LEGISLATIVE ASSEMBLY
FOR THE AUSTRALIAN CAPITAL TERRITORY

STANDING COMMITTEE ON ENVIRONMENT, CLIMATE CHANGE AND BIODIVERSITY
Dr Marisa Paterson MLA (Chair), Mr Andrew Braddock MLA (Deputy Chair),
Mr Ed Cocks MLA

Submission Cover Sheet

Inquiry into Climate Change and Greenhouse Gas Reduction (Natural Gas Transition) Amendment Bill 2022

Submission Number: 7

Date Authorised for Publication: 6 September 2022

Submission

Inquiry into Climate Change and Greenhouse Gas Reduction (Natural Gas Transition) Amendment Bill 2022

Robert Edwards
Director
H2Networks and Canberra Solar Hot Water Repairs and Installations
[redacted]

30 August 2022

Contents

1. Executive Summary & Recommendations

The Climate Change and Greenhouse Gas Reduction (Natural Gas Transition) Amendment Bill 2022 (the proposed bill) will result in the unsustainability of the gas networks in the ACT. A transition away from gas to electrification only, will have long-lasting environmental impacts and will be very expensive for all ACT residents, publicly and privately.

At best, the proposed bill will leave whole suburbs in the ACT without the ability to ever connect to a national green hydrogen network when it eventuates, as it is expected to do. The most likely, and worst case scenario is that the proposed bill will ensure that no Canberrans will have access to cheap green hydrogen without going through another major transition.

Nationally, numerous sectors of the gas industry are currently working on making the transition to a national green hydrogen network. The aim is to make the transition seamless for, and at the lowest cost to consumers, and to complete the transition by state and federal government target dates. This includes low cost renewable hydrogen and transitional appliances, cheaper renewable energy storage, utilising existing consumer piping systems, and network distribution and transmission infrastructure where possible.

Recommendations

1. Undertake rigorous further consultation:

   Due to the lasting impacts of the proposed Bill, H2 Networks recommends that before committing to the transition, considerable consultation is taken with numerous interstate gas network operators, Australian appliance manufacturers, Future Fuels CRC, the Gas Technical Regulators Committee (GTRC), the CSIRO Hydrogen Mission, Standards Australia's WG 093, gas producers, gasfitters and other hydrogen transition subject matter experts. ACT law makers would then **have a** better understanding of the benefits of and the pace of change towards a green hydrogen future.

2. Remove the Amendment Bill 2022

   The ACT government's reasoning for the proposed bill has significant flaws, factual errors and omissions. Therefore, The Climate Change and Greenhouse Gas Reduction (Natural Gas Transition) Amendment Bill 2022 (The proposed bill) should not be passed through the ACT legislative assembly.

2. Background – H2 Networks Expertise

Robert Edwards Expertise:

Member of Standards Australia Working Groups

- ME 093 06 Fuel cells – safety and performance
- ME 093 08 End use – combustion, safety and performance
- ME 093 00 01 - Review British PAS 4444 (hydrogen combustion appliance design and performance) for Australian adoption.
- Review of international IEC and ISO standards for Australian adoption- hydrogen safety – hydrogen applications and performance

Member of TAC - UEG Electrotechnology Hydrogen VET Technologies Training Package

- Upstream of the gas meter – safety, storage, electrolysis, distribution, transmission blending, pipeline construction and maintenance.

Member of TAC - CPC Case for Change VET Hydrogen Training.

- Downstream of the gas meter hydrogen work – safety, storage, piping systems, combustion, electrolysis, fuel cells and appliance installation.

Chair

- Master Plumbers Australia and New Zealand Hydrogen Skills Committee

Subject Matter Expert Energy Skills Queensland

- Hydrogen - Gas fitting – Training - Safety

Qualifications / licences and training

- Electrical - REL licence
- Plumbing
- Gas fitting
- Hydrogenics / Cummins - Water Electrolysis, Storage, HRS….

Director

- H2 Networks
- Canberra Solar Hot Water Repairs and Installations
- 6 Star Hot Water and Plumbing

3. Background – Evidence against 100% electrification

a) Regulatory timing should not be the driver

The only reason the bill is being put to the ACT Legislative Assembly now, without a thorough investigation of known alternatives, is so that the timing of the transition aligns with regulatory determination cycles that also align with the government's 'zero emissions by 2045' target date.

Industry is aware that the bill is being put to the ACT Legislative Assembly now, so that the timing and financing of the transition aligns with regulatory determination cycles that also align with the government's 'zero emissions by 2045' target date*.

The proposed bill will result in the unsustainability of the gas networks in the ACT. Given the environmental and economic impacts, the bill should not be rushed just to fit in with the 5 year regulatory cycles that happen to coincide with the zero emissions by 2045 target.

**Utilities are subject to economic and technical regulation. The Australian Energy Regulator is responsible for economic regulation everywhere except WA. These economic regulatory cycles apply for electricity distribution and transmission, and gas distribution and transmission.*

These economic regulatory cycles last 5 years.

- *The EN24 regulatory cycle for Evoenergy's electricity distribution network will run from 1 July 2024 to 30 June 2029.*
- *The GN26 regulatory cycle for Evoenergy's gas distribution network will run from 1 July 2026 to 30 June 2031.*
- *The ACT's Independent Competition and Regulatory Commission (ICRC) establishes a price direction for small residential customers only. The terms of the ICRC electricity price investigation require the retail electricity price direction to apply over a four-year period, ending 30 June 2024.*

b) Incorrect statements in the Economic and Technical Modelling of the ACT Electricity Network Base case Report (EPSDD 26 April 2022)

The "Economic and Technical Modelling of the ACT Electricity Network Base case Report (EPSDD 26 April 2022)" makes several incorrect statements:

> *"… Large scale hydrogen transition would require significant costs to convert gas connected properties to hydrogen only."*

The report is also incorrect in stating:

> *"… the introduction of hydrogen into gas networks to a significant extent (that is hydrogen blending at greater than 20 per cent) is limited by technological, network and cost barriers, coupled with the availability and commercial development of appropriate appliances."*

ACT residents and ACT Legislative Assembly members are not aware of the many technological advances that have been and are being made to help transition the ACT's and Australia's existing gas networks, public and private buildings, and homes to zero emissions gas by 2045 and 2050.

Future Fuels CRC is already working to assess internal coatings for existing high pressure transmission pipelines. Utilities have been relining large and small diameter drainage pipes for decades. Therefore, a solution for the gas networks will not be a major leap. https://www.futurefuelscrc.com/project/retrofitting-pipelines-by-in-situ-coating-rp3-4-01/

The ACT's existing gas network is one of the newer and more hydrogen-compatible networks in Australia. Of the 4,000kms, 300kms of the network is steel. According to Evoenergy, only 30kms of steel pipeline between Hoskins Town and Fishwick may not be compatible with pure hydrogen. The ACT's High Density Polyethylene (HDPE) pipe, PVC, Polyamide (Nylon) and low strength steel pipes are compatible with hydrogen. The "Economic and Technical Modelling of the ACT Electricity Network Base case Report (EPSDD 26 April 2022)" is also incorrect to state:

> *"However, transitioning to hydrogen would incur much higher costs. Besides replacing natural gas appliances with hydrogen compatible appliances, other costs that are likely to be incurred include … new gas line from meter to house (estimated to cost between $1,000 to $3,000)."*

The above statement is incorrect because, consumer inlet services in the ACT are nylon, (some with copper risers) and both materials are compatible with hydrogen at their normal operating pressures, stresses, and temperatures. Therefore, new inlet services will not be required.

The Economic and Technical Modelling of the ACT Electricity Network Base case Report (EPSDD 26 April 2022) is incorrect to state:

> *"However, transitioning to hydrogen would incur much higher costs. Besides replacing natural gas appliances with hydrogen compatible appliances, other costs that are likely to be incurred include … potentially new gas lines through the house (which would cost a further $5,000 to $10,000)."*

The above statement is incorrect because, downstream of the meter, consumer piping systems between meter sets and appliances operate at very low pressures and moderate temperatures. In Australia, typical installations will use copper and composite plastics. Some galvanised steel consumer piping systems will remain in operation. Under normal operating conditions, copper, composite plastic and galvanised steel pipes are compatible with hydrogen in consumer piping systems*.

**Hydrogen transportation pipelines IGC Doc 121/04?E*
http://www.hyresponse.eu/files/Lectures/Hydrogen_fires_notes.pdf
Basic Considerations for the safety of hydrogen ISO TR1 15916:2015
https://h2tools.org/bestpractices/hydrogen-compared-other-fuels

The Economic and Technical Modelling of the ACT Electricity Network Base case Report (EPSDD 26 April 2022) is incorrect to state:

> *"… the introduction of hydrogen into gas networks to a significant extent (that is hydrogen blending at greater than 20 per cent) is limited by technological, network and cost barriers, coupled with the availability and commercial development of appropriate appliances."*

The above statement is wrong because, Australian Standards Working Group ME 093 00 01 along with Australian appliance designers and manufacturers and gas industry experts are working on the Australian version of the British PAS 4444 (hydrogen combustion appliance design and performance). This Australian version will be finished towards the end of 2022 and will allow Australian gas appliance manufacturers and suppliers to roll out next gen gas appliances within a few short years. The appliances should allow for a transition from very low hydrogen blends to 100% hydrogen in the gas networks.

In May this year I made the following enquiry with an internationally respected cooperative research organisation. "Can you please tell me if any work has been done to determine how many times consumers will be required to replace their type a) gas combustion appliances as we transition to transition to 100% hydrogen?" The response I received was:

> *"A consumer might expect to change or adapt their appliance once. From initial stage appliance testing in Australia and those of other nations, existing appliances should operate correctly with low-level blends of hydrogen. A 100% hydrogen system would in many cases require a new appliance, although some appliances may be adaptable. There is still more research to do on this topic, both in Australia and globally, but that's a very quick overview of global research to date.*
>
> *We understand some appliance manufacturers are looking at developing 'hydrogen-ready' appliances that could be installed to run on natural gas, but could be quickly and cost effectively converted when 100% hydrogen is available. This would mean consumer would never need to change their appliance, just have a technician convert it when 100% hydrogen is available."*

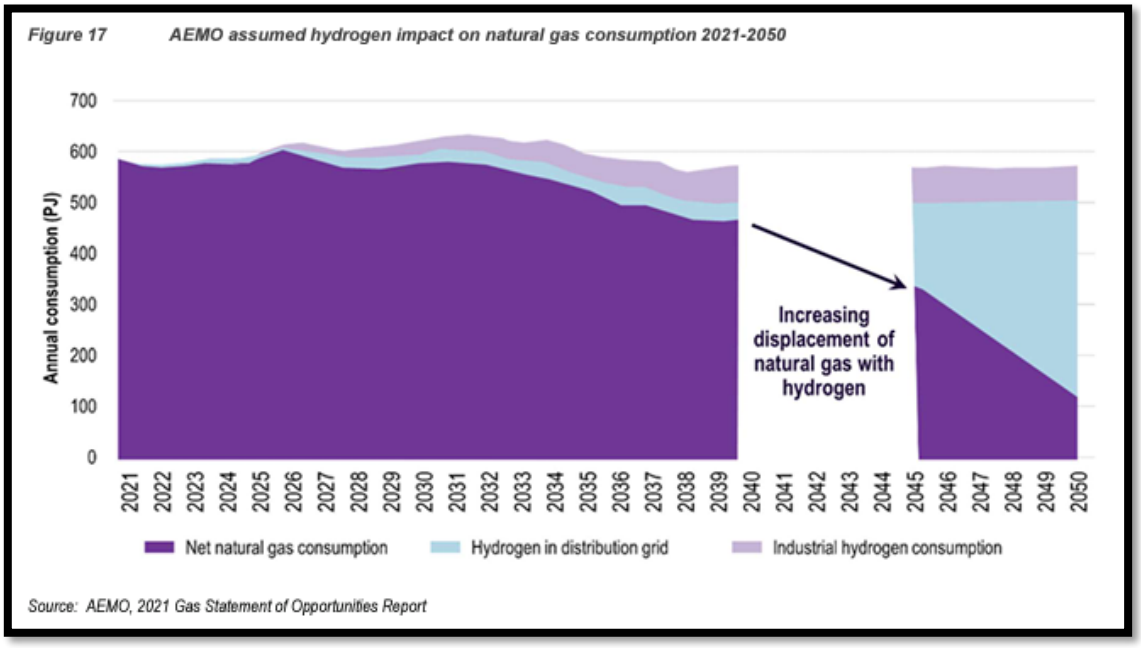
Solid Oxide Fuel cells (SOFC) are also a proven technology for domestic and commercial gas to power applications and hot water. More than 100,000 Panasonic Ene-Farm units have been installed across Japan over the last decade. SOFCs are not effected by variations in hydrogen and natural gas blends and when used for heat and power they are up to 85% efficient. https://news.panasonic.com/global/topics/4444

The Economic and Technical Modelling of the ACT Electricity Network Base case Report (EPSDD 26 April 2022) is correct to state:

> *"Given the Evoenergy network is integrated into the broader east coast system, the potential for green gas penetration into the ACT is likely to follow the broader regional trend."*

The report is also right to say:

> *"Hydrogen is gaining momentum as a pathway to lower emissions. For example, in the 'Hydrogen' scenario in its 2021 Gas Statement of Opportunities, AEMO projects that hydrogen could replace up to 20 per cent of the domestic natural-gas demand by 2040, with more significant contributions possible after 2040 as illustrated at Figure 17".*



c) ACT government modelling uses inaccurate information

The ACT government's modelling uses inaccurate information to argue against green gas as an option, but the modelling does not clearly explain the high personal expenses to homeowners and building owners to convert away from gas to an all-electric building such as:

- Disconnection and removal of gas appliances - which would cost a further $300 - $1,000 for a single residential building.
- Many older buildings will require new inlet services from the power pole or green box to the electricity meter - which would cost a further $3,000 to $20,000 for a single residential building.

- Some detached dwellings and townhouses will require new meter board upgrades and new internal cabling - which would cost a further $1,000 to $10,000.
- Commercial and apartment buildings, currently connected to gas will require extensive upgrades to electrical inlet services, meter boards, internal wiring, central hot water systems and plant rooms - which would cost many tens of $000s – and many hundreds of $000s for each building.
- Behind the meter battery electric storage systems – which add a further $13,000. - $26,000 for a single residential building.
- EV charging stations in single residential buildings – which will add a further $1000 - $1500 per vehicle.
- EV charging per residence in multi residential buildings – which will add a minimum $1000.00, and the upper price will be many multiples of that.
- The capital costs of heat pump hot water systems and solar hot water systems are 100% - 300% higher than the capital costs of gas and electric storage hot water systems - which would add a further $2,000 - $7,000 for single residential buildings.*
- Compared to gas and electric resistant hot water systems, servicing and repairs of solar hot water systems and heat pump hot water systems is 100% - 300% more expensive over their lifetime.

**In general, in Canberra, storage electric resistant and gas storage hot water systems will last 50% -25% longer than continuous flow electric hot water systems. heat pump hot water systems and split system solar hot water systems.*

d) ACT government modelling does not present comparative modelling

With little modification, the ACT's gas network has the capacity to store 32 hours of H_2. The governments modelling does not appear to compare CAPEX and OPEX of transitioning the ACT's existing gas networks to green hydrogen with the CAPEX and OPEX of Battery Electric Storage Systems (BESS) with the same storage capacity over a 10, 25 and 40 year period.

e) ACT Government pathway overlooks AEMO specifications for a portfolio of storage

The electrification pathway discounts the importance of having a portfolio of energy storage to maintain secure and reliable energy supply. The proposed bill overlooks that storage of H_2 in existing gas pipelines meets the Shallow, Medium and Deep storage requirements specified by the Australian Energy Market Operator (AEMO) to ensure a stable and secure energy supply.

According to the AEMO, "A portfolio of storage will be needed to support accelerated transition to a National Energy Market (NEM) dominated by Variable Renewable Energy (VRE). Different types and depths of storage play very different roles in the system."

These are:

Coordinated Distributed Energy Resources (DER) storage – includes behind-the-meter battery installations that are enabled and coordinated via Virtual Power Plant (VPP) arrangements. This category also includes Electric Vehicles (EV) with Vehicle to Grid (V2G) capabilities.

Distributed storage – includes non-aggregated behind-the-meter battery installations designed to support the customer's own load.

Shallow storage – includes grid-connected energy storage with durations less than four hours. The value of this category of storage is more for capacity, fast ramping and Frequency Controlled Ancillary Services (FCAS) (not included in Australian Energy Market Operator's (AEMO's) modelling) than for its energy value.

Medium storage – includes energy storage with durations between four and 12 hours (inclusive). The value of this category of storage is in its intra-day energy shifting capabilities, driven by the daily shape of energy consumption by consumers, and the diurnal solar generation pattern.

Deep storage – includes energy storage with durations greater than 12 hours. The value of this category of storage is in covering VRE "droughts" (long periods of lower-than-expected VRE availability) and seasonal smoothing of energy over weeks or months.

AEMO Appendix 4. System operability December 2021 - 2.5 Storage to firm renewables

Australia's existing natural-gas pipeline infrastructure stores and transports an amount of energy equivalent to 5.4 billion Tesla Powerwall 2 batteries* (73 terawatt-hours*).* Following incremental enhancements, this infrastructure can be used to store and transport hydrogen, either mixed with natural gas or in some cases completely replacing it.

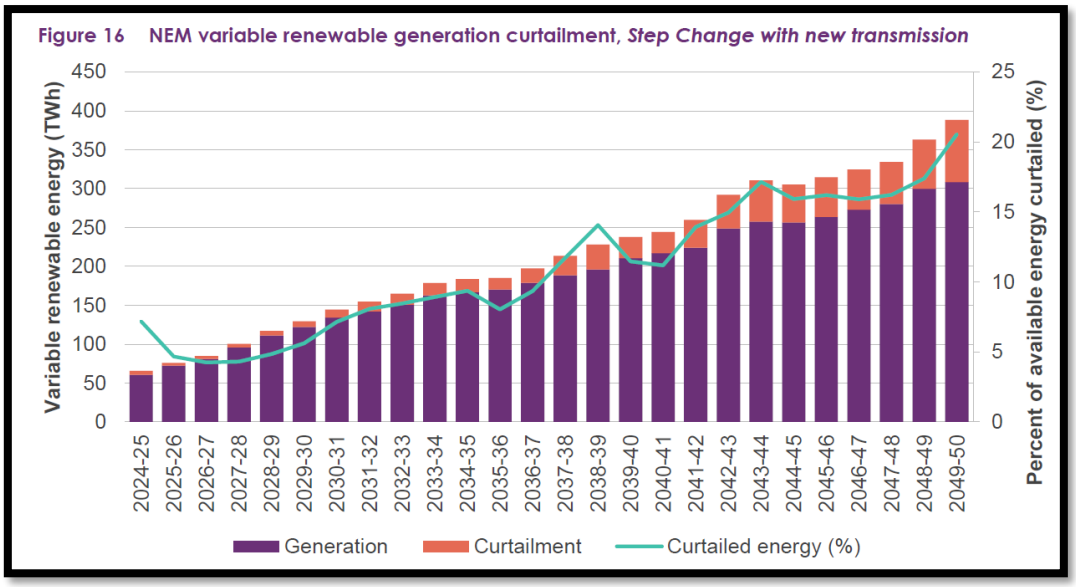
https://www.chiefscientist.gov.au/sites/default/files/HydrogenCOAGWhitePaper_WEB.pdf

**(NG to H_2 energy conversion equivalent is 1.8 billion tesla power wall batteries).*

f) ACT government pathway overlooks AEMO forecasts for renewable energy curtailment

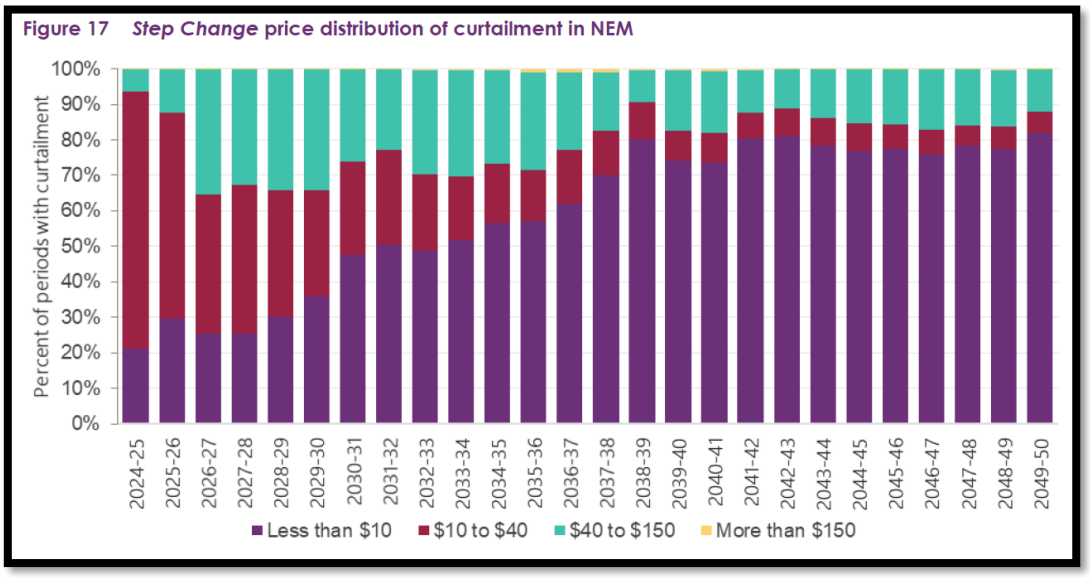
The Economic and Technical Modelling of the ACT Electricity Network Base case Report (EPSDD 26 April 2022) does not mention the amount of renewable electricity that will be curtailed if we do not adopt a portfolio of energy storage systems.

AEMO modelling shows that the economic development of VRE, storages and transmission may lead to periods where VRE does not generate at its full available capacity. It is sometimes more efficient to curtail or 'waste' some generation. This is due to system security or other operability constraints in the network, or to there simply being over-abundant renewable energy available with insufficient load or energy storage to consume the surplus. Figure 16 shows the trajectory of energy curtailed in the *Step Change* scenario



Prices during curtailment

Figure 17 show the distribution of curtailment across wholesale price bands due to transmission limitations and the inability to deliver local generation to the customer. This is a proxy of lost value as well an indication of the opportunity cost of developing additional transmission and storage capacity to soak up this excess. Most of the excess is projected to occur during periods of relatively low wholesale prices. By the end of the horizon the distribution narrows and over 80% of the total will occur at prices below $10/MWh.



The efficiency, responsiveness and flexibility of PEM Water Electrolysis is suited to capturing Renewable Generation Curtailment.

g) The proposed Bill does not address significant environmental impacts of full electrification

Green hydrogen storage in existing gas networks will have very little impact on the environment. The proposed bill does not appear to properly address scope 1,2 and 3 emissions, waste and other environmental impacts resulting from electrification such as:

- Mining for copper, lithium, cobalt and other metals.
- Use of precious water resources in arid regions to extract lithium carbonates from brine.
- E-waste due to the short life associated with behind the meter and grid scale Battery Electric Storage Systems (BESS).

Additionally, unlike BESS, the energy storage capacity of a gas network does not deteriorate over time. Gas network life is not adversely affected by charging and discharging cycles such as occurs with BESS.

The Economic and Technical Modelling of the ACT Electricity Network Base case Report (EPSDD 26 April 2022) is wrong to say:

> *"The time when consumers are likely to convert is when the appliance reaches the end of its useful life (often when warranties expire)."*

The above statement is incorrect because, as an installer of hot water heat pumps and solar hot water systems we can provide ample evidence that the proposed bill is already encouraging Canberrans to generate unnecessary waste by removing their existing, perfectly good, modern and efficient gas hot water systems. The gas hot water systems are being replaced with heat pump hot water systems and solar hot water systems . This is occurring long before the existing gas hot water system reaches its used by date and well after the warranty period has expired.

4. Conclusion

The ACT Government should be commended for setting the zero emissions target for the ACT by 2045. The path we take will have long lasting environmental impacts and the electrification only pathway will be very expensive for all ACT residents, publicly and privately.

At best, the proposed bill will leave whole suburbs in the ACT without the ability to ever connect to a national green hydrogen network when it eventuates as it is expected to do. The most likely, and worst-case scenario is that the proposed bill will ensure that no Canberrans will have access to cheap green hydrogen without going through another major and expensive transition.

A better outcome could be achieved through working with the numerous interstate gas network operators, Australian appliance manufacturers, Future Fuels CRC, the Gas Technical

Regulators Committee (GTRC), the CSIRO Hydrogen Mission, Standards Australia's WG 093, gas producers, gasfitters and other hydrogen transition subject matter experts.

There is overwhelming evidence that green hydrogen distributed in our gas networks will play a large role alongside electrification in reducing greenhouse gas emissions. The door must be left open for all Canberrans to benefit from the positives of both electrification and a national green hydrogen network.

The Economic and Technical Modelling of the ACT Electricity Network Base case Report (EPSDD 26 April 2022) is largely supportive of hydrogen as a viable and very cost effective means to reach zero emissions. However, flaws, errors and omissions exist in its modelling, and the ACT government's reasons, to justify the outcome of an electrification only pathway, if the proposed bill passes the ACT legislative Assembly.

Given the amount of work currently underway to transition Australia's gas networks to zero emissions, with the lowest impacts on the environment and consumers, the ACT legislative Assembly should not pass the Climate Change and Greenhouse Gas Reduction (Natural Gas Transition) Amendment Bill 2022.

Robert Edwards

If committee members have questions regarding comments made in this submission or would like to know more about other hydrogen related issues such as safety, combustion and round trip efficiencies, please feel free to contact me.

H2 Networks
[redacted]
www.h2networks.com.au
A clean hydrogen future