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Submission to The Victorian Green Hydrogen Discussion Paper – The Victorian Hydrogen Investment Program

AGL Energy (**AGL**) welcomes the opportunity to make a submission in response to the Victorian Hydrogen Investment Program Discussion Paper (**Discussion Paper**) released in November 2019.

AGL is one of Australia's largest integrated energy companies and the largest ASX listed owner, operator and developer of renewable generation. Our diverse power generation portfolio includes base, peaking and intermediate generation plants, spread across traditional thermal generation as well as renewable sources. AGL is also a significant retailer of energy, providing energy solutions to around 3.5 million customers throughout eastern Australia.

In addition, AGL is continually innovating our suite of distributed energy services and solutions for customers of all sizes. These behind-the-meter energy solutions involve new and emerging technologies such as energy storage, electric vehicles, solar PV systems, digital meters, and home energy management services delivered through digital applications.

The commitment by the COAG Energy Council in December 2018 to establish a dedicated working group, chaired by the Chief Scientist Dr Alan Finkel, is a step forward in progressing the development of a clean, innovative, and competitive hydrogen industry. This may create significant opportunities to further integrate energy markets with emissions reduction, provide alternative energy sources for customers, and provide significant value to Australia's economy through both export revenue, domestic industrial development and mobility fuels.

The Hydrogen Working Group's briefing paper Australia's National *Hydrogen Strategy*, and the CSIRO's *National Hydrogen Roadmap* provide useful overviews of these issues along with the current status of hydrogen production technologies and the challenges and opportunities associated with expanding this production in Australia.

As a participant in the Hydrogen Energy Supply Chain (HESC) project, AGL is advanced in its awareness of these technical and operational challenges.

The HESC project is a world-first initiative, in which brown coal from the AGL Loy Yang mine will be converted to gaseous hydrogen at the Loy Yang Complex and then transported by road to a liquefication terminal at the Port of Hastings. The gas will be shipped to Japan for use predominantly in the transport industry.[1] AGL's support for the pilot project includes land, energy and water for the plant and up to 160 tonnes of brown coal.

[1] For more information on the HESC project, see https://hydrogenenergysupplychain.com/

With support from the Australian, Japanese, and Victorian governments, the HESC Project includes leading Japanese energy and heavy industries corporations including Kawasaki Heavy Industries, J-Power, Iwatani, and Marubeni Corporation.

During commercial operations, HESC will require a Carbon Capture Utilisation and Storage (CCUS) solution. CCUS will not be a feature of the HESC pilot phase, due to the low volume of carbon dioxide emitted, which equates to the annual emissions of about 20 cars. Carbon offsets will instead be used to compensate emissions for the pilot phase. However, if the pilot is successful, CCUS will be an essential component of the commercial phase, a factor which has been recognised by both the CSIRO and Hydrogen Strategy Taskforce's discussion papers.

AGL is also interested in how hydrogen could support existing electricity and natural gas markets and assist in meeting Australia's international commitments to reduce emissions. As noted by the *Hydrogen for Australia's Future* briefing paper, electricity requirements for hydrogen production from electrolysis could provide a useful level of demand for low-cost renewable generation that is not being dispatched into the grid. We look forward to working to expand the knowledge regarding opportunities in this sector.

Similarly, we note the initial discussions regarding the replacement of natural gas with hydrogen in the existing gas supply chain. In our view, the partial replacement of the existing natural gas supply chain with hydrogen may be an effective approach to both increasing gas supply and reducing emissions, but we consider that more work needs to occur to understand the full commercial and technical implications of such a concept.

The value of these opportunities to the Australian economy and energy security have the potential considerable and are therefore worth exploring in some detail. Continuing this initial analysis and supporting innovation and funding for research and development would be a welcome first step towards unlocking the potential benefits that a hydrogen economy could deliver.

We look forward to continuing to work with governments to further develop and inform the future development pathway of hydrogen in Australia, and we have provided responses to the specific questions posed by the Department in the body following this letter.

Should you have any questions in relation to this submission, please contact Dean Smith, Manager Power Development on 02 9921 2359, or Aleks Smits, Manager Policy & Research on 03 8633 7146.

Yours sincerely,

Eleanor McCracken-Hewson

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Key Policy Questions

1. **What are the greatest opportunities for investment and employment in hydrogen?**

AGL notes that hydrogen is already used in industry in a variety of ways, for example in the refining industry, and for production of ammonia, methanol, and heat. In the context of this submission, AGL has focused mainly on changes that may occur in the generation (supply) of hydrogen, including for conventional end-uses, and changes in the end-use (applications) of hydrogen. This excludes, for example, detailed consideration of opportunities for investment and employment in existing methods of hydrogen production.

Hydrogen may be valuable in the decarbonisation of hard-to-decarbonise sectors of the economy, such as heavy-duty transport, aviation, and manufacturing. In the short term, the opportunities for investment and employment in hydrogen is likely to yield greatest value if directed at the development of robust and safe end-use applications in these sectors, and techniques for transport and distribution of hydrogen. Over time, investment in developing scaled applications and distribution are likely to have greater value.

2. **What is Victoria's competitive advantage in relation to capitalising on an emerging hydrogen economy?**

Victoria is well positioned with a mature gas and energy sector, associated skilled workforce, abundant natural resources applicable to hydrogen (solar, wind, coal, CCUS), and world-leading universities. These factors, in combination with a stable regulatory regime, will assist in managing the production and use of hydrogen. Global experience suggests that novel hydrogen industries (whether at the generation or end-use of the value chain) require firm funding regimes to provide incentives for research and development.

Victoria also houses one of Australia's early hydrogen energy supply chain projects, the world first Hydrogen Energy Supply Chain (HESC) at AGL's Loy Yang site. The project has the potential to realise hydrogen production at a scale that is likely to be competitive to alternative sources. Whilst the consortium acknowledges the need for Carbon Capture Utilisation and Storage (CCUS) during a commercial phase, projects like HESC have the potential to offer overall emission reductions and are likely to be materially important to a future hydrogen industry and in meeting climate policy objectives.

3. **What lessons can Victoria learn from the global hydrogen agenda and international experience to date?**

Two themes emerge from international experience to date; firstly, the global economic and political environment that promotes action on hydrogen; and secondly, possible technology pathways to achieving those objectives. Regarding political pressures, international experience in Japan, Korea, and Europe suggests that a combination of climate policy pull, and geopolitical reasons to reduce use of natural gas are important in motivating activity along the hydrogen supply chain. In relation to technology pathways and cost curves, the current consensus is that hydrogen from non-fossil fuel sources will remain a more expensive source until at least 2030, making at-scale development of related industries unlikely until the 2030s unless there is substantive acceleration of investment in research and commercialisation of technologies.

4. **Geographically, where are the most significant clusters for this investment, employment and production?**

Internationally, Japan and Korea's bold plans to realise a Hydrogen Society are designed to help the countries meet their Paris Climate Targets. These plans have prompted and fostered significant government and private sector research into the creation and utilisation of hydrogen for those economies. These developments extend, but are not limited to, the following:

- Fuel cell development and utilisation;
- 'Hydrogen to power' or 'Power to hydrogen' technologies;
- Hydrogen transport and liberation (within ammonia or in a condensed phase); and
- Mobility solutions based on hydrogen

Some European centres have also made progress in development and deployment of hydrogen technologies, based in part on their desire to reduce dependence on potentially fragile natural gas supplies.

We note that none of these international geographies are as well-resourced as Australia or Victoria in terms of wind and solar potential. While well placed to accelerate the hydrogen economy on the demand side, they are arguably less well-placed to develop large scale renewable hydrogen generation capacity.

5. What are the skills and training requirements needed to grow Victoria's hydrogen industry?

Hydrogen, as an energy carrier, has the potential to append to, disrupt, and change Australia's energy and mobility sectors. As a result, relevant elements of Victoria's education and training sectors, particularly at an advanced level, need to reflect this diversification and disruption potential within the traditional frameworks. As industry adapts to this new substance as a fuel and feedstock, the workforce will require education on handling and transporting hydrogen; building or renovating pipelines to be suitable; and refurbishing or building end-use applications.

6. What are the challenges to developing a hydrogen economy in Victoria?

AGL believes that confidence in the cost, safety, reliability, and availability of supply are required for a successful industry.

- Costs must be equal to or better than substitute fuels.
- Hydrogen and associated waste products must be produced, stored, transported and utilised in a safe manner.
- Hydrogen must be available in volumes that enable it to underpin its role within local and export end user industries.

From a high-level economic perspective, however, there are limitations to the achievement of each of these objectives in the absence of broader economic or political drivers. For example, in the absence of coordinated efforts to reduce carbon emissions from the natural gas supply chain, there is no immediate imperative to transition away from natural gas to hydrogen.

The key challenge in kick starting a hydrogen economy is therefore allocating initial capital on the demand or supply side where benefits may only be realised after a longer period of time and in coordination with the development of other complementary policy objectives both domestically and internationally.

7. Who are the critical stakeholders needed to support a Victorian hydrogen economy?

AGL believes that safety and environmental impacts should be a primary consideration when considering the production and utilisation of hydrogen. Our communities should feel confident and comfortable with hydrogen generation, storage, transport and utilisation.

In addition to the safety and comfort of Victorian communities, AGL expects that the Victorian, other state, and Federal governments; industry organisations and leaders; and the education sector will all be important stakeholders in supporting a Victorian hydrogen economy.

8. What does a supportive regulatory environment for a sustainable hydrogen industry look like?

Domestically, safety considerations are critical for developing a sustainable hydrogen industry. Safety considerations by gas facilities are generally very well managed, however, within Australia the absence of

specific, suitable and complete hydrogen standards may hold back an acceleration of industry growth. Progress towards appropriate regulation as well as domestic and International Standards may therefore support the development of a complete supply chain of safe generation, transport, handling and utilisation of hydrogen, and the management of associated waste streams.

By way of example, the introduction of alternate fuels (such as phasing out of lead-based petroleum, or the introduction of ethanol blends or LPG) required concerted research, the development of standards, and their application within multiple industrial and transport sectors. Similarly, the application of standards at an early stage that do not impede development options would be useful to guide the industry to scale.

Looking internationally, for Australia, including Victoria, to capitalise on a global hydrogen market it must either develop cost effective hydrogen technologies (generation, transport, handling or utilisation) for export or facilitate or develop suitable marine hydrogen transport.

Some see hydrogen on a similar development pathway to LNG in the late 1970s; technological advancements in the shipping of LNG unlocked the commodity to become a truly global energy commodity. Ocean-going transportation of hydrogen remains an outstanding issue for the acceleration of a global hydrogen market.

9. **Are there barriers to achieving a social licence for hydrogen to operate? What does the Victorian Government need to consider in addressing these?**

The use of novel hydrogen generation technologies or end-use applications will require comprehensive consideration of the impact on communities. AGL believes that safety and environmental impacts should be a primary consideration when considering the manufacturing and utilisation of hydrogen. Our communities should feel confident and comfortable with hydrogen generation, storage, transport and utilisation.

AGL urges all governments to work with industry leaders to develop appropriate regulation and standards, ideally International Standards, to support the complete supply chain of safe generation, transport, handling and utilisation of hydrogen and associated by product streams.

10. **What role can hydrogen play in Victoria's energy system into the future? Are there limits to the role hydrogen can play in Victoria's energy mix?**

In the future hydrogen fuel cells could be part of Victoria's energy mix. There are some factors which will limit the role that hydrogen can play in Victoria's energy mix. In the gas system, it is currently expected that hydrogen cannot safely make up more than about 10% of gas transported without augmentations to gas infrastructure. In the electricity system, hydrogen could be an important medium for long-term storage to smooth demand and supply, however long-term hydrogen storage systems are currently expensive, and this will limit their adoption in the short to medium term. In transport, if fuel cell technology develops, it may be possible to leverage this for heavy duty transport for specific applications where it is competitive against alternative solutions.

11. **What does the Victorian Government need to consider attracting investment in the hydrogen supply chain in Victoria?**

The Victorian Government should consider the technological risk that businesses will take on in exploring different parts of the hydrogen supply chain, and may find that providing certainty in the regulatory regime, available incentives, and standards for technology experimentation would give industry players confidence in the way that they can operate.

12. **What is the best way for the Victorian Government to support hydrogen R&D, pilot projects and demonstrations? Are there any we should prioritise?**

There are lessons to be learned from the development and implementation of past national and state approaches, including previous approaches for transport fuel replacements. A national approach to funding and promotion of such a scheme, supported by COAG, is likely to provide additional benefits in terms of scale and efficiency. While state-based approaches may provide useful contributions, especially in terms of research and development and pilot projects, a clear national policy has the potential to achieve reduced costs and timelines for developing the industry.

13. **What possible uses for hydrogen offer greatest benefit to Victoria?**

The development and production of clean hydrogen may provide additional benefits. Whilst the term 'clean hydrogen' is yet to be formally defined AGL interprets this is either renewable energy utilised in the creation of hydrogen or a fossil fuel derivative with carbon capture utilisation and storage. Whilst the industry is in its infancy, AGL believes there is medium-term potential for clean hydrogen in areas including the following:

- As a supplementary de-carbonising gas within the national gas grid;
- Within the transport sector as a displacement to traditional combustion engine fuels;
- As an energy storage solution for time lapsed distribution; and/or
- Large industrial users may have an interest in the direct sale of hydrogen (as a feedstock), rather than current supplies being blended with natural gas.

14. **What is the level of hydrogen transport infrastructure needed in Victoria and where are the priority areas for infrastructure and Victorian Government policy (e.g. procurement)?**

Victoria's current hydrogen transport infrastructure may not be compatible with a substantial ramp-up of a hydrogen economy. We consider that rapid uptake of hydrogen fuel cell vehicles will require a concerted effort to develop associated infrastructure, although we consider that the primary focus of current transport infrastructure is appropriately focused on battery electric vehicles, which represent a much more advanced technology that is likely to reach scale many years before hydrogen. Nevertheless, awareness of the need for hydrogen infrastructure should develop as the potential need for it grows.

15. **What are the considerations for business and consumers in purchasing a new type of vehicle, such as hydrogen or battery electric vehicle?**

Businesses and consumers still see significant potential drawbacks to the purchase of new types of vehicles. Their concerns are often around the range of the vehicle. Hydrogen vehicles suffer from lower range limitations than battery electric vehicles; but with the limited (near non-existent) infrastructure for refuelling, these concerns are likely to remain a significant barrier for some time.

16. **Other than cost and technology barriers, what factors help current and potential users of hydrogen in commercial and industrial settings decide how to procure hydrogen? How could the Victorian Government assist commercial and industrial businesses switch to green hydrogen for chemical feedstock and/or heating?**

Hydrogen procurement decisions for various potential users are likely to be diverse. Drawing on experience of previous policy here and abroad, the Victorian government could consider proactively enabling technology trials, including through exposure of local industries to novel technologies; capacity building or support to trial technologies; and promoting sharing of what is learned through these trials.

17. **What other issues does the Victorian Government need to consider in developing an Industry Development Plan?**

AGL has welcomed this opportunity to contribute to the Victorian Government's consultation process in relation to an Industry Development Plan. In the early stages of this industry, it would be highly advantageous to establish regulatory standards which do not impede innovation and development of small-scale, exploratory, projects. It would be valuable to share the insights from this study into the sensitivities and concerns of industrial leaders in relation to hydrogen, so that all members of the Victorian community can work on the most significant challenges as this industry develops.