15 November 2016

Dr Alan Finkel AO
Commonwealth Chief Scientist
NEM Security Review Taskforce
via email: Alison.Dell@environment.gov.au

The role of gas networks in Australia's long term energy security

Dear Dr Finkel

I refer to recent discussions in which you invited Energy Networks Australia to provide additional background information on the future of gas in a decarbonising energy system, including hydrogen solutions, biomethane and support for renewables.

Energy Networks Australia is the national industry association representing the businesses operating Australia's electricity transmission and distribution and gas distribution networks. Member businesses provide energy to almost every household and business in Australia.

The intention of this submission is to highlight the current and future role of gas networks in supporting the decarbonisation of the stationary energy sector, balancing the energy trilemma of environmental impacts, cost and security. We are aware your Panel is adopting a systemic approach, considering the complementary role of electricity and gas systems.

1. Gas Networks today

There are 4.7 million households connected to the gas distribution network (and a further 1.7 million on bottled gas), representing 67% of the total number of households in Australia[1]. These households rely on gas to provide safe, reliable and cost-effective space heating, hot water and cooking.

Australian gas networks consist of different materials for the distribution of gas including cast iron and steel pipes, polyethylene and nylon pipes. The businesses are completing mains replacement programs on an economic basis to replace the low pressure iron pipes with high pressure polyethylene or nylon pipes. Most of these programs are nearing completion. Australia's gas network includes gas storage facilities such as at those located at Iona, Victoria[2] that allow daily and seasonal fluctuations in gas demand to be met. The gas storage facilities can store over 150 days of average gas demand. Unlike electricity, gas transmission and distribution networks themselves also store energy that can be drawn on over a period of time. In effect, gas infrastructure facilities provide a national energy storage service for electricity generation from gas and for the direct use of gas in the home.

[1] Deloitte (2016), *Draft Data collation study for Energy Networks Australia.*

[2] Core Energy Group (2015), *Gas Storage Facilities – Eastern and South Eastern Australia,* accessed from: https://www.aemo.com.au/-/media/Files/Gas/National_Planning_and_Forecasting/GSOO/2015/Core--Gas-Storage-Facilities.ashx

The expected lifespan of this infrastructure is between 60 to 80 years and value of this national gas distribution network is almost $9 billion[3]. The economic role of gas will remain dependent on its competitive position as a fuel of choice, competing on price, sustainability, security and amenity. While there has been upward pressure on wholesale gas prices due to the internationalization of Australia's gas market, it is important to recognize the delivered cost to customers reflects other elements of the cost structure. Historically, gas distribution network costs can represent approximately 50% of the delivered cost to residential customers[4], compared to the wholesale cost proportion of about 20%. However, in many jurisdictions, these network costs are falling and the decrease in network costs have substantially offset increasing wholesale costs.[5]

2. Future of Gas in a Decarbonising System

Gas is currently a low emission fuel with significant capacity to support Australia achieve carbon abatement targets. It is estimated that the direct use of gas in the home has between ¼ to 1/6th the emissions of the same energy sourced from the electricity grid.[6] Gas used in power generation has approximately half the emissions of the current electricity grid[7]. As the energy system decarbonises, there is the potential for gas to reduce its carbon footprint, particularly through use of biomethane and hydrogen energy solutions.

Biogas

Biogas is generally produced from organic waste with different processes designed to process different fuel stocks, although the main route is through the use of a digester. The biogas produced – methane, just like natural gas - can then be injected into the gas distribution network. This process is commercially available and widely deployed within the UK and Germany. It has been estimated that in the UK[8], by the end of 2015, the established anaerobic digesters and biogas facilities had the capacity to inject 2 TWh/annum into the gas network, equivalent to the gas use of 155,000 homes. National Grid has also noted the potential capacity for in excess of 20 to 35 TWh of energy output by 2035, or the equivalent of over 2.7 million homes.

Within Australia, there are a number of biogas digestors operational such as the Jandakot 'Biogass' Facility[9] in Western Australia. This produces biogas which it then stores for producing electricity for use on site. ARENA[10] is also supporting a project to complete national biomass feedstock mapping resources. The AREMI platform will enable the Rural Industries Research and Development Corporation (RIRDC) to geospatially map existing and projected biomass resource data alongside other parameters such as existing network and transport infrastructure, land use capability and demographic data. When this project is completed, it will provide a reliable source of information for biogas project proponents to use.

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[3] Australian Energy Regulator (2015), *State of the Energy Market* 2015, accessed from http://www.aer.gov.au/publications/state-of-the-energy-market-reports
[4] OakleyGreenwood (2015), *Gas Price Trends Review - December 2015.*
[5] Australian Gas Networks (2016), *Draft Plan for the Victorian and Albury natural gas distribution networks*, accessed from: https://www.australiangasnetworks.com.au/our-business/have-your-say
[6] Energy Networks Association (2015), *Australia's Bright Gas Future – competitive, clean and reliable*, accessed from: www.energynetworks.com.au
[7] Department of the Environment (2014), *National Greenhouse Accounts Factors.*
[8] NationalGrid (2016), *The future of gas: supply of renewable gas*, February 2016, available from: http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/Gas/
[9] Biogass (2016), *Commercial and Industrial Bioenergy. Now In Australia*, accessed from: http://www.biogass.com.au/
[10] ARENA (2016), *The Australian biomass for bioenergy assessment project*, accessed from: http://arena.gov.au/project/the-australian-biomass-for-bioenergy-assessment-project/

The use of biogas results in zero net CO_2 emissions as the biomass is recognised as a renewable energy source. Producing biogas from organic waste and injecting that biogas into the gas distribution network – either as a mixture or by itself - will result in even lower emissions from the direct use of gas in the household.

Hydrogen

Hydrogen provides another alternative to lowering emissions from the use of gas. Currently, bulk hydrogen is often produced through steam re-forming of methane. This separates the hydrogen atoms from the carbon atoms to produce hydrogen gas and CO_2 as a byproduct. This CO_2 can be collected and sequestered in suitable geological storage reservoirs using a process called carbon capture and storage (CCS). All these technologies are proven at commercial scale and numerous studies have been completed[11] to identify suitable geological storage sites within Australia.

The UK Committee on Climate Change[12] notes that "*hydrogen production with CCS has been clearly identified as the lowest-cost route to low-carbon hydrogen.*" Producing hydrogen through steam methane reforming - combined with CCS - achieves a near zero emissions future for gas.

Currently, the Japanese government is championing hydrogen fuels as part of their commitment to the 2020 Summer Olympic Games in Tokyo. This has resulted in renewed interest in producing hydrogen from brown coal from the Latrobe Valley through the Kawasaki Hydrogen Road[13]. While this process uses brown coal instead of natural gas for the production of hydrogen, both processes sequester the CO_2 byproduct and produce clean hydrogen, which could be injected into the networks or exported (to Japan).

Hydrogen can also be produced from bioenergy, or from using surplus renewable energy to electrolyze water. Both these technologies are technically viable and being actively demonstrated. For example, the National Renewable Energy Laboratory[14] is completing a wind-to-hydrogen project where electricity produced from wind turbines and photovoltaic arrays are linked to electrolyzers to split water into hydrogen and oxygen. This hydrogen can then be stored on site for refueling or can be used to generate electricity using an internal combustion engine or fuel cell.

Modern gas networks are able to transport hydrogen, either in its pure state or as a mixture with methane (whether that is from fossil or organic sources). The H21 Leeds city gate project[15] has proved, via a desktop study, that the Leeds gas network in the UK is large enough to convert to hydrogen. The project is now seeking to develop a roadmap to hydrogen to provide higher level of confidence in the feasibility of hydrogen conversion by addressing any remaining technical, regulatory, commercial gaps.

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[11] For example, Carbon Storage Taskforce (2009), *Australia's potential for the geological storage of CO2*, September 2009, accessed from: http://www.industry.gov.au/Energy/Documents/cei/cst/Aus_Potential_co2_Brochure.pdf

[12] UK Committee on Climate Change (2016), *Next steps for UK heat policy*, October 2016, accessed from: https://www.theccc.org.uk/wp-content/uploads/2016/10/Next-steps-for-UK-heat-policy-Committee-on-Climate-Change-October-2016.pdf

[13] http://global.kawasaki.com/en/stories/hydrogen/

[14] National Renewable Energy Laboratory (2016), *Hydrogen & Fuel Cell Research – Wind-to-Hydrogen Project*, accessed from: http://www.nrel.gov/hydrogen/proj_wind_hydrogen.html

[15] KPMG (2016), *Energising the North – a report for Northern Gas Networks*, April 2016, accessed from: http://www.northerngasnetworks.co.uk/wp-content/uploads/2016/04/Energising-the-North-report-final.pdf

3. Australian gas businesses leading innovation

Australian gas distribution businesses are investing in demonstrating the role of future gas networks through the following activities.

- Energy Networks Australia - Gas R&D Fund

  The Energy Networks Australia Gas Committee members contribute to this fund. One of the projects supported by this fund aims to identify the commercial, technical and regulatory issues for ***injecting hydrogen into networks*** at levels of up to 15%. The scheduled completion date for this project is June 2017.

- Australian Gas Networks (AGN) Hydrogen Project

  AGN has partnered with AquaHydrex, a business that has developed an advanced electrolysis technique for producing ***hydrogen from water***. The concept is based on the use of surplus electricity from renewables (i.e. wind and solar) to produce hydrogen for injection into natural gas networks. AGN currently purchases natural gas to offset system losses, and the displacement of all of this gas with hydrogen would be the ultimate goal. Funding is currently sought to build a demonstration pilot plant for commissioning in 2018.

- ActewAGL Networks Sustainability Projects

  ActewAGL is investigating sustainability projects. One of these projects aims to convert organic waste streams to ***biogas*** in an anaerobic digestor and to inject that the produced gas into the ACT's gas distribution network. A business case for a pilot scheme is being developed. The second project aims to establish a pilot plant for R&D into producing hydrogen from excess renewable energy, linked to one of the ACT's wind farms.

4. Further assistance

ENA notes that the purpose of the NEM Security Review is to: *develop a national reform blueprint to maintain energy security and reliability in the NEM, for consideration by the Council of Australian Governments through its Energy Council.* The purpose of this submission is to highlight how gas and gas networks can provide a complementary role in supporting the security and reliability of the NEM, while also achieving emission reductions from energy consumption in Australia.

We would be happy to provide any further assistance to the Review on the issues addressed in this submission. Please don't hesitate to contact me if you would like further information on (02) 62721510.

John Bradley
Chief Executive Officer

As of 10th November 2016, the Energy Networks Association commenced trading as Energy Networks Australia. Our website and email has changed to energynetworks.com.au. Please update your records accordingly.