Hydrogen Energy Supply Chain (HESC) Project

Submission to Infrastructure Victoria's "Towards 2050: Gas infrastructure in a zero emissions economy" report on Victoria's Gas Substitution Roadmap

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Introduction

The HESC Project is a world-first initiative that aims to demonstrate that clean hydrogen produced through gasification of coal in Victoria's Latrobe Valley and liquefied at a port in Victoria, can be safely and cost-effectively produced and exported to Japan, creating an integrated supply chain that could put both Australia and Japan at the forefront of a hydrogen society and the global hydrogen revolution.

The HESC Project is coordinated by Hydrogen Engineering Australia Pty Ltd (HEA), a consortium of reputable and highly-experienced industry partners: Kawasaki Heavy Industries, Ltd, Electric Power Development Co., Ltd (J-Power), Iwatani Corporation, Marubeni Corporation, AGL Energy and Sumitomo Corporation, and encompasses two phases: the Pilot Phase and a Commercial Phase. The long-term overarching goal of the HESC Project is to build and commercialise a sustainable clean hydrogen energy supply chain, leveraging Victoria's resources and Carbon Capture and Storage (CCS) capabilities.

While the export of liquefied hydrogen is the focus of the project, discussions for the potential local offtake of gaseous hydrogen (GH2) have also been progressed during the Pilot Phase which is now nearing completion. Indeed, as the Project Partners turn their focus towards the commercialisation of the Project, it is anticipated that a portion of the production of GH2 will be utilised for local application, most likely for blending with natural gas in the local gas networks. This will contribute significantly to achieving Victoria's emissions reduction goals, help decarbonise its gas supply and support the development of a hydrogen market in the State.

The HESC Project Partners welcome this opportunity to provide input into the future of Victoria's gas networks and its potential to contribute to net zero by 2050. We have provided our responses to the key questions listed in the discussion paper.

What policies and/or regulations, if any, are needed to support the development of low carbon pathways such as biogas, green hydrogen, and carbon capture and storage?

The HESC Project appreciates the Victorian Government's existing technology-neutral policies for hydrogen production that are supporting the development of a low carbon pathway for the gas network. Clean hydrogen produced from coal gasification with CCS has the potential to play an important role in the State's future energy mix and principles of optionality should be enshrined in future policies and regulations to support this low carbon pathway. Referring to different colours of clean hydrogen or favouring different production methods detracts from the key hydrogen characteristic and purpose of Victoria's decarbonisation goals for its gas network – the successful elimination of greenhouse gas emissions into the atmosphere.

In the absence of certainty, Government policies should anticipate that a blend of clean hydrogen will feature in household gas networks and that high heat industrial users will fully transition from natural gas to clean hydrogen. As such, Victoria's gas infrastructure should be resilient to future possibilities with all new major network assets built to specifications that are clean hydrogen compatible. This might include requirements for all new natural gas pipes and arterial pipelines to be built with polyethylene material that is impervious to the embrittlement and other degradation that existing pipes experience after contact with certain levels of hydrogen gas.

As clean hydrogen leaves industrial settings and comes closer to consumers, it will be important for government policies to support the social licence of this low carbon pathway. Carefully trialling technology-neutral end-use cases and progressively scaling up technologies within appropriately regulated environments will be the best way to build community support. Community acceptance of clean hydrogen will be predicated on safety considerations, and community and stakeholder engagement activities should encircle any future hydrogen blending or substitution trials.

Strategic support for CCS initiatives like CarbonNet will continue to be critical. This large-scale CCS network will bring together various CO2 capture projects in Victoria's Latrobe Valley, transporting CO2 via a shared pipeline and storing it safely in rock formations beneath the sea bed in Bass Strait, similar to the way oil and gas have been trapped naturally for millions of years. In addition to the HESC Project, there is potential for this network to be used by natural gas companies in the transition to net zero emissions. Embedding consideration of CCS in future policies will maintain the reliability of Victoria's gas supply, support the existing gas industry in their decarbonisation efforts and create further synergies for the Government's existing investments in the CarbonNet and HESC projects.

What is your view on the best ways to maintain the reliability and affordability of Victoria's gas supply if natural gas use declines?

Although decarbonisation of the gas network is widely supported, the issues of reliability and affordability could pose a challenge for the transition to cleaner energy. A pragmatic, technology-neutral approach will be required to ensure substitution of natural gas with clean fuels does not result in shortages of supply or unexpected price increases. Blue hydrogen with CCS may meet the cost target set by the Federal Government of $2/kg by 2025. For green hydrogen to become commercially viable, however, the cost of electrolysers and balance of plant need to reduce by 75%-85% from current levels, and the cost of solar and wind energy needs to reduce by another 50%. In addition, electrolyser efficiency needs to improve from the current 55kWh/kg to 50kWh/kg.[1] Even if these targets are achieved, affordability to the end-user will be highly dependent on financial and policy/regulation support from the Government, to bridge the cost gap between hydrogen and natural gas by 2025-2030, and to ensure retailers and end-users are both protected from significant cost increases.

Collaboration between infrastructure owners and operators, industry, and hydrogen producers will be key, to ensure uninterrupted supply to end-users. Government may play a role in providing financial and policy support to end-use application projects, to stimulate demand, and eventually support long-term offtake agreements from large-scale producers.

[1] ARENA, Opportunities for Renewable Hydrogen, presentation by Matt Walden, May 2021

How can the use of Victoria's existing gas infrastructure be optimised during the transition to net zero emissions, over the short (10 years), medium (20 years) and long-term (30+ years)? How can the Victorian Government assist in this?

Victoria's gas infrastructure is more than 40 years old and is reaching end of life. The Victorian Government needs to make a careful appraisal of priority areas for investment over the short, medium and long term. Focussing on decarbonisation of current hard-to-abate sectors in the short-term and moving the introduction of new end-use applications to a later stage in the transition roadmap, may contribute significantly to achieving interim emissions reduction targets in the most cost-effective manner. An example of this may be to prioritise investment in hydrogen-compatible infrastructure between hydrogen production facilities and high-heat industrial users in the short term, then to focus on investment in applications that are likely to become commercially viable in the medium-term, such as hydrogen-fuelled transport, and finally, to invest in applications that will require more intensive activity to achieve benefits at scale, such as hydrogen blending/substitution in the distribution networks for household use.

Proactive trialling of industrial hydrogen applications in the short-term will be key to ensure carbon abatement at scale. This may include trialling of gas blending in the transmission gas network and testing of hydrogen/biogas use in gas turbines at existing power stations. The results of these trials could inform the mapping of future infrastructure developments, which may include pipelines between hydrogen production facilities and industrial sites or connections between hydrogen production facilities and transmission network injection points. Blending in the transmission networks may also be ideal to get hydrogen-blended gas to large demand nodes in Melbourne, Altona and Geelong. Government support for CCS infrastructure development around these industry dense areas will further contribute to achieving interim emissions reduction targets and ultimately net zero by 2050.

Latrobe Valley presents a significant opportunity for large-scale hydrogen application trials. The HESC Project is under development with potential commencement of commercial operations around 2030. The project will produce gaseous hydrogen in large volumes, which could potentially be made available for hydrogen trials in industries requiring high-temperature heat (steel and cement production, etc.) operating in this area. The proposed HESC gasification and refining site is also in close proximity to the Longford-Dandenong pipeline that is running through the Latrobe Valley, which is ideal for hydrogen blending trials.

We note the Victorian Government is looking to trial hydrogen blending to support a couple of smaller Victorian towns becoming 'hydrogen first-movers'. With a good percentage of customer take-up (which will potentially need to be incentivised) these trials may help test for issues but more importantly create a beachhead for promoting more widespread use of hydrogen/hydrogen blend in the longer term.

What principles should apply or what measures will be needed to manage the impacts of gas decarbonisation on households and businesses?

The successful rollout of a decarbonised network requires a coordinated effort, whether it is policy or commercially led. Each possible action briefly discussed below is an essential part of the transition to a cleaner gas network and will support the social acceptance of decarbonised gas.

- In terms of hydrogen blending into the distribution network, at a certain blending level the pipes would require to be upgraded to high-density polyethylene pipe or equivalent to protect against issues such as embrittlement.[2] New distribution infrastructure should be designed and constructed to be "hydrogen ready", i.e. to transport up to 100% hydrogen. Network upgrades will also be required if production points are not directly connected to the distribution network. This is a costly exercise and may impact the affordability of gas for households and businesses. Careful consideration should be given to pass-through mechanisms in regulatory instruments, to maintain overall affordability.

[2] COAG Energy Council – National Hydrogen Strategy, p4

- Any changes to the gas supplied may impact the safe operation of existing domestic and industrial gas appliances. The blending thresholds under which appliances in Australia can operate safely should be a research and testing priority. Currently, changes to gas mixtures will need to comply with AS/NZS 5263 (domestic) Type A appliances and AS 3814 (industrial) Type B appliances. Safety standards will have to be developed for blended gas and those who work with gas infrastructure will need to be trained/upskilled to effectively and safely manage installation and operation of the new gas connections.
- If the new gas blend involves hydrogen levels in excess of the technical thresholds, users connected to the network may require new appliances or changes to existing appliances. Appliance manufacturers would need to develop compatible appliances. To ensure the total cost of the conversion is minimised, direct government support may be necessary such as subsidy schemes through which customers could acquire compatible appliances. This may follow the example of The Victorian Energy Efficiency Target (VEET) that provides subsidies for energy-saving appliances[3].
- If networks were to introduce blended gas, blending technology needs to ensure a consistent mix of gases, and metering needs to be calibrated and tested to obtain an accurate estimate of blended gas consumption for billing purposes.
- Collaboration between the Government and Gas retailers will be key to obtaining and maintaining social licence for infrastructure developments and minimising disruption during the transition to cleaner gas. Retailers are a valuable contact point for upstream businesses, to ensure smooth engagement with, and direction of information to customers.

What policies, programs and/or regulations should the Victorian Government consider or expand to encourage households, commercial buildings and small businesses to reduce their gas use?

The HESC Project supports the government continuing to invest in research and trials of clean hydrogen in existing pipelines and appliances to support households, commercial buildings and small businesses transition away from natural gas. The HESC Project will aim to contribute to these trials by making hydrogen available to support these studies. It is anticipated that a portion of the GH2 produced during early commercial operations will also be made available for blending in local gas networks. The Project Partners are already engaging in discussions with local gas network owners/operators to establish interest in this low carbon pathway.

Targeted funding programs should be considered to further incentivise industry participation in trials of hydrogen gas delivery systems and future regulatory architectures. Hydrogen powered boilers and heating systems may represent the best pathway to substitute natural gas with hydrogen in households, commercial buildings and small businesses. Given the challenges associated with modifying domestic appliances for hydrogen use and the relative ease at which they could be replaced with electrical appliances, the Government may want to focus its incentives for hydrogen uptake in industrial applications, as discussed above.

What policies, regulations or other support, if any, do you think are needed to support industrial users to switch from natural gas to lower emissions energy sources or chemical feedstocks?

Many heavy industry players will be likely to transition their natural gas use to clean hydrogen given the high energy density and temperatures it offers when compared to electricity. The best way to support this transition will be to develop infrastructure nodes around key industrial centres looking to receive and use clean hydrogen. Incentives for trials in these nodes and connecting transport infrastructure will provide the largest return on Government investment in the medium term.

Situated in Gippsland, the HESC Project is already located in an emerging hydrogen node that will play a pivotal role in accelerating the development, deployment, and commercialisation of the Australian hydrogen industry. This is demonstrated by National Energy Resources Australia's (NERA) decision to fund the region as a key industry cluster being led by the Committee for Gippsland. The

[3] https://www.victorianenergysaver.vic.gov.au/save-energy-and-money/victorian-energy-upgrades

region also has the strong potential to benefit from Commonwealth designation as a clean regional hydrogen export hub. Linking production hubs with industrial end-use nodes will provide the co-location synergies and cost efficiencies needed to drive hydrogen substitution into industrial settings.