as they operate at 30% capacity; jobs have already been lost except from those power stations cooled by seawater.

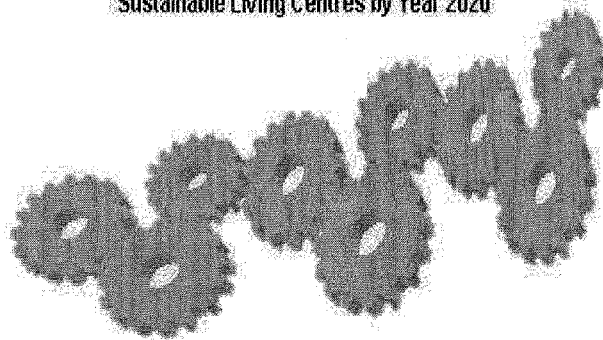
Coal is not necessarily public “enemy number one”, but the pollution that comes from using such is. In the interim coal must be processed to augment the process of combustion in a way so as to reduce emissions, or apply processes of non-combustion. Much investigation is thus required ASAP on clean coal technologies. Any new power generation plants in Australia must be of the high efficiency variety.

Any new centralised power plants using processed coal by year 2030 must be integrated fuel cell electricity power plants. Carbon emissions would be naturally sequestered however by year 2030 I would expect carbon soot powder generation technologies used, extracting the hydrogen directly. These technologies also allow for large hydrogen generation capacity for transport usage.

The correct conceptual direction on electricity location - production in Australia’s future, is to produce electricity in a decentralised manner.

This is critical firstly, as it reduces the energy loss due to the transmission of the generated energy by using electricity as an energy carrier and wires as conductors over shorter localised distances to consumers. Secondly, it is critical for Australia to utilise its land mass natural advantage. This conceptual direction of decentralised production of electricity is complemented by example with the suggested policy of fast broadband for all of Australia, further complementing a future integrated Australian wide working population (100 years+) not just around its perimeter.

Sustainable Living Centres by Year 2020



Finally utilising Australia’s main natural advantage – Land.

The types of renewable electricity generation in Australia to be examined at location is now the “A\$64,000” question, but can we first get a conceptual direction correct on the proportion of renewable electricity generation in the mix for Australia’s future?

The firm direction over time is renewable energy electricity generation in a decentralised manner, by where renewable energy electricity generation progressively increases its % in the total mix. Existing and more efficient fossil fired power generation plants should progress to become the “fillers” by year 2020, and extinct by year 2030.

Energy cannot be created nor destroyed but it can obviously be transformed from one state to another. Hydrogen like electricity and petrol are all energy carriers (NOT energy sources) so let me make that perfectly clear, and electricity is not energy in itself. Hydrogen is already Australia’s future energy carrier as selected by the CSIRO. Australia is already a member of the International Partnership for The Hydrogen Economy (IPHE).

Geothermal:

Geothermal electricity generation as like from hot rock has limitations of transmission line losses as such sites are heavily centralised by location, but potentially geothermal generates 24/7. I would prefer geothermal electricity maximised for initial and obvious strategic uses, whilst transmission distance issues are solved. Hydrogen as an energy carrier could be made 24/7 with such hydrogen transported via pipeline and or heavy vehicle/train (>2010). Australia’s natural gas pipeline should be able to facilitate up to 5% hydrogen loading without any suffrage, facilitating another way to transport such energy: Geothermal has significant potential.

Note that Australia’s crude oil trading account will go into the “red” by year 2010, and our reserves extinct by year 2020. The point being always facilitate “killing two birds with one stone” if one can as hydrogen has always been designed for hydrogen fuel cell propulsion systems, which are as well zero emission technologies.

■ Tidal:

Tidal electricity generation electricity is too expensive as recently Western Australia entertained the tidal-hydrogen link and it was basically deemed too expensive then (Yr2003). Tidal potentially generates as well at night and is less intermittent, however improved technological developments are needed to be demonstrated cost effectively (Global warming risk analysis required / >2015).

■ Wind:

Wind electricity generation has expanded significantly in Australia as like in the world more generally. More decentralised yet noisy but will improve (Yr 2010) and is more difficult then perceived but NOT overly difficult. Wind turbine is becoming more efficient and I see wind becoming a significant player as a generator of renewable energy in Australia (Global warming risk analysis required / >Yr 2010). Hydrogen generated by wind and then stored and returned through a hydrogen fuel cell to generate electricity, can have significant benefits as to provide electricity when the wind is not blowing, and of course hydrogen for fuel cell powered cars. Hybrid integrated systems should be used where applicable, and hydrogen can be used as an effective energy storage medium along with several others like Australia's world leading battery technology.

■ Wave:

Wave electricity generation has natural advantage of mobility around Australia and must sustain such. It's always going to be potentially there near 24/7 generation capacity, so from a common sense perspective the technology needs just further demonstration (Global warming risk analysis required / >Yr 2015).

■ Solar:

Solar electricity generation is of course a "natural selection" by a country which has ~7.8 million kms² of landmass. Flat plate silicone solar electric panels which are commonly used in Australia to date for domestic usage, are well matured and tested albeit still too expensive. I am not impressed how researchers in universities have been continuing pathways of forever seeking % efficiency improvements in silicone, without seeing "outside the square". Too many valuable resources have been wasted on egos and that has been expensive for Australia's solar industry and has to stop immediately.

New thin film solar generation technologies being silicone and non-silicone are soon to be available from around the world, and Australia's slow progression now means that its thin film technologies are virtually redundant before they begin. These are applicable to domestic and industrial settings by where the thin cells are implanted onto the building item either tile and or window.

Solar concentrator technology concentrating solar energy makes sense in a country like Australia. This solar concentration can be solar thermal or photovoltaic, and if solar thermal there can be several technologies from parabolic trough, parabolic dish, and solar tower. A new technology recently developed at Sydney University by Dr Mills is similar to parabolic trough, yet the heat collector is overhead and the mirrors are not overly moulded and do the tracking, so combined reducing cost significantly.

CPV or concentrated photovoltaics concentrates light to small solar cells (500suns) that are not typical solar cells. These solar cells are not silicone and are designed to absorb high concentrations of sunlight giving high efficiency (39%), but in large parabolic dishes need cooling. Smaller systems for rooftops both industrial and utility scale, are being developed around the world and are due by the end of year 2007. Solar Systems Pty Ltd use such concentrated solar energy and CPV in their large parabolic dish systems, and tower systems by where tracking mirrors focus light to a tower where concentrator cells are fixed generating electricity.

Solar **thermal** technologies are more simplistic in my opinion relative to other large-scale solar technologies in Australia. What convinces me 100% is that the ANU has its big solar thermal dish at 400m² and now Dr Mills from Sydney University develops an even more simplistic system so that it borders on "agricultural" but works exceedingly well. The ANU's big dish has enormous potential as all that has to do is to make them cheaper and I am very confident they will do this.

Solar thermal technology facilitates solar chemical storage for return at night for electricity generation. The ANU have had such working systems for some years and I am confident in these systems along with the CSIRO's parabolic dish system "cracking" natural gas with an ~20% solar energy content installed into the product gases (including hydrogen). The CSIRO as well at Newcastle NSW have a scaled solar tower concentrator working.

■ Hydrogen:

Hydrogen production storage and transportation and the importance of such are now covered by numerous projects from around Australia as highlighted in the "Australian Hydrogen Activity May 2005" book produced by The DITR, and freely available in hard copy; hydrogen is already our energy carrier our destiny.

■ Bioenergy

I fully support bio-energy development in Australia as regarding ethanol, biomass and hydrogen production methodologies, and also noting bio-fuel cell capacities are in fact developing in the world around us. We already have large numbers of "pocket battleship" sized bio-energy electricity generators in Australia, and the potential is subject to rate and magnitude of supply. I had strongly encouraged animal waste harvesting electricity generation in Newcastle NSW between years (2001-2003), involving chicken and cattle farming, and I am sure many other potential generators can begin soon with appropriate incentives (Carbon Trading.....), and of course such biogas production could soon be used in large commercial fuel cell power plants(no combustion).

Ethanol has been talked about for years in Australia as a means to progress a renewable fuel which can be manufactured here, and can be easily added as a percentage to petrol. Ethanol blended with petrol burns cleaner and reduces our dependence on foreign crude oil.

Certain South American countries currently use ethanol as a sustainable renewable fuel, which is used in their cars at high % levels. This has allowed the very large local sugar growers to produce equally large quantities of ethanol, for their local populations and as well save billions of dollars annually in the foreign debt associated with crude oil importation; the economic factors are sure to be multiplied overtime. Australian researchers have recently discovered new ways of fermenting the sugar cane waste sugars, by evolving new yeasts for the job. This now allows for the first time much more Ethanol production from sugar cane waste, and can as well apply to other bio-wastes

Australia produces sugar and is thus capable of producing ethanol. We of course need cars that can operate safely on ethanol blends of 10% and more. Can the new Holden or Ford cars operate on Ethanol?

Ethanol can now be used as a fuel in an Ethanol based Fuel Cell. This amazing breakthrough in year 2005, allows ethanol at room temperature to be consumed in a dedicated fuel cell producing "clean" electricity, without combustion. The Ethanol Fuel Cell [EFC] is being co-developed by Italy and the UK, and it is hoped by ~yr 2010 that power and performance will rival the PEM fuel cells of today.

What this can mean is that Ethanol can be used for combustion today and non-combustion tomorrow. Ethanol can thus have its own "Bridge" plan being able to be used today in combustion engines and co-exist with futuristic fuel cells running on Ethanol. The risk associated with Ethanol is thus reduced significantly, as a technology led approach towards future sustainability will embrace it not exclude it; this applies to stationary and auto ethanol fuel cells, so electricity generated can power houses /industry 24/7 and as well power cars.

Summary:

“If a technology led approach towards future sustainability should ever get complemented by the “push” of carbon trading administrative systems, we change the world forever”-sz05

Federal tender requests I observed during years 2005/2006 on the topics of global warming impact studies on Australia, suggest that Canberra is mindful of climate change and were implementing real attempts with scientific scrutiny, to determine the impact that global warming is having and will most likely have on Australia in the future.

Some technologies are subject to global warming climate change risk analysis, to assess what potential anomalies could happen more specifically to the renewables of wind, tidal, wave and bio-energy. Lets not go “off half cocked” looking to spend billions here until the questions are scientifically determined. As well I think this must be embraced in any future technology roadmap assessment/s. Tidal and wave electricity generation have near 24/7 potential, but need more cost effective technology development. Geothermal has 24/7 potential capacities in magnitude, so I am more impressed here. Solar and wind are intermittent, yet are used and much proven, but now looking futuristically solar thermal concentrator potential is enormous via landmass, whilst wind is subject more to the variations in climate risk analysis and more expensive storage technologies. New assessments will need to be done regularly as all renewable energy technologies are now growing rapidly in the world.

Bio-energy can further be expanded where applicable (all relevant farming) throughout Australia, as there are already significant numbers of such generators so proven. Ethanol is the “new kid” which already has a reputation as a clean transport fuel, but now “bridged” as there is now non-combustive technologies growing rapidly in the world today (fuel cell), which generate electricity using ethanol as its fuel (non-combustive alcohol fuel cell). The “two birds with one stone” concept is raised here again, as stationary power generation potential materialises for ethanol via the ethanol/alcohol fuel cell.

The ethanol/alcohol fuel cell as well of course can potentially be used in transportation (electric) once power density improves like the existing hydrogen PEM fuel cell used in the fuel cell buses of Western Australia.

Australia does have many talented scientists, engineers and planners but we now need to think “outside of the square”. How many times have we really spoken, written and reported on the concept of *Innovation* over the last decade by example?

The “glasses must now go onto the table” to be fair and reasonable, for there now needs to be technology assessments into certain renewable energy types in Australia. I would recommend **solar-thermal** without any hesitation representing excellent potential for future electricity production/ storage in Australia. Further and obviously **hydrogen** along with **geothermal**. As a “ring in” hydrogen from coal/fossil is required minus (-) the carbon, so **coal gasification** is equally an essential for Australia, noting transport fuel generation other than hydrogen can be easily done (“two birds with one stone”).

End short report-----

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