

Since the IPHE SC meeting in Beijing in May 2004, progress has been made on a number of fronts in Australia. The Australian Government issued a major statement on energy policy in June 2004 founded upon the objectives of prosperity, security and sustainability. At a specific hydrogen level, we have undertaken a significant survey of hydrogen-related activity in Australia. We are increasing our participation in the IEA Hydrogen Implementing Agreement, and Australia has been selected to host the World Hydrogen Energy Conference in 2008.

Australia's Energy White Paper

The Australian Government's Energy White Paper embodies the Government's objectives of ensuring that Australians have reliable access to competitively priced energy; that the value of energy resources is optimised; and that Australia responds effectively to domestic and global environmental challenges.

The Energy White Paper sets out a comprehensive and integrated approach to meeting these energy objectives of prosperity, security and sustainability. It announced funding for developments in low-emission technologies. Innovation and the introduction of new technologies will play a key role in creating an energy sector in Australia that will deliver our energy objectives. Domestic and global advances in energy technology are reducing the cost of producing and using energy with lower emissions. Improvements in transport technologies are bringing fuel consumption and emissions down for users. Longer term, there is potential for using technologies like hydrogen to deliver abundant low-emissions energy. The Australian Government provides substantial support for innovation across all sectors of the Australian economy, including the energy sector. It has also recently allocated funds to assist with the International Energy Agency's policy work on hydrogen (Program 15) as agreed at a meeting of the Hydrogen Coordinating Group.

Hydrogen-related research and development programs

Compendium of hydrogen-related innovation in Australia

Australia has just completed a companion volume to the *National Hydrogen Study*. The Government commissioned a report to identify all the organisations and individuals who are engaged in the development of hydrogen-based energy technologies, and the integration of such technologies into Australia's energy system. This will soon result in publication of *Australia's Hydrogen Activity*. It is expected that the report will become a valuable resource for those wishing to identify potential research and industrial collaboration partners. Some of the key findings from the report are:

- There is a significant amount of work in natural gas reforming, coal gasification, and hydrogen production from biomass, as well as a few projects on gas cleaning and separation technologies. The CSIRO Energy Futures Flagship program is examining the use of renewable (mainly solar) energy in making hydrogen from fossil fuels.
- A number of projects are researching hydrogen production from water by electrolysis using renewable (solar, wind, water) energy, both at room-temperature and at high temperatures; direct solar-electro-chemical splitting; and polymer electrolyte membrane (reverse fuel cell) electrolysis.

- A group of projects focus on the bio-production of hydrogen, mostly in conjunction with the treatment of sewage.
- Hydrogen storage in Australia is mostly being approached from the nano-materials perspective or using metal-hydride systems.
- Nano-materials work is also a critical component of the significant effort in developing fuel cells that is going on at a number of universities and industrial organisations. The types of fuel cells being developed include Permeable Electrolyte Membrane Fuel Cell, Direct Methanol Fuel Cell, and Solid Oxide Fuel Cell.
- In addition to the research above, a variety of related demonstrations are planned or under way including modifying vehicles (cars and motorbikes) for hydrogen, using either fuel cells or internal combustion engines.
- There are also related technologies such as super-capacitors, novel battery systems, and new power-supply options, as well as a range of social and environmental assessments of hydrogen and related technologies.

The report has identified more than 100 projects suitable to provide a basis for developing international collaborations; indeed, a number of them already have links with IPHE member nations. This study places Australia in a strong position to work closely with IPHE members in fostering future collaborations.

Hydrogen technology demonstration projects

Perth fuel cell buses

A number of trials are in progress around the world, testing hydrogen-powered fuel cell buses in different climates and under a variety of operating conditions. Since the last IPHE Steering Committee meeting, plans for the demonstration of hydrogen-powered fuel cell buses in Perth, Western Australia have come to fruition, when three buses commenced operations in September 2004.

The Perth bus trial maintains links with the Clean Urban Transport for Europe (CUTE) series of trials and will exchange data for analysis as it progresses. The trial is jointly sponsored by the Australian Government, the Western Australian State Government, Daimler-Chrysler and BP.

- Each bus runs 8 hours a day, 5 to 7 days a week. The buses have travelled nearly 20 000 kilometres.
- The buses achieve good fuel efficiency, currently running at between 16 and 17 kilograms of hydrogen per 100 kilometres in suburban routes, with an average speed of 27 km/h. For inner-city routes, the fuel economy is between 20 and 24 kg per 100 km, with an average speed of 15 km/h.

The trial will be evaluated as it progresses, by Murdoch University in Perth. Bus operational performance will be compared with diesel and compressed natural gas (CNG) buses. In addition they will do a Life Cycle Assessment (LCA), cost-benefit analysis, and an analysis of public perceptions of the use of hydrogen and fuel cells as a mainstream energy system in transport in WA.

Antarctic demonstration project

Two large wind turbines have been installed at Mawson Base with the aim of supplying all the base's annual electricity requirements. Subsequently, hydrogen electrolysis, storage, and power generation equipment will be added giving energy storage for low-wind periods and producing sufficient extra hydrogen for use as a transport fuel. The hydrogen installation at Mawson Base is planned for late 2005. The combination of wind turbines and hydrogen will almost eliminate the need to transport diesel to this remote and pristine location. It will also eliminate emissions from the existing diesel generating plant and will remove the risk of diesel spillage. The project is overseen by the Antarctic Division of the Australian Government's Department of Environment and Heritage and the University of Tasmania. They are collaborating in this endeavour with Norsk Hydro which is undertaking a similar project on the Norwegian island of Utsira.

Currently an Antarctic Division 'quad' vehicle is being modified to run on hydrogen by the University of Tasmania, which is also investigating hydrogen pumping equipment for vehicle filling. The innovative nature of this project earned the Antarctic Division the President's Prize at the 2004 Australian Engineering Excellence Awards.

Domestic and/or international hydrogen conferences, workshops or other events

Workshop on Hydrogen Technologies for a Sustainable Energy Future, 20-23 March 2005, Melbourne

In the wake of the survey of Australian activity in hydrogen and related technologies, a small workshop will be held in Melbourne to look at Australian aspects of sustainable hydrogen technologies and infrastructure, and to advance local networking and overseas collaboration opportunities.

World Hydrogen Energy Conference in 2008

The 17th World Hydrogen Energy Conference will be held in 2008 in Brisbane, Australia. The Conference organisation is being co-ordinated by Dr Andrew Dicks of the University of Queensland, the Australian Institute of Energy's Hydrogen Division and the Brisbane Convention and Exhibition Centre.

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