

A.C.T. LAW ft. HYDROGEN

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DRIVE. **CLEVER.** H. POWER. SAFETY.
MARKETS. UPSKILL. ENERGY. **LOCAL.** FUTURE.
RENEWABLE. NATIONAL.
PIPES. H²O. COOK.

A REVIEW OF GAS LAWS AND LEGAL
FRAMEWORKS FOR CANBERRA'S UPTAKE
OF HYDROGEN ENERGY, PREPARED FOR
THE A.C.T. GOVERNMENT

December 2020

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A Executive summary

The ACT is well placed to become a leader in the introduction of hydrogen. The ACT is in a strategic position where planning and development laws can be amended at the Territory level to allow the gradual introduction of hydrogen, starting with hydrogen refuelling stations for hydrogen fuel cell electric vehicles and small levels of hydrogen in the existing gas network. The production of hydrogen can then be scaled to enable the introduction of hydrogen into the natural gas mix. This ability to gradually introduce hydrogen and then to scale the operations as the technologies become more advanced provides attractive opportunities for private investors in the ACT. In particular, owners of existing service stations and liquid fuel depots (commonly, “petrol stations”) should consider themselves well-placed, and should be supported by legible regulation.

1 Understanding ACT’s hydrogen adoption goals

No hydrogen strategy exists for the ACT. Inspiration from reports published by the ACT government on the topic of a zero-emissions future guided us to focus on vehicular uses first, then grid related uses.¹

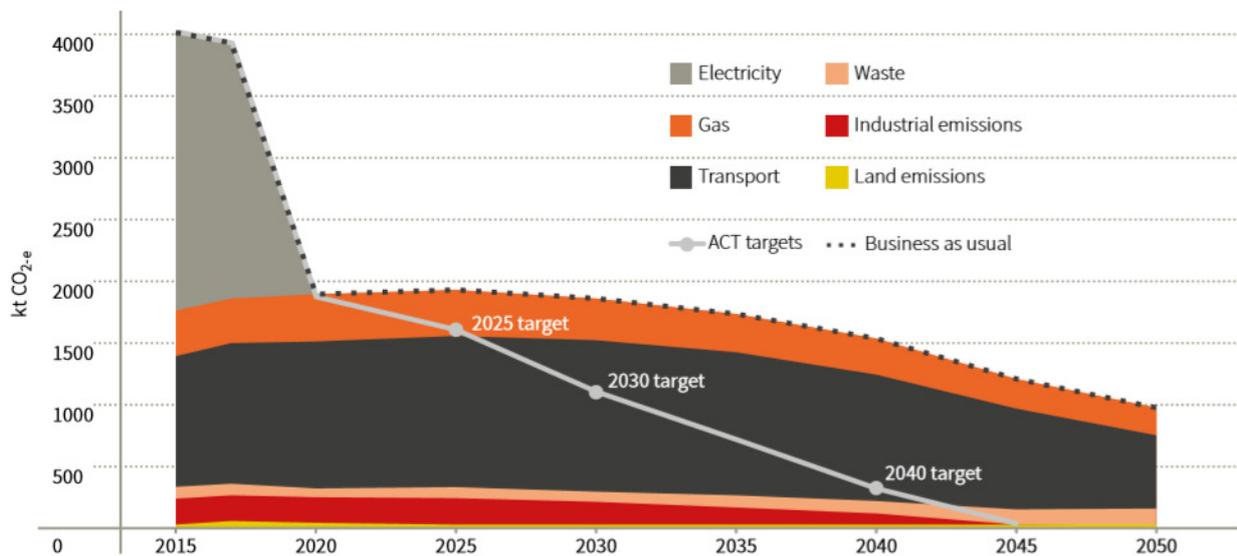


Figure 1 - ACT Greenhouse gas emissions modelling 2018. This graph shows the level of emissions from each source without government intervention.²

A hydrogen pilot project, comprising of a combined electrolyser and filling station, is currently underway in Fyshwick, with associated procurement of hydrogen powered vehicles. The station houses a 60 kilowatt hydrogen electrolyser facility and refuelling infrastructure. This pilot project is one of the first of its kind in Australia, placing the ACT at the forefront of hydrogen development in this country. Initially,

¹ In April 2018 the ACT Government released the Zero Emissions Vehicles Action Plan 2018–21. The intention of the Action Plan is to accelerate the transition to battery electric and fuel cell vehicles, including shifting to zero emissions alternatives for newly leased government passenger vehicles from 2020-21. The Action Plan is available via <https://www.environment.act.gov.au/__data/assets/pdf_file/0012/1188498/2018-21-ACTs-transition-to-zero-emissions-vehicles-Action-Plan-ACCESS.pdf>.

² Extracted from *ACT Climate Change Strategy 2019 -2025* (“The Strategy”), which explores the potential role of hydrogen in meeting future stationary energy and transport energy needs. The Strategy is available via <https://www.environment.act.gov.au/__data/assets/pdf_file/0003/1414641/ACT-Climate-Change-Strategy-2019-2025.pdf/_recache>.

the hydrogen produced by this facility will power a government fleet of 20 Hyundai fuel cell electric vehicles.

Our recommendations in this report target the largest sources of greenhouse gas (“GHG”) emissions: transport and natural gas. We understand that the ACT government wishes to target vehicular use and grid use, which means that hydrogen refuelling stations and hydrogen standards will need to be developed, alongside safety protocols to not only provide necessary physical protections but also to mitigate concerns and counteract misconceptions that the public may have about hydrogen gas.

2 Main barriers to hydrogen gas uptake

The major barriers to achieving the ACT’s hydrogen adoption goals, in no particular order, are/will be:

- a lack of knowledge, unknowns in the technology that require scientific and technical clarification, and community misunderstandings;
- the infancy of jurisdictional collaboration towards amending the relevant legal frameworks and changing public opinions;
- the time it takes to upskill labour,
- network capabilities, and the ability of the public to trust those capabilities; and
- interests of the incumbent natural gas producers and pipeline owners.

3 Summary of recommended legislative priorities

The ACT has legislative power to make changes having effect within its jurisdictional area, if it wishes to exercise such power. The ACT can pursue policies to encourage a hydrogen-enabled community, and legislate to that end, within its geographical and sovereign boundaries.

Our overarching conclusion is that the current legal frameworks are a good basis for hydrogen. Some amendments are required to accommodate these developments, and they are not without some complication, especially in the absence of collaborative change under the national energy laws. An entirely new regulatory framework is not required. Most issues can be addressed by definitional change within existing frameworks, especially through the adoption of existing or new standards.

In proposing legislative priorities for the ACT, we have adopted a future-minded yet practical approach. We have ranked the changes that the ACT may like to consider in terms of the ACT’s ability to introduce the changes, and the effectiveness those changes would have in creating and encouraging further change. We convey our impressions about the priority of the changes in terms of ability. Thus, a ranking of “soon” conveys that the change is practical and reasonable at the present time and that the ACT has a unilateral ability to effect the legal change referred to. A ranking of “medium term” indicates that the change involves a need for collaboration with external jurisdictions or other delay factors, for example, technical or scientific matters. The ranking “long term” recognises that some change will not be quick in coming and that the legislative changes required will need to await policy developments beyond the individual control of the ACT before they are crystallised.

This report recommends the following legislative change in order to facilitate and regulate the uptake of hydrogen gas in the ACT.

a Land use, production and refuelling

Gap/barrier/topic	Recommendation	Reference	Current wording	Action by	Rating
Service stations cannot produce hydrogen gas for refuelling purposes	<p>Recommendation 1</p> <p>Broaden “service station” uses to allow hydrogen production on site, and clearly allow hydrogen storage and sale. For example, add the words “production, storage and sale of hydrogen gas for refuelling purposes”. Also consider flow-on changes to development codes. Move “service station” as redefined out of the prohibited development list in TSZ2.</p>	Territory Plan – Section 13 (Definitions)	<p>Service station means the use of land for the fuelling and/or servicing of motor vehicles, whether or not the land is also used for any one or more of the following purposes: a) the sale by retail of spare parts and accessories for motor vehicles; b) washing and greasing of motor vehicles; c) installation of accessories; d) the retail sale of other goods, within an ancillary retail area not greater than 150m² in area; e) providing toilet facilities, amenities and service for motorists; f) repairing of motor vehicles (other than body building, panel beating or spray painting); and g) the hiring of trailers.</p>	Planning and Land Authority within EPSDD	Soon

Gap/barrier/topic	Recommendation	Reference	Current wording	Action by	Rating
Liquid fuel depots cannot produce, store or sell hydrogen gas for refuelling purposes	<p>Recommendation 2</p> <p>Broaden “liquid fuel depot” uses to allow hydrogen production on site, and hydrogen storage and sale. For example, re-name the land use as “fuel depot”, and add references to “hydrogen gas” (including the production of same). This would involve special drafting so as to not withdraw the existing definition from those that currently comply. Consider clarification of “municipal depot” for same purpose, and flow-on changes to development codes stemming from each of the changes. Move “liquid fuel depot” as redefined out of the prohibited development list in TSZ2.</p>	<p><i>Territory Plan - Section 13 (Definitions)</i></p>	<p>Liquid fuel depot means the use of land for the bulk storage or wholesale distribution of petrol, oil, petroleum products or other inflammable liquids or the retail distribution of drums containing petrol, oil, petroleum products or other inflammable liquids.</p> <p>Municipal depot means the use of land for the storage of any plant, machinery, vehicles, light rail vehicles or materials used in the course of a municipal undertaking, whether or not facilities are included for the parking, servicing and repair of plant, machinery or vehicles.</p>	<p>Planning and Land Authority within EPSDD</p>	<p>Soon</p>
Hydrogen refuelling points not exempted from development approval	<p>Recommendation 3</p> <p>Extend exemption afforded to electric vehicle charging points to hydrogen refuelling points. For example, add the words “or a hydrogen fuel cell vehicle refuelling point”.</p>	<p><i>Planning and Development Regulation 2008 - Schedule 1 (exemptions from requirement for development approval)</i></p>	<p><i>Electric vehicle charging points (1) a designated development for an electric vehicle charging point on a block</i></p>	<p>Planning and Land Authority within EPSDD Transport Canberra</p>	<p>Soon</p>

Gap/barrier/topic	Recommendation	Reference	Current wording	Action by	Rating
Zoning to enable injection of hydrogen gas into the gas reticulation network	Recommendation 4 Review the Territory Plan and consider “ <i>power generation station</i> ” as a land use where hydrogen electrolyzers can be located for grid injection.	<i>Territory Plan</i>	Compare locations of secondary distribution network nodes with land uses presently allowed under the Territory Plan. Include “ <i>power generation station</i> ” as re-defined according to Recommendation 5.	Planning and Land Authority within EPSDD Environment Protection Authority	Soon
Power generation stations cannot generate hydrogen gas	Recommendation 5 Broaden definition of “ <i>power generation station</i> ” to include the generation of hydrogen gas. For example, replace “ <i>electricity</i> ” with “ <i>electricity and/or hydrogen gas</i> ” and delete the word “ <i>fuel</i> ” for clarity.	<i>Territory Plan - Section 13 (Definitions)</i>	<i>Power generation station means equipment and associated buildings constructed for the generation of electricity utilising gas, coal, renewable energy technology or other fuel sources.</i>	Planning and Land Authority within EPSDD Environment Protection Authority	Soon

b Conveyance, production/injection, use (in heating/appliances and for transport)

Gap/barrier/topic	Recommendation	Reference	Current wording	Action by	Rating
Headline gas definition in National Gas Law (SA legislation) does not acknowledge and include hydrogen gas	<p>Recommendation 6</p> <p>Collaborative change to the National Gas Law, to allow hydrogen gas to enter and be conveyed by pipelines. This could be done by amending the definition of natural gas to admit of the presence of an allowable percentage of hydrogen. This expanded definition of “<i>natural gas</i>” to include hydrogen would then become a law of the ACT as applied by the <i>National Gas (ACT) Act 2008</i>. In so far as changes to regulations under the National Gas Law and to the National Energy Retail Law were to be required, they would also carry over to the ACT.</p>	<p><i>National Gas (South Australia) Act 2008</i></p>	<p>natural gas means a substance that -</p> <p>(a) is in a gaseous state at standard temperature and pressure; and</p> <p>(b) consists of naturally occurring hydrocarbons, or a naturally occurring mixture of hydrocarbons and non-hydrocarbons, the principal constituent of which is methane; and</p> <p>(c) is suitable for consumption;</p>	<p>EPSDD Commonwealth Hydrogen Taskforce</p>	<p>Long term</p>
Complexity and delay in negotiating and agreeing changes to the National Gas Law (SA legislation) amongst the States that are party to it and the ACT.	<p>Recommendation 7</p> <p>Widen scope of the ACT utilities legislation to allow a utility to be regulated in the ACT in relation to entry of hydrogen gas into the ACT’s distribution network and its conveyance by the network. This would allow the licensing of a utility to provide the gas (as more broadly defined) in the ACT under the <i>Utilities Act 2000</i>.</p>	<p><i>Utilities Act 2000</i> Section 8 (Gas – terminology)</p>	<p>(1) In this Act: gas means natural gas.</p> <p>(2) A term used in any of the following has the same meaning in this Act:</p> <p>(a) <i>National Gas (ACT) Act 2008</i>;</p> <p>(b) <i>National Gas (ACT) Law</i>;</p> <p>(c) <i>National Gas (ACT) Regulation</i>.</p> <p>(3) In this section: natural gas - see the <i>National Gas (ACT) Law</i>, section 2.</p>	<p>Minister for Water, Energy and Emissions Reduction within EPSDD ICRC Evoenergy</p>	<p>Soon</p>

Gap/barrier/topic	Recommendation	Reference	Current wording	Action by	Rating
Scope of ACT gas safety legislation is broader than overarching national gas law but does not include any proportion of hydrogen gas.	Recommendation 8 Broaden the definition of gas in the <i>Gas Safety Act 2000</i> and the <i>Dangerous Substances Act 2004</i> .	<i>Gas Safety Act 2000</i> <i>Dangerous Substances Act 2004</i>	<i>Gas Safety Act 2000</i> <i>gas means -</i> <i>(a) natural gas; or</i> <i>(b) a gas (LPG) in its vapour phase composed predominantly of 1 or more of the following hydrocarbons:</i> ... <i>natural gas - see the National Gas (ACT) Law, section 2</i> <i>Dangerous Substances Act 2004</i> <i>This Act does not apply to...:</i> <i>(a) the transmission, distribution and use of natural gas to which the Gas Safety Act 2000 or Utilities Act 2000 applies;</i> <i>(b) the transmission, distribution and use of LPG to which the Gas Safety Act 2000 applies.</i>	Utilities Technical Regulator WorkSafe ACT	Soon
Standard for “general purpose natural gas” used in appliances, equipment and vehicles allows up to 10% hydrogen in the gas stream, but not more.	Recommendation 9 Encourage development of standards so that 100% hydrogen is included as “general purpose natural gas” or has its own standard, and for hydrogen-specific odorant within Australian gas distribution systems, and then formulate the regulations to accommodate them.	<i>AS/NZS 4564 (Specification for general purpose natural gas)</i> 1.6.13 Wobbe Index	According to technical experts, <i>Table 3.1 – Specification limits</i> in <i>AS/NZS 4564</i> allows up to 10% hydrogen gas within the “general purpose natural gas” defined therein, but not more. Technical expertise would be required to revise the wording of <i>AS/NZS 4564</i> suitably.	Standards Australia - Committee AG-010 Evoenergy	Medium

Gap/barrier/topic	Recommendation	Reference	Current wording	Action by	Rating
<p>Standard for “gas distribution networks” may not address hydrogen specific risks above 10% hydrogen in the gas stream. Current gas service and installation rules will not be consistent with updated standards for network management, steel pipe systems and plastics pipe systems.</p>	<p>Recommendation 10 Review network management, steel pipe systems and plastics pipe systems standards, in particular locations of meters and odorant levels, consistently with changes to standard for “general purpose natural gas” and/or new hydrogen standards. Update <i>GS&I Rules</i> in accordance with changes in <i>AS/NZS 4645</i>.</p>	<p><i>AS/NZS 4645 (Gas distribution networks)</i> <i>GS&I Rules</i> – 3.3.3 (prohibited meter set locations) issued under the <i>GS&I Rules Code</i> created under the <i>Utilities Act (ACT) 2000</i>.</p>	<p>Technical expertise would be required to consider any revisions to the wording of <i>AS/NZS 4645</i> that may be needed. <i>In accordance to AS/NZS 4645.1 but subject to additional requirements of Section 3.4 of these GS&I Rules, meter sets/ regulator sets must not be installed in the following locations:</i> [list of locations omitted]</p>	<p>Standards Australia, Committee AG-008 Evoenergy</p>	<p>Medium</p>
<p>Standards relating to hydrogen usage in the broad sense need to be reviewed, such that uptake of hydrogen gas is safely regulated and changes can then flow through to relevant ACT legislation</p>	<p>Recommendation 11 Encourage national review of standards/codes to acknowledge effects of hydrogen blending when fitting gas appliances, and unique considerations of pure hydrogen gas appliances during gas fitting.</p>	<p><i>AS/NZS 1375 (Industrial fuel-fired appliances); AS/NZS 3814 (industrial and commercial gas-fired appliances); and AS/NZS 5601 (gas installations).</i></p>	<p>The standards are listed in the <i>Gas Safety Act 2000 (ACT)</i>, Section 6H(2). Technical expertise would be required to consider any revisions to the wording of these standards. <i>AS/NZS 5601</i> is used by gas appliance workers to install gas appliances, however the gasses called up by <i>AS/NZS 5601</i> are natural gas, LPG and biogas.</p>	<p>Standards Australia Construction Occupations Registrar</p>	<p>Medium</p>

c Occupational licencing

Gap/barrier/topic	Recommendation	Reference	Current wording	Action by	Rating
The categories of gas fitting licence and gas appliance workers licence do not adequately relate to the skills required to work safely with hydrogen fuel cell vehicles and hydrogen gas appliances.	Recommendation 12 Amend legislation to update trades licensing for new hydrogen gas compatible appliances and hydrogen fuel cell vehicles, whether by introducing new skills requirement within existing categories, or originating new licence categories.	<i>Constructions Occupations (Licensing) Regulation 2004,</i> Part 1.7 and Part 1.7A	Part 1.7 categorises gasfitters (advanced, general and journeyman; automotive and forklifts both LPG and NGV). Part 1.7A lists categories of gas appliance workers (restricted and unrestricted type A and B appliances).	Construction Occupations Registrar	Soon (vehicles) Medium term (gas appliances)
Units of competency to award construction occupation license my not reflect the skills required to work with hydrogen gas.	Recommendation 13 Units of competency to award construction occupation license need to be updated to reflect the skills required to work with hydrogen gas.	<i>Construction Occupations (Licensing) Regulation 2004,</i> Section 13 and <i>Construction Occupations (Licensing) (Qualification) Declaration 2019</i>	<i>Gas Fitter</i> (various units of competency and methods of acquisition) <i>Gas appliance worker</i> (various units of competency and methods of acquisition)	Construction Occupations Registrar	Soon (vehicles) Medium (gas appliances)

B Introduction

1 The task

Moulis Legal is pleased to deliver this report, which has been prepared in collaboration with ITP Thermal and under the instructions of the ACT Government's Environment, Planning and Sustainable Development Directorate ("EPSDD").³

The purpose of this report is to make recommendations to the ACT Government for adjustments, attenuations and/or augmentations of existing regulatory frameworks, and of directly gas-related laws, as would be necessary to accommodate and facilitate the introduction of a hydrogen gas capability in the ACT. These changes need to be well-considered in a legal context, and well-informed in a technical and commercial context.

At the time the work was commissioned by EPSDD, the work involved was divided into two separate tasks, under two separate work orders. One was for a report to be provided that reviewed regulatory frameworks, of general application, to accommodate the uptake of hydrogen gas in the ACT. The other was a more specific task to review gas-related laws. These two areas are not easily divisible, and maintaining a distinction between them would not be conducive to an integrated approach towards legislative change. Also, in light of the teaming arrangements adopted by Moulis Legal (legal aspects) and ITP Thermal (technical aspects), the distinction has been unnecessary.

Therefore, the work undertaken in preparing this report spans the entire library of ACT law.

It is important to note that this report is not in the nature of detailed drafting instructions, such as might be provided by an ACT government agency to, say, the ACT Parliamentary Counsel's Office for the purposes of actually drafting legislative amendments. Rather, it takes the overarching and generalised observations regarding potentially relevant laws as set out in the COAG National Hydrogen Strategy,⁴ as they touch and concern the ACT, to the next level of policy and legal specificity for the ACT's purposes.

What this means is that the report serves as an alert to the government agencies concerned of the kinds of changes that could and should be contemplated, and that will need to be contemplated, with respect to the particular pieces of legislation we have identified as being relevant.

The precise scope of the two tasks that have been combined in this report are as follows:

³ The project has been undertaken by Moulis Legal (team members Daniel Moulis, Caroline Faeh, Joan Wu, Yunjin Lee and Rocky Lagudi) with valuable support with respect to technical matters provided by ITP Thermal (team members Keith Lovegrove, Gian Gentilini and Kalirajan Urkalan). We acknowledge the support and input of the ACT Government (team members Catherine Collins and Tracy Cui) in the preparation of this report.

⁴ COAG Energy Council. 2020. *Announcing Australia's National Hydrogen Strategy | Energy Council*. [online] Available at: <<http://www.coagenergycouncil.gov.au/news/announcing-australias-national-hydrogen-strategy#:~:text=The%20National%20Hydrogen%20Strategy%20aims,governments%2C%20industry%20and%20the%20community>>.

- **Review of ACT legal frameworks (EP2200498)**
 1. *Reviewing the ACT's legal frameworks to determine the applicability to support hydrogen safety, hydrogen supply chain development (production, transportation, storage, use), and impacts on consumers and the broader community, including:*
 - a. *Specifying the relevant sections in the ACT legal frameworks, not including the gas sector;*
 - b. *Identifying gaps in the existing ACT legal frameworks;*
 2. *Providing recommendations on amending existing legislation, or drafting new legislation, including:*
 - a. *Justifications/criteria on amending existing legislation or drafting new legislation in the ACT, with consideration of national legal reform developments;*
 - b. *The content of any proposed amendments and/or new legislation and which gaps it would address; and,*
 - c. *Identifying priority levels (urgent, medium, long-term) for implementing legal framework reform based on the ACT hydrogen industry development priorities.*

- **Review of ACT Gas Laws (EP2200511)**
 1. *A review of the ACT gas legal frameworks and identification of regulatory gaps and barriers in relation to:*
 - a. *Safety impact and technical aspects of hydrogen use in the gas distribution networks, as well as on downstream installations and consumer appliances*
 - b. *Reference to ACT laws governing trades licensing relevant to hydrogen applications*
 - c. *Wholesale and retail gas markets*
 2. *Recommendations on updates to the existing legislation, or on the development of a legal framework in the ACT, that would allow for regulation of production, transmission and distribution of hydrogen in the ACT gas networks, including:*
 - a. *The content of any proposed amendments and/or new legislation*
 - b. *Consideration of making ACT law consistent with the Commonwealth and other jurisdictions*
 3. *Recommendations on effective implementation of the legal framework and legislative amendments including, where feasible, identifying priority levels (short, medium, long-term) for implementation of gas legal framework reform*

In a separate but related piece of work for the ACT Government that has proceeded in parallel with this, ITP Thermal has investigated the market potential and frameworks for green gas (either hydrogen or biogas) trading.⁵

In delivering the requested report we have reviewed the ACT's legislation and legislative frameworks, the policies underpinning those laws and frameworks, and associated regulations and standards (existing and required). The objective in doing so has been to work out how to remove barriers to the development of a hydrogen capability in the ACT, and to ensure safety concerns and any special issues arising from the introduction of this new technology are addressed.⁶

Through our efforts we are pleased to assist the ACT Government in meeting its own policy objectives and in achieving the ultimate goal of the Council of Australian Governments, now the National Federation Reform Council ("NFRRC"),⁷ of a nationally consistent, commercially sound framework that will enhance engagement with key stakeholders for the introduction of hydrogen gas into the energy industry and market.

2 Achieving zero emissions from natural gas use by 2045

Amongst Australian jurisdictions the ACT Government is at the forefront of both renewable energy usage and the pursuit of zero emissions. The Territory has a legislated target of net zero emissions by 2045.⁸

In the last two years there has been major interest in hydrogen in Australia. State and Territory governments, the Federal Government, and industry players are active. Australia's *National Hydrogen Strategy* (2019) was a cooperative effort by all State and federal governments under the Council of Australian Governments ("COAG").⁹ The Strategy suggests:

A cautiously optimistic scenario could see an Australian hydrogen industry generate about 7,600 jobs and add about \$11 billion a year in additional GDP by 2050. If global markets develop faster, it could mean another ten thousand jobs and at least \$26 billion a year in GDP.

⁵ ITP Thermal. 2020. *Green gas trading – a tool for a zero emissions ACT*.

⁶ Legal notice - this report has been prepared pursuant to a supplier/customer arrangement governed by the terms and conditions of Territory Short Form Contract Nos EP2200498 and EP2200511 between Moulis Legal Pty Ltd (as supplier) and the Australian Capital Territory (as customer). With respect to any third parties the report presents an overview and commentary of the subject matter only and is not provided in the context of a solicitor-client relationship. The report does not constitute legal advice given to any third parties and may not be relied upon by third parties. Moulis Legal neither assumes nor accepts any legal responsibility for its contents or duty of care with respect to third parties.

⁷ Department of Prime Minister and Cabinet. 2020. [online] Available at: <<https://www.pmc.gov.au/news-centre/government/coag-becomes-national-cabinet>>.

⁸ *Climate Change and Greenhouse Gas Reduction Act 2010* (ACT), Section 6(1).

⁹ Department of Industry, Science, Energy and Resources. 2020. [online] Available at: <<https://www.industry.gov.au/data-and-publications/australias-national-hydrogen-strategy>>

The Australian Renewable Energy Agency (“ARENA”) is evaluating bids for its \$70 million hydrogen deployment funding round that will see several large scale electrolyser systems established around the country.¹⁰

All State and Territory governments now have plans to embrace a hydrogen future. South Australia has a hydrogen action plan.¹¹ Western Australia has a renewable hydrogen strategy.¹² Queensland has a hydrogen strategy.¹³ Tasmania has a renewable hydrogen action plan.¹⁴ Victoria has a hydrogen investment program,¹⁵ New South Wales is planning for a hydrogen technology program.¹⁶ The Northern Territory has a renewable hydrogen strategy too.¹⁷

In April 2018 the ACT Government released the *Zero Emissions Vehicles Action Plan 2018–21*.¹⁸ The intention of this Plan is to accelerate the transition to battery electric and fuel cell vehicles, including shifting to zero emissions alternatives for newly leased government passenger vehicles from 2020-21.

A hydrogen pilot project comprising of a combined electrolyser and filling station is currently underway in Fyshwick, with associated procurement of hydrogen powered vehicles. The station houses a 60 kilowatt hydrogen electrolyser facility and refuelling infrastructure. This pilot project is one of the first of its kind in Australia, placing the ACT at the forefront of hydrogen development in this country. Initially, the hydrogen produced by this facility will power a government fleet of 20 Hyundai fuel cell electric vehicles.

The *ACT Climate Change Strategy 2019 -2025* explores the potential role of hydrogen in meeting future stationary energy and transport energy needs. Reducing emissions from gas is a crucial part

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- ¹⁰ Australian Renewable Energy Agency. 2020. [online] Available at: <<https://arena.gov.au/funding/renewable-hydrogen-deployment-funding-round/>>.
- ¹¹ Renewables SA. 2019. *South Australia's Hydrogen Action Plan - Renewables SA*. [online] Available at: <<http://www.renewablesa.sa.gov.au/topic/hydrogen/hydrogen-action-plan>>.
- ¹² Department of Primary Industries and Regional Development. 2020. *Western Australian Renewable Hydrogen Strategy*. [online] Available at: <http://www.drd.wa.gov.au/Publications/Documents/wa_renewable_hydrogen_strategy.pdf>.
- ¹³ State Development, Infrastructure, Local Government and Planning. 2019. *Queensland Hydrogen Industry Strategy*. [online] Available at: <<https://www.dsdmip.qld.gov.au/resources/strategy/queensland-hydrogen-strategy.pdf>>.
- ¹⁴ Department of State Growth. 2020. *The Tasmanian Renewable Hydrogen Action Plan*. [online] Available at: <https://www.stategrowth.tas.gov.au/news/archived_news/the_tasmanian_renewable_hydrogen_action_plan>.
- ¹⁵ Energy VIC. 2019. *H2 Green Hydrogen Discussion Paper*. [online] Available at: <https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.vic-engage.files/6415/8025/2510/VHIP_discussion_paper_FA3_WEB_booklet.pdf>.
- ¹⁶ Energy NSW. 2020. *Memorandum of Understanding*. [online] Available at: <<https://energy.nsw.gov.au/government-and-regulation/electricity-strategy/memorandum-understanding>>.
- ¹⁷ Department of Industry, Tourism and Trade. 2020. *Northern Territory renewable hydrogen strategy*. [online] Available at: <<https://business.nt.gov.au/publications/strategies/northern-territory-renewable-hydrogen-strategy>>.
- ¹⁸ Environment, Planning and Sustainable Development Directorate. 2018. *Transition to Zero Emissions Vehicles Action Plan 2018-2021*. [online] Available at: <<https://www.environment.act.gov.au/cc/zero-emissions-vehicles#:~:text=In%20April%202018%2C%20Government%20launched%20its%20Transition%20to,vehicle%20fleet%2C%20new%20charging%20infrastructure%2C%20and%20incentives%20>>.

of achieving net zero emissions by 2045.¹⁹ As an energy source, natural gas is relatively emissions intensive. However, it is also the “entrenched” gas energy source. Infrastructure has been developed and maintained for the purposes of handling that gas and not a gas like hydrogen. There is still some level of uncertainty around the ability of the natural gas infrastructure and equipment to allow for higher levels of hydrogen injection, and what components of same may require upgrading and replacing. However there is a generally held view that at lower percentages of hydrogen blending there are no deleterious impacts, and that the existing infrastructure and existing natural gas appliances can likely handle up to 10% hydrogen concentration without difficulty.²⁰

From that base, the community’s understanding of the capabilities of existing systems will improve, and upgrades will take place. Standards will be introduced, hopefully at the national level, for appliances and vehicles. Training courses and better-targeted safety regulations will emerge. Through this evolution greater amounts of hydrogen will come to be used in the ACT and, through the ACT, in surrounding NSW districts.

Responsibility for investment in gas distribution infrastructure rests with Evoenergy as the gas distributor for the ACT and with Jemena as the distributor of gas that reaches the ACT through NSW. The implication is that Evoenergy will always be involved, but that Jemena will also be involved to the extent that the ACT is reliant on gas conveyed into the ACT by Jemena. Discussions with Evoenergy indicate confidence that the ACT network can manage a transition to a higher concentration than the current up to 10% limit of hydrogen gas. The exact limits of hydrogen blending and the nature of any upgrades needed will be determined over time, however the view of many stakeholders was that most of the network assets in the ACT are workable for hydrogen use. For example, technical advice is to the effect that the existing low pressure piping within the ACT is all polythene or nylon, and is compatible with pure hydrogen.

¹⁹ EPSDD. 2019. ACT Climate Change Strategy 2019-2025. [online] Available at: <https://www.environment.act.gov.au/__data/assets/pdf_file/0003/1414641/ACT-Climate-Change-Strategy-2019-2025.pdf/_recache>.

²⁰ COAG Energy Council. 2019. “Hydrogen in the Gas Distribution Networks – a kickstart project as an input into the development of a National Hydrogen Strategy for Australia”. [online] Available at: <http://www.coagenergycouncil.gov.au/sites/prod.energycouncil/files/publications/documents/nhs-hydrogen-in-the-gas-distribution-networks-report-2019_0.pdf>.

C Methodology

Prior to conducting the review of the ACT legislation, it was important to gain a deep understanding of not only “what is hydrogen”, but also of the legal and contextual nature of the various frameworks that come into play when energy and gas reforms are contemplated.

The initial review required for EP2200498 and EP2200511 was conducted as part of a single process, which broadly required six steps.

- Step 1** Learn about the unique characteristics of hydrogen gas and its perceived impact on stakeholders, in order to understand the scope of this report. This step also involved the aforementioned stakeholder meetings.
- Step 2** Identify and review the relevant legislation requiring detailed review. The relevant ACT legislation was identified via a keyword search of words related to the hydrogen gas life cycle. Ultimately, all ACT legislation was reviewed for relevance, regardless of the number of keyword matches. Thus, this step involved the review of all 365 ACT statutes listed on the Territory’s legislation register, alongside ACT regulations and codes, and also those from other jurisdictions where relevant to the ACT.

Step 3 Categorise the legislation as follows:

- within scope, amendment required – it is considered that the legislation concerned is relevant to the task and requires significant amendments, either with respect to the head statute itself or to subordinate instruments, and/or the decisions as to how to amend require broad consultation with industry stakeholders;
- within scope, minor amendments required – it is considered that the legislation concerned is relevant to the task and requires a small number of amendments, either with respect to the head statute or a subordinate instrument;
- within scope, no amendment required – it is considered that the legislation concerned is relevant to the task but requires no amendment; and
- out of scope – it is considered that the legislation concerned is irrelevant to the task and requires no amendment.

The report summarises the key learnings that emerged from that review. The statute-by-statute results of the review is provided at Appendix F.

- Step 4** Compile a list of background technical material and a list of potentially relevant standards.²¹ This list is organised into existing Australian standards, international standards, ISO standards appearing on the Australian Standards website, standards for the purpose of underground storage, and standards recommended by industry.

This list is provided at Appendix E.

²¹ CSIRO. 2020. *National Hydrogen Roadmap*. [online] Available at: <<https://www.csiro.au/en/Do-business/Futures/Reports/Energy-and-Resources/Hydrogen-Roadmap>>.

Step 5 Conduct stakeholder meetings to gain a better understanding of hydrogen production and usage, and the likely implications of its uptake in the ACT, to better inform the work required to be done. As a result of those meetings, further lines of inquiry regarding the stakeholder organisations and the regulators involved in the legal and energy frameworks was undertaken. The information generated in and from these stakeholder meetings was summarised and reported to EPSDD and used in the preparation of this report.

Step 6 Arrive at recommendations about the nature, scope and prioritisation of amendments to the law as it applies in the ACT, after further consideration of the legislation concerned.²² These recommendations assume that the ACT has the ability to achieve change “on its own”, but that it needs to be cognisant of the advantages and disadvantages of national change and inter-jurisdictional supply.²³ If the ACT wishes to replace natural gas at concentrations of hydrogen that are not able to be commercially achieved by way of production within the ACT,²⁴ the assumption is that extra hydrogen will be sourced externally. The ACT will need to engage with the national pipeline legislation and, to the extent it introduces different factors, the NSW pipeline legislation, to achieve transportation by existing or new pipelines.²⁵

²² See H, I and J of this report.

²³ ACT Government. 2019. *ACT Sustainable Energy Policy 2020-2025 Discussion Paper*. [online]. Available at: <https://www.environment.act.gov.au/__data/assets/pdf_file/0007/1411567/act-sustainable-energy-policy-discussion-paper.pdf>. The Discussion Paper was used to inform prioritisation of recommended amendments.

²⁴ The ACT has the capacity to replace all of the natural gas currently in use with hydrogen, and can do so well within its existing water allocation. However, if any amount needs to be externally sourced, the hydrogen will need to be transported through NSW.

²⁵ Energy NSW. 2020. *Pipelines Regulation*. [online] Available at: <<https://energy.nsw.gov.au/government-and-regulation/our-role-networks/pipelines>>. In particular: *Pipelines Act 1967 (NSW)*; *Pipelines Regulation 2013 (NSW)*; and *NSW Licensed Pipeline Performance Report Guidelines 2018*.

D What is hydrogen gas?

1 Chemical properties

Hydrogen is almost exclusively found in chemical compound form (e.g. water and hydrocarbon molecules). Hydrogen gas is extremely light. It weighs about 14.5 times less than air and about eight times less than natural gas.

Pure hydrogen is a colourless, odourless, transparent gas. It is also non-toxic, non-corrosive and stable. However, in concentrated amounts it is highly flammable when in contact with an oxidising substance (e.g. oxygen). However the lightness of hydrogen gas means that it is quickly dispersed should it escape from a pipe, valve, tank or other containment.

2 Production

Hydrogen gas can be produced using diverse resources, and via several technological pathways. There are three primary categories of production. They are electrolysis, biomass conversion and fossil fuel conversion.

a Renewable energy-based electrolysis

Water electrolysis is the process of dissociating the water molecule (H_2O) into its constituents, namely hydrogen and oxygen, by applying electrical power. In its simplest form, this is achieved by applying an electrical current between two conductive electrodes (metal rods) immersed in water. Hydrogen forms at one electrode, while oxygen forms at the other. The two gases can then be separately extracted and stored.

Although dependent on the efficiency of the electrolyser, approximately 60 kWh of electrical energy are required to produce one kilogram of hydrogen. If renewable electricity is used in the electrolyser, the hydrogen produced is considered to be “zero emission” hydrogen, or “green hydrogen”.

b Biomass conversion

Biomass refers to organic materials that can be used as a source of energy. It includes a broad range of resources, including agricultural waste, wood and wood processing waste, energy crops, sludge from wastewater treatment and urban organic waste. Depending on the resource, the biomass can produce energy by direct combustion (e.g. wood) or can be converted to gaseous (e.g. biogas) or liquid (e.g. biodiesel) fuels.

Available pathways for the conversion of biomass to hydrogen are:

- biomass gasification – where, in a process similar to fossil fuel coal gasification, the biomass reacts with water to produce hydrogen and CO_2 ;
- steam methane reforming (“SMR”) - where methane, the main component of biogas, reacts with water or carbon dioxide plus water to produce hydrogen and CO_2 , in a similar way as for natural gas SMR.

While biomass combustion and conversion processes generate CO_2 , these technologies are considered carbon neutral. This is because no more than the same amount of CO_2 as was captured

from the atmosphere through photosynthesis is emitted during the generation of the hydrogen from the biomass.

The possibility of sequestering the CO₂ captured by biomass gasification is one of the few approaches that can give a genuinely negative GHG emissions result.

c Fossil fuel-based processes

At present, around 95% of global hydrogen production is based on the conversion of fossil fuels. This primarily occurs through SMR, which is where methane reacts with water to produce hydrogen and CO₂. Coal gasification – where coal reacts with water to produce hydrogen and carbon dioxide (CO₂) - is also employed, but to a lesser extent.

This production takes place almost exclusively within the confines of oil refineries and chemical plants, where it is itself used as a chemical feedstock for production of other products. The processes are highly carbon intensive, with the CO₂ produced typically released into the atmosphere. Hydrogen produced from these processes is sometimes called “brown” or “grey hydrogen”.

It is possible to potentially avoid the release of the bulk of CO₂ into the atmosphere through carbon capture and storage (“CCS”). CCS technology involves separating CO₂ from the stream of products that arise from the reactions that occur in producing (in our case) hydrogen and storing the CO₂ indefinitely in large underground cavities, in order to largely prevent its emission into the atmosphere.

The terms “green”, “grey”, and “blue” hydrogen are used by both the International Energy Agency (“IEA”) and the International Renewable Energy Agency (“IRENA”) to represent, respectively:

- hydrogen produced with electrolysis powered by renewable energy (green);
- hydrogen produced from fossil fuels (grey); and
- hydrogen produced from fossil fuels with CCS (blue).

In Australia, the COAG *National Hydrogen Strategy* adopts the terms “clean renewable” hydrogen and “clean CCS” hydrogen for green and blue hydrogen, respectively. In the National Hydrogen Roadmap, the term “clean” hydrogen represents both green and blue hydrogen.

The ACT Government has generally opposed the use of fossil fuel-based hydrogen.²⁶

3 Safety

The natural gas industry has a well-established approach to safety, due to the significant hazards of flammability, and other issues, that accompany the use of natural gas. Hydrogen has several properties that differ from natural gas, requiring a change in approach to safety. While this does not mean that hydrogen is less safe, a careful assessment of the technical implications of using hydrogen in substitution for natural gas is required, so that its use can be safe.

²⁶ Open Government. 2020. *COAG Energy Council Meeting - Chief Minister, Treasury And Economic Development Directorate*. [online] Available at: <https://www.cmtedd.act.gov.au/open_government/inform/act_government_media_releases/rattenbury/2019/coag-energy-council-meeting>.

The specific characteristics of hydrogen that must be considered in this context are summarised below.

a High flammability range, quick dispersion

Combustion is a chemical reaction between a fuel (e.g. natural gas, hydrogen) and an oxidant (typically, oxygen).²⁷ To have self-sustained combustion, both the reactants (the fuel and the oxidant) must be available in sufficient quantities to allow for the ignition and continuation of the reaction. If the concentration of either reactant in the mixture is lower than a specific threshold, the mixture cannot continue to combust. The flammability range is the range of concentrations of a gaseous fuel in the air that can create a mixture that can combust if ignited. This range varies depending on the type of fuel.

A hydrogen-air mixture is flammable if the hydrogen concentration is between 4% and 75%. Natural gas has a similar lower limit, but a lower upper limit (15%).

Hydrogen is 14.5 times lighter than air. This means that when hydrogen is released it rapidly disperses upwards. This is useful in the case of a leakage in open space, as hydrogen concentration will quickly fall below the 4% flammability limit, making it unable to explode. However, particular care must be taken to avoid potential overhead gas pockets, such as could occur with a hydrogen leak in a confined and unventilated space.

b Low ignition energy

Ignition energy is the energy required to initiate a combustion reaction between a fuel and oxygen (e.g. a spark). Under optimal combustion conditions, corresponding to the condition where there is a 29% concentration of hydrogen in air, hydrogen is easily ignited. This is because its ignition energy is 15 times lower than that of natural gas. However, at lower concentrations of hydrogen gas in the blend, the ignition energy of the blend is comparable to that of natural gas.²⁸

c Small molecule and low viscosity

Hydrogen is made up of molecules (H_2) that are smaller than the molecules in natural gas. Hydrogen also presents lower viscosity. Viscosity is the internal friction of molecules of a fluid. It characterises the resistance of a fluid to “flow”. Fluids with a low viscosity will flow through a leak at a higher rate. These characteristics have an important safety implication, because they mean that hydrogen is more prone to leaking than other gases. This underlines the importance of existing and future standards for pipes, connections and valves.

d Steel embrittlement

Hydrogen embrittlement of steel is a deterioration process that involves the ingress of hydrogen within the atomic structure of steel, reducing its ductility and strength. This can cause cracking and

²⁷ On a separate point, technical experts saw no combustion risks solely by reason of fossil fuel (“petrol”) fumes and hydrogen gas intermingling at the same facility. If either is ignited then that could ignite the other. That would happen because of the ignition of the other. It would not happen solely by mixing with each other pre-ignition.

²⁸ For more information about the potential implications of a blended gas on the gas network, please see E-2.c below.

brittle failure of pressure equipment. The phenomenon is not completely understood but it is known to particularly affect high strength/high carbon steels.

The issue has been explained thus:

When hydrogen is put into a steel pipeline used in gas transmission and distribution systems, some of it dissociates and then is absorbed into the pipeline wall as atomic hydrogen due to the pressure of the gas. However, the permeability of hydrogen through the steel is insignificant and so it can be considered that there is no leakage of hydrogen from a pipeline through the steel.

Nevertheless, the absorbed hydrogen can affect the properties of the linepipe through hydrogen embrittlement, resulting in a deterioration of the mechanical properties of the steel.

The susceptibility of a particular grade of steel to hydrogen embrittlement depends on a number of factors, including the steel's strength, chemistry, impurities, microstructure, surface condition and processing. Operating parameters, such as time, temperature, pressure, loading mode (including cyclic loading and its frequency), hydrogen concentration and gas purity also have a bearing on the performance of the steel in service.²⁹ [footnotes omitted]

Low carbon steels are in general considered to be appropriate for use in hydrogen applications, especially if operated at low pressures. For context, the medium pressure natural gas piping infrastructure in the ACT consists of low-carbon steel, and the low pressure piping consists of polyethylene ("PE") and nylon ("PA11").³⁰

The ACT's steel piping is under low stress, and experts are of the view that it certainly would be suitable for use with hydrogen at levels up to around 20% in a mixture with natural gas, and could possibly be suitable for use with pure hydrogen.³¹

e Compatibility with plastic

Polyethylene and nylon are not subject to hydrogen embrittlement. The ACT's network of polyethylene and nylon pipes at the low pressure reticulation level is said by experts to be up to the task of conveying pure hydrogen, based on applied research conducted on the topic.³²

²⁹ Energy Pipelines CRC. 2017. *Research Report - Identifying the commercial, technical and regulatory issues for injecting renewable gas in Australian distribution gas networks*. [online]. Available at: <<https://www.energy-pipelines.com.au/resources/reports/identifying-the-commercial-technical-and-regulatory-issues-for-injecting-renewable-gas-in-australian-distribution-gas-networks-research-report-energy-pipelines-crc/>>.

³⁰ For more detail of the location and composition of the ACT's gas piping infrastructure, please refer to *Figure 3*.

³¹ COAG Energy Council. 2019. *Hydrogen in the Gas Distribution Networks*. p. 52:

The susceptibility of particular steels to hydrogen embrittlement depends on three factors; environment, materials and stress. In the natural gas distribution system, the strength of steels and other ferrous alloys used is relatively low. This low strength, combined with low operating pressure and low operating stress, mean that the steels are not particularly vulnerable to hydrogen embrittlement.

³² Evoenergy. 2021. *Hydrogen Test Facility – Results to date*. [online]. Available at <<https://www.evoenergy.com.au/emerging-technology/hydrogen-test-facility>>.

After testing 100% hydrogen in a “replica” gas network for almost two years, Evoenergy and the Canberra Institute of Technology (“CiT”), partners in the commissioning of the hydrogen test facility at CiT’s Fyshwick campus, announced:

*We have verified that the underground 100 kPa plastic (polyethylene and nylon) network is compatible with 100 percent hydrogen, and that the procedures that comprise our Safety Management System can be adapted for hydrogen.*³³

f Odourless, tasteless, transparent, and non-toxic

Hydrogen cannot be detected by the human senses. This characteristic poses certain risks. Because of its ability to displace oxygen and cause hypoxia, hydrogen at very high concentrations in air is an “asphyxiant” gas.³⁴ Natural gas and propane have the same characteristics, but the industry mixes them with a small quantity of sulphur-based odorant to make them detectable by smell. Natural gas odorants are not compatible with a gas with high hydrogen content, and decisions need to be made about the point at which there should be a change of odorant in natural gas blended with hydrogen, and the different odorant that would be identified and used. Industry does not see this as being problematic but agreement will need to be reached on the standard odorant to be applied.

g Invisible flame

A hydrogen flame is nearly invisible in daylight, making it hard to detect without thermal safety sensors. Hydrogen flames also produce a smaller amount of heat radiation compared to natural gas. As such, it is more difficult for someone standing close to a hydrogen flame to perceive the flame’s presence. On the other hand, hydrogen flames are less likely to cause a combustion reaction (i.e. ignition) in nearby combustible material unless in direct contact.

³³ Ibid.

³⁴ An asphyxiant is a substance that can cause unconsciousness or death by suffocation (i.e. asphyxiation).

E Hydrogen gas usage in the ACT

The main future uses of hydrogen are the following:

- as an energy carrier that produces electricity in vehicles (in fuel cells), including motor vehicles, heavy road vehicles, public buses and rail vehicles;³⁵
- as an energy source for heating, cooking and hot water boilers in both domestic and industrial applications; and
- as a form of energy that can be stored for electric power production via fuel cells or gas engines.³⁶

Other promising hydrogen applications which might not be carried out in the ACT, but in which ACT companies and institutions have interests, include:

- production of zero-emissions ammonia; and
- production of zero-emissions steel.

Hydrogen sold outside the ACT's borders could become an available market for investors that are "early adopters" of the new technology and, although the ACT is not proximate to the Australian seaboard, there could also be future export opportunities for ACT industry.³⁷

1 The ACT's gas supply

Importantly, how is gas supplied into the ACT?

At the national level (south-eastern sector of Australia), there are two physical, legal and commercial "networks" that are involved. Gas supplied to the ACT originates from Moomba, SA, in the Cooper Basin gas field, and from Yolla, in the Bass Strait gas field.

³⁵ The tank of a typical light vehicle contains around 5 kg of hydrogen for a 500 km driving range.

³⁶ H21. 2016. *H21 Leeds City Gate*. [online]. Available at: <<https://www.h21.green/projects/h21-leeds-city-gate/>>. As observed in the Leeds City Gate Report, the number of electrolyzers required for 100% hydrogen adoption in Leeds will depend on storage capability. This is to ensure that peak energy demand can be met, without over-investment in production capacity. For example, when electricity is cheap in summer, more hydrogen gas could be produced and stored for use in peak consumption periods during winter.

³⁷ ACIL Allen Consulting. 2018. *Opportunities for Australia from Hydrogen Gas Exports*. [online]. Available at: <<https://arena.gov.au/assets/2018/08/opportunities-for-australia-from-hydrogen-exports.pdf>>.

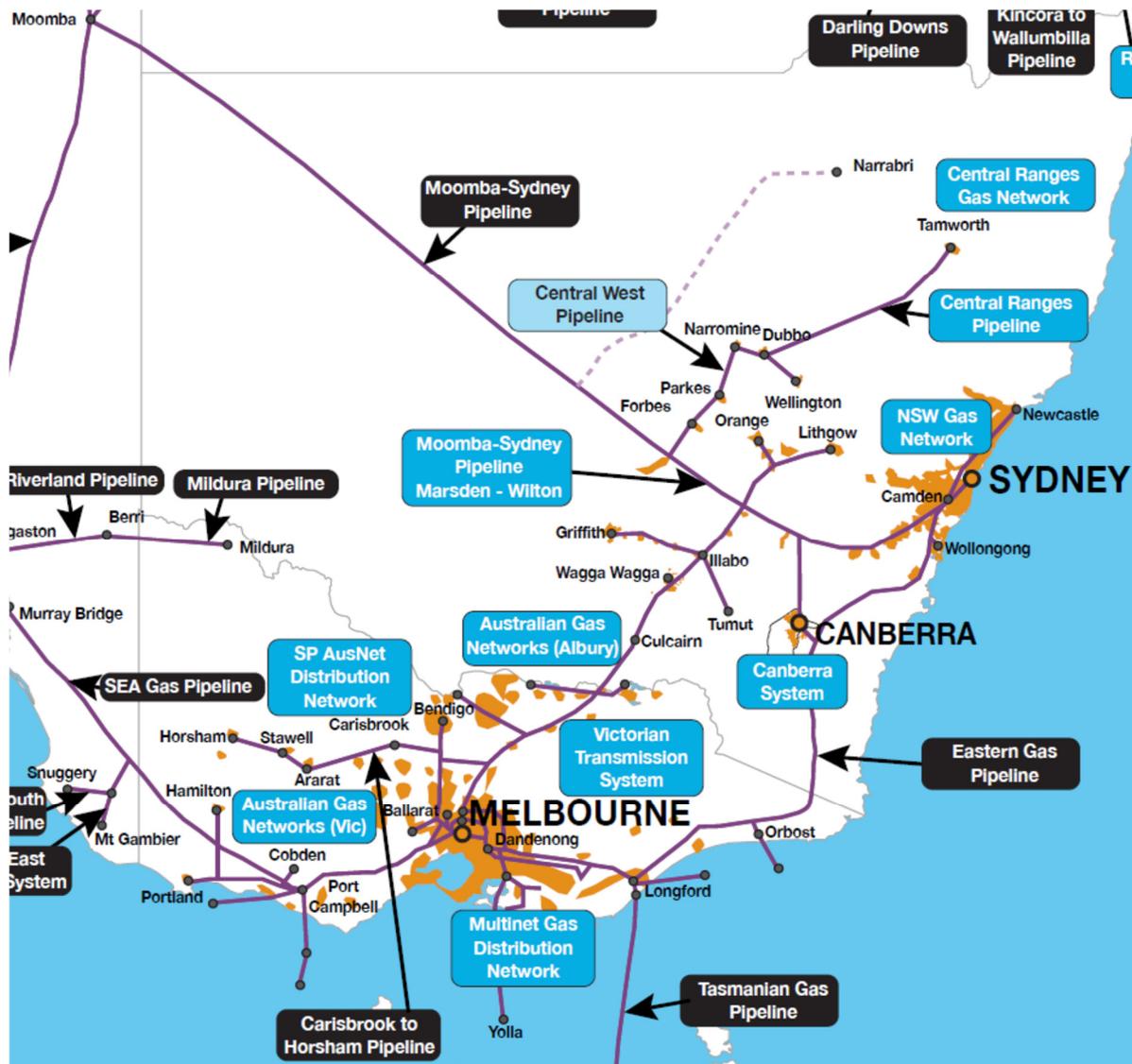


Figure 2 – South-eastern Australian gas transmission pipelines³⁸

There are two access points into the ACT.

- NSW License 16 relates to the Moomba (SA) to Wilton (NSW) pipeline. It is 1,300 km in length. This pipeline is owned by Australian Pipeline Trust. The Dalton (NSW) to Canberra (ACT) pipeline branches off the Moomba to Wilton pipeline at Dalton and runs to the suburb of North Watson in the ACT. It is also owned by Australian Pipeline Trust. It is 58 km in length and is operated under NSW Licence 21. These are high-pressure transmission pipelines (6.9 MPa). The section of pipeline within the ACT that brings the gas to North Watson is regulated under an ACT Utilities Service Licence issued by the Independent Competition and Regulatory Commission (“ICRC”).
- NSW License 26 relates to the pipeline from the Victoria/NSW border to Horsley Park (NSW). It is 797 km in length. This pipeline is owned by Jemena Ltd. The Hoskinstown (NSW) to Canberra (ACT) pipeline branches off the Victoria/NSW border to Horsley Park pipeline at

³⁸ Australian Energy Market Commission, 2019. *Australia with gas pipelines – scheme register (August 2019)*. [online]. Available at <<https://www.aemc.gov.au/energy-system>>.

Hoskinstown and runs to the suburb of Fyshwick in the ACT. It is owned by ActewAGL. It is 31 km in length. The part of the branch pipeline that is in NSW is 22km in length and is operated under NSW Licence 29. There is then an 8 km section that brings the gas to Fyshwick. This section is regulated under an ACT Utilities Services Licence. These are high pressure transmission pipelines (14.9 MPa), although Licence No 29 treats the Hoskinstown (NSW) to Canberra (ACT) branch pipeline as a distribution pipeline for regulatory purposes.

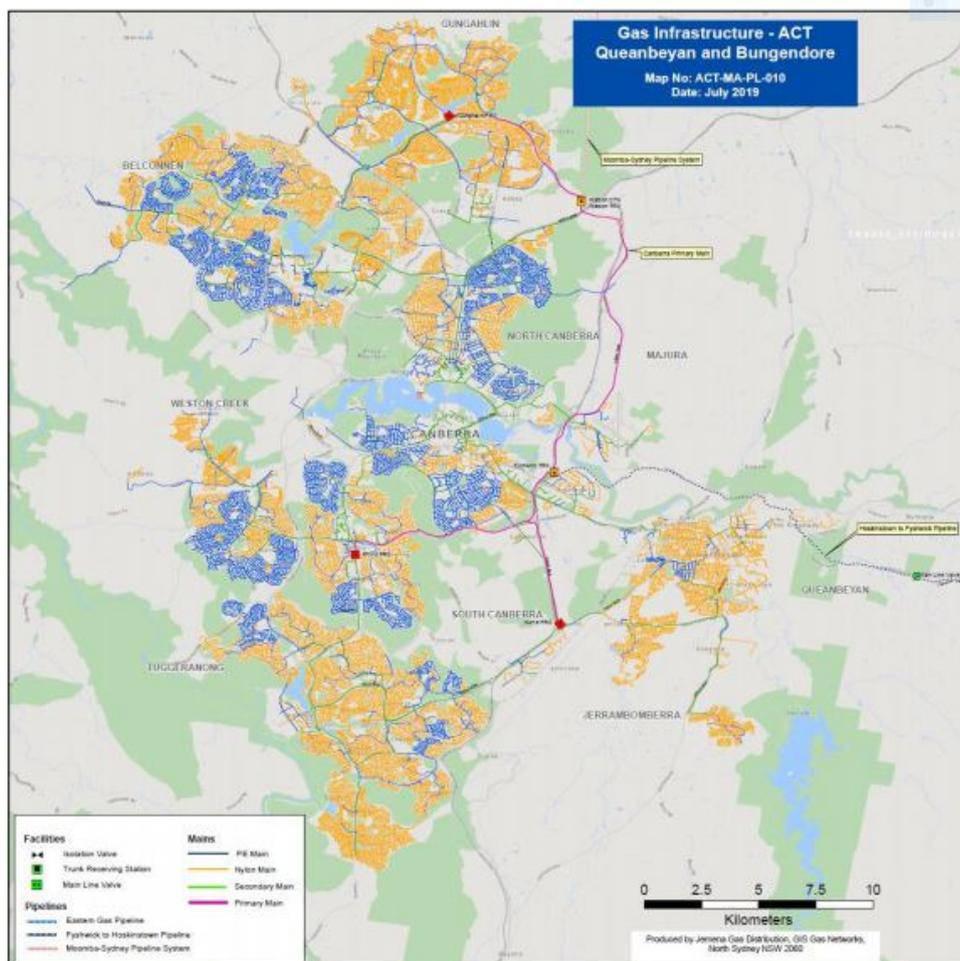


Figure 3 – ACT gas network connection points, key assets and primary mains³⁹

2 Usage in the ACT

The ACT, as a light industry jurisdiction, is assumed to be more interested in commercial uses rather than industrial uses. However, hydrogen production, as a form of energy for the industry we do have here, can be expected to be of great interest for the following activities.

³⁹ Evoenergy. 2019. *Gas network service and access information - Service and access information for the ACT, Queanbeyan and Palerang gas network published in accordance with Division 2 of Part 11 of the National Gas Rules. Version 1.1 July 2019.* [online]. Available at <<https://www.aer.gov.au/system/files/Evoenergy%20-%20Appendix%20B%20-%20Network%20map%20-%20June%202020.pdf>>.

a Hydrogen for electricity generation

Hydrogen can be used as a “fuel” in gas turbines, internal combustion engines or fuel cells. Of these technologies, only the latter is mature and readily available.

A fuel cell is a device that generates electricity through an electrochemical reaction. The combining of hydrogen and oxygen generates electricity, with only water and heat as by-products. Usually, the oxygen used in this reaction is oxygen obtained from the air rather than pure oxygen. The reaction that takes place inside a fuel cell is effectively a reversal of the electrolysis process that produced the hydrogen in the first place. To achieve high power output, several fuel cells are typically packed together, in a fuel cell “stack”.

There are several fuel cell technologies available, each working at a different temperature, and having different efficiency, durability and cost. Medium and high temperature fuel cells can be used as an efficient source of both power and heat.

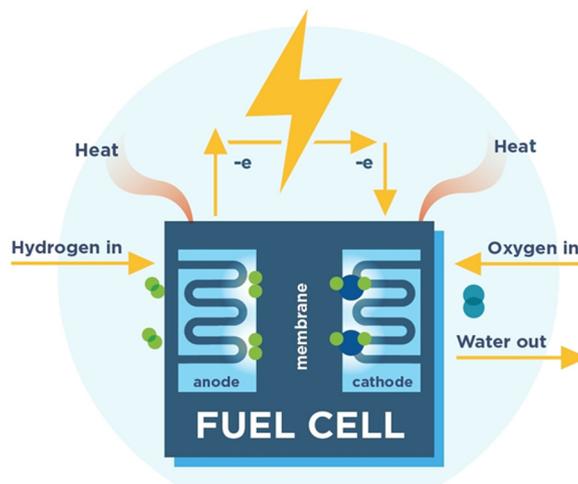


Figure 4 - Diagram of a hydrogen fuel cell.⁴⁰

Hydrogen-powered fuel cells can be used to produce electricity in a wide range of applications, including:

- Fuel cell electric vehicles (“FCEV”) - fuel cell stacks can be used to power forklifts, light and heavy-duty road vehicles, and trains. In all these applications, the electricity produced in the fuel cells is used to power electric motors in the same way batteries do in battery electric vehicles (“BEV”). In FCEVs the hydrogen required by the fuel cell is stored in high pressure hydrogen tanks.
- Stationary power stations - fuel cells can provide primary or backup power in small to medium applications (e.g. apartment buildings and hospitals).
- Combined heat and power (“CHP”) systems - in stationary applications, in addition to the power output, the heat produced in the fuel cell system can be harvested and used. When

⁴⁰ Fuel Cell and Hydrogen Energy Association. 2020. *Fuel Cell Basics*. [online] Available at: <<http://www.fchea.org/fuelcells>>.

this system is applied to a residential or commercial building, the heat can be used (for example) for space heating or for producing hot water.

There is another way that hydrogen can be used to generate electricity. In stakeholder meetings the idea of storing energy by diverting excess electricity generated in a locality by solar photovoltaic panels to local electrolyzers, so that the local electrolyzers can produce hydrogen, was introduced. In hydrogen form the energy can be more easily stored for future use. Further, damage to the electricity network by over-generation would be avoided, and the costs of surplus electricity production by solar panel owners would be mitigated.

b Hydrogen refuelling stations

A hydrogen refuelling station can be stand-alone infrastructure or part of existing service stations/liquid fuel depots. The basic structure must contain a high pressure storage system, at least one dispenser, compressors and a pre-cooling system. The compressor is used to bring the hydrogen to the desirable pressure level. If hydrogen gas is to be produced on site as a liquid, or delivered as a liquid, then another intermediary storage unit is needed.

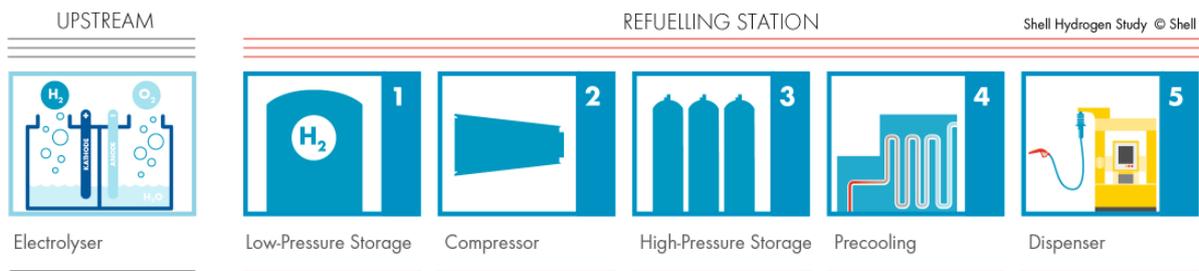


Figure 5 - Hydrogen Europe. Hydrogen Refuelling Station⁴¹

Safety is of chief concern. Hydrogen in a vehicle tank heats up during refuelling because the hydrogen *in situ* is progressively compressed by the incoming gas. Pre-cooling of the hydrogen gas is usually necessary for it to stay within the temperature limits of the vehicle's fuel storage system. Adequate cooling of hydrogen is also necessary to reduce fire risk. The standard refuelling pressure for hydrogen as specified in the European Union is 700 bar.⁴² For 700 bar refuelling, hydrogen is generally pre-cooled to minus 40°C. Higher pre-cooling temperatures are possible, but may lead to longer refuelling times.⁴³ Currently, no such fuelling protocol exists in the ACT.⁴⁴ The authors of this Report have confidence that industry will develop the required standards and protocols to commercialise hydrogen fuelled vehicles, in conjunction with Standards Australia.

⁴¹ Hydrogen Europe. 2020. *Refueling Stations | Hydrogen*. [online] Available at: <<https://hydrogeneurope.eu/refueling-stations>>.

⁴² SAE J2601 – *Fuelling Protocols for Light Duty Gaseous Hydrogen Surface Vehicles*.

⁴³ Hydrogen Europe. 2020. *Refueling Stations | Hydrogen*.

⁴⁴ In Europe, the SAE J2601 fuelling protocol covers hydrogen vehicle refuelling.

In July 2020, Standards Australia (ME-093 Hydrogen Technologies Committee)⁴⁵ adopted eight international standards that are fundamental to hydrogen production, storage and mobility.⁴⁶ The ME-093 Committee is tasked with developing Australian Standards critical to the entire hydrogen sector, in furtherance of the National Hydrogen Strategy.⁴⁷ These standards are directed at new hydrogen technologies that previously did not have Standards Australia coverage.⁴⁸ One of these eight standards deals directly with the safety of high pressure valves used in hydrogen refuelling stations.⁴⁹

Another dimension is consumer rights. A hydrogen vehicle's fuel tank accepts typically around four kilograms of hydrogen. The mass of hydrogen that will fill a tank to a particular pressure will vary depending on the temperature at which compressed hydrogen gas is transferred into the vehicle's hydrogen fuel tank. Petroleum products are offered for sale by the litre. The impact of temperature on density has necessitated oversight by *the Fair Trading (Fuel Prices) Act 1993* (ACT).⁵⁰ Although the Act includes hydrogen in its definition of fuel, there are no temperature-related requirements for the sale of hydrogen in the Act at this time.

The fairest approach with respect to the pricing of hydrogen at the point of sale is to charge the customer by the kilogram. This is analogous to the way in which compressed natural gas ("CNG") is offered for sale. Measuring compressed hydrogen gas by the kilogram removes the risk of price distortion due to fluctuations in density caused by the temperature of the gas at the time of refuelling.

Safety concerns, as opposed to pricing matters, will be addressed through pressure and temperature specifications of the fuel tank and refuelling equipment. Thus, we see legislative amendment for consumer protection reasons to be unnecessary at this stage.

It is recommended that ACT government directorates keep an eye on developments from within Standards Australia. Relevant Ministers should approve updates to disallowable instruments under relevant legislation to reference useful new standards, so as to apply them within the ACT.⁵¹

⁴⁵ Standards Australia is Australia's peak, independent, non-governmental, not-for-profit standards organisation.

⁴⁶ Standards Australia. 2020. *Hydrogen standards release summary*. [online]. Available at: <<https://www.standards.org.au/getmedia/52741f79-b166-40f7-b998-e0cf5287aec0/Hydrogen-standards-release-summary-July-2020.aspx>>.

The ME-93 Committee covers all aspects of hydrogen across the value chain, including the production, storage and handling, measurement, transport, transmission and distribution of hydrogen, as well as end-use applications such as hydrogen refuelling infrastructure and mobility applications, domestic and industrial appliances and power and heat generation.

⁴⁷ ME-093 Hydrogen Technologies. *Strategic Work Plan*. [online]. Available at: <<https://h2council.com.au/uploads/ME-093-Hydrogen-Technologies-Strategic-Work-Plan.pdf>>.

⁴⁸ For a brief introduction of these standards, please see Appendix E, Section 2.

⁴⁹ Standards Australia. 2020. Hydrogen standards release summary. *AS 19880.3:2020, Gaseous hydrogen – Fuelling hydrogen – Fuelling Stations, Part 3: Valves (IAO 19880-3:2018, MOD)*.

⁵⁰ Part 3 of the Act mandates that fuel must be sold at 15 degrees Celsius.

⁵¹ For example, on the issue of storage of hydrogen gas, a code of practice could be added to *Dangerous Substances (Storage and Handling Code of Practice)* under Section 219 of the *Dangerous Substance Act 2004* (ACT). As a further example, a code of practice for hydrogen refuelling stations could be added to *Gas Safety (Codes of Practice)* under Section 65 of the *Gas Safety Act 2000* (ACT).

c Hydrogen blending

Hydrogen gas can be blended with natural gas in existing gas reticulation networks. For sufficiently small hydrogen concentrations, the blended gas has generally comparable combustion characteristics and behaves similarly to that of unblended natural gas. While further investigation of the impact of hydrogen blending is recommended,⁵² hydrogen concentrations of 10%⁵³ are likely to require no modifications to domestic and commercial appliances, nor to distribution piping installations.⁵⁴ For example, most domestic burners in Australia comply with AS 3645, a standard that applies to natural gas appliances. These appliances must be able to handle gas composed of 13% hydrogen and 87% methane.

Hydrogen gas produces a lower amount of energy when compared to the same flow of fossil fuel gas. Thus, gas meters will need to be recalibrated to measure the correct flow of energy into the place of consumption of the blended gas in homes, apartments and businesses.

Consultations with interested parties make clear that more research is needed in order to better understand the consequences of higher hydrogen blending concentrations in the existing network.

3 Scalability

Consultations with Evoenergy revealed that the primary natural gas regulating stations are potential locations for large scale electrolyzers to be situated. The hydrogen gas produced at these locations could then be injected into the ACT's gas network at the station concerned. By injecting at these locations it will be possible to distribute hydrogen over large sections of the gas network while making sure that the concentration of hydrogen is maintained at or below set values.

In addition, smaller electrolyzers could be installed in areas where high electricity generation from rooftop solar photovoltaic installations is likely to create congestions in the power grid. These electrolyzers could act as controlled power loads, using the available surplus electricity to produce hydrogen and reduce the need for renewable power curtailment and for any upgrading of the power grid.

Not every vehicle refuelling station would produce its own hydrogen. Instead, hydrogen will in many cases be produced elsewhere and transported to refuelling stations, whether by truck or by hydrogen pipelines. This will require the creation and scaling up of a hydrogen distribution system, meaning that scalable distribution will be an issue.⁵⁵

Two competing views were expressed as to how hydrogen could be used in the natural gas system. The cautious approach suggested by some stakeholders who ventured an opinion on the subject

⁵² Evoenergy. 2021. *Hydrogen Test Facility – Results to date*. Research about the stratification of different gases within a gas blend is currently being undertaken. In July 2020, the hydrogen test facility installed a gas mixer to carry out further testing on blends of hydrogen and natural gas.

⁵³ GPA Engineering. 2019. *Hydrogen Impacts on Downstream Installations and Appliances*. [online] Available at: <http://www.coagenergycouncil.gov.au/sites/prod.energycouncil/files/publications/documents/nhs-hydrogen-impacts-on-downstream-installations-appliances-report-2019_0.pdf>.

⁵⁴ COAG Energy Council. 2019. *Hydrogen in the Gas Distribution Networks*. The review found that the addition of 10% hydrogen (by volume) to a typical natural gas blend has no significant impacts or implications on gas quality, safety and risk aspects, materials, network capacity and blending (providing the mixture is homogenous).

⁵⁵ “Scalable” in this context refers to a situation in which hydrogen can be produced efficiently and profitably at adequately large scales through investment in capital, labour and technology.

was to limit the use of hydrogen gas to a 10% blend because the natural gas transmission infrastructure used for the transport of hydrogen could suffer embrittlement. It was postulated that this situation should be maintained and not exceeded until the issue of embrittlement and its implications were better understood.

However, transmission pipelines are only a small part of the local pipeline network. Thus, another view was that the local distribution system, made up of steel pipes handling gas at much lower pressures than the transmission pipelines, and a later reticulation system that is mostly made up of plastic piping, was eminently suitable for handling high levels of hydrogen gas, with meter upgrades. Thus, it was postulated that local origination and injection of hydrogen gas into the distribution system could be encouraged to take place earlier, rather than waiting for any expensive upgrading of national transmission infrastructure and for national-level reform.

For both transmission and distribution, it will be important to evaluate the type of piping connections and fittings used, because of the different characteristics of hydrogen. As mentioned, these include the small size of the gas molecules, its low viscosity, and the high pressure at which it is stored.

4 Environmental impact

a Carbon dioxide emissions

Hydrogen usage has the potential to decarbonise large sectors of the Australian economy, but only if it is green hydrogen, produced with zero emission technologies.

Electrolysis powered by renewable energy has zero CO₂ emissions. Contrastingly, fossil fuel-based hydrogen production produces CO₂, because it is fossil fuels that generate the electricity used in the electrolysis process. It is estimated that in a best-case carbon sequestration scenario around 90% of the CO₂ produced in electrolysis could be separated and stored.

Under a scenario in which natural gas was entirely substituted by hydrogen gas produced from fossil fuels, and 90% of the CO₂ was successfully sequestered, it is estimated that emissions would drop by 70% to 85%.⁵⁶

b Water consumption

Hydrogen production requires the consumption of water. The electrolysis process requires around nine litres of water to produce one kilogram of hydrogen.

In 2018-19, the ACT's natural gas demand was 7,100 TJ.⁵⁷ This equates to 59,200 tonnes of hydrogen each year. If produced solely by electrolysis, this would require 11.5 PJ (or 3,200 GWh) of electrical energy every year, and consume a minimum of 530 million litres of water per annum. This amount of water equates to around 0.8% of the capacity of the Corin Dam reservoir, or 4.3 days of the ACT's water consumption.

⁵⁶ Jotzo, Frank et al. 2019. *For hydrogen to be truly 'clean' it must be made with renewables, not coal*. The Conversation. [online] Available at: <<https://theconversation.com/for-hydrogen-to-be-truly-clean-it-must-be-made-with-renewables-not-coal-128053>>.

⁵⁷ Strategy. Policy. Research. 2019. *ACT Greenhouse Gas Inventory 2018-19*. [online] Available at <https://www.environment.act.gov.au/__data/assets/pdf_file/0009/1508976/ACT-GGI-report-2018-19.pdf>.

5 Storage

Hydrogen gas at atmospheric pressure occupies a very large volume per unit of mass. In order to effectively store it, density must be increased. To achieve this there are several technologies available, each presenting its own level of readiness, energy density, cost and efficiency. These technologies can be grouped as follows.

- Compression – gaseous hydrogen is stored at high pressures. This is currently the most common storage pathway. It is typically applied to hydrogen in transmission pipelines (70 bar, or about 70 times the atmospheric pressure), heavy-duty vehicles (350 bar), light-duty vehicles (700 bar), and refuelling stations (850 bar).
- Liquefaction – if hydrogen is pressurised and cooled to minus 253°C, it liquefies and remains in a liquid state. This process is typically applied to hydrogen used as a fuel for the propulsion of rockets. Liquefied hydrogen has a density about twice that of gaseous hydrogen at 700 bar but it requires the use of more energy to be converted into liquid. Also, a well-insulated large-scale liquefied hydrogen tank will release around 1% of evaporated hydrogen each day (“boil off”). Accordingly, liquefaction is not an ideal solution for long term storage.⁵⁸
- Chemical bonding – this is where hydrogen is incorporated in a chemical compound that has higher hydrogen volumetric density than gaseous hydrogen.⁵⁹ Typically, these compounds can be stored at ambient temperature and ambient (low) pressure. When hydrogen is required, it can be recovered from the compound by using a chemical reaction. Alternatively, some compounds can be directly used as a green fuel. Potential hydrogen carriers are ammonia, methanol, metal hydrides, and liquid organic hydrogen carriers (“LOHC”), such as toluene.⁶⁰ Each of these compounds has its own characteristics but what they have in common is a higher energy density (due to the particular intermolecular forces) compared to compressed or even liquefied hydrogen.

6 Transport

As mentioned above, hydrogen gas can be transported within Australia by truck and in pipelines. Anyone exporting hydrogen gas from Australia would likely transform the hydrogen into a liquefied state to take advantage of the higher densities of liquid-state hydrogen. Another option considered for overseas exportation of hydrogen is in the form of green ammonia.

Within Australia, hydrogen is expected to be transported in the following ways.

⁵⁸ CSIRO. 2018. *Hydrogen Research, Development & Demonstration (RD&D)*. [online] Available at: <<https://www.csiro.au/en/Showcase/Hydrogen>>.

⁵⁹ Chemical bonding of hydrogen with other molecules allows the hydrogen to be stored and transported more easily than when it is in a pure state. As well as allowing storage of hydrogen, which can later be extracted, some of the compounds themselves have diverse industrial applications, including use as fertiliser. Hydrogen which is bonded with other chemicals opens up potential export opportunities as well.

⁶⁰ Ammonia can be used in the production of fertilisers, and is suitable for export, as is LOHC. Methanol can be blended with typical fossil fuels for combustion engines, and metal hydrides could be used in hydrogen vehicles. It is possible that one or more of these applications could be used by ACT consumers and commercially exploited by ACT industry.

a Transmission pipelines

The economics of large scale investment in hydrogen production to satisfy the totality of the ACT's gas (hydrogen gas) requirements is beyond the scope of this report. It is relevant to consider whether the ACT would find it economic to produce and inject ever higher concentrations of hydrogen into the gas distribution network within its own boundaries in the future.

Transmission pipelines, serviced by industrial scale hydrogen production facilities at an earlier point in the gas transmission network, would be better placed for the large volume, long distance conveyance of compressed hydrogen gas to the relatively small population of the ACT. However, embrittlement of the steel pipelines that are utilised for transmission, a condition that is known to affect the structural integrity of relevant transmission pipelines,⁶¹ is an unresolved technical concern.

The pace of continuing gas grid decarbonisation in the ACT, serviced initially by (say) local electrolysers and small scale injection into the distribution network, would eventually be slowed by the pace at which the transmission lines feeding the ACT accept and deliver hydrogen gas to the ACT. The commercial interests of natural gas producers will start to become more relevant to policy reform as the uptake of hydrogen increases.

b Distribution pipelines

Distribution pipelines can be used for large volume, medium distance conveyance of compressed hydrogen gas. In the ACT, the natural gas distribution network is currently divided into these networks:

- Primary network – this is comprised of high pressure steel pipes (handling around 6,000 kPa). Injecting hydrogen into this network is difficult. Injection necessitates the use of a compressor to bridge the pressure gap between the electrolyser producing hydrogen gas (at a pressure of roughly 3,000 kPa) and the pressure within the pipeline.
- Secondary network – this is comprised of medium pressure steel pipes (handling around 1,050 kPa). A view was expressed during consultations for the purposes of preparing this report that this part of the network can easily accept hydrogen at levels exceeding 10% and that the risk of damage to the pipes by hydrogen through the “embrittlement” effect is exaggerated, especially at low stress and low pressure.
- Reticulation network – this was once comprised of cast iron pipes which were prone to leaking, but is now comprised of polyethylene (“PE”) and polyamide (“PA11”) plastic pipes.⁶²

⁶¹ East Australian Pipelines Limited holds a gas transmission licence in the ACT for that part of the transmission pipeline it owns and operates that brings gas in from the north of Canberra to Watson (a branch of the Sydney to Moomba pipeline). Evoenergy operates a transmission pipeline that runs from the ACT border with NSW into Fyshwick. This is part of the transmission pipeline that branches off the main line bringing Bass Strait gas into the south eastern network at Hoskinstown. These ACT-located transmission pipelines are subject to technical regulation in the ACT.

⁶² There are no cast iron mains in the Evoenergy distribution network. See AER. 2009. *ActewAGL Distribution - Access arrangement information for the ACT, Queanbeyan and Palerang gas distribution network*. [online] Available at: <<https://www.aer.gov.au/system/files/Access%20Arrangement%20Information.pdf>>, footnote 107.

The reticulation network presently handles gas at pressures of around 210 kPa.⁶³ These pipes are said to be capable of handling 100% hydrogen flow.⁶⁴

- Customer-side piping - the final piece is the piping on the customer side of meters that connects the meter to the various appliances. This is not under the control of Evoenergy but must be compliant with the *Gas Safety Act 2000 (ACT)*, where the Utilities Technical Regulator has powers in relation to the safety of gas appliances.⁶⁵

This diagram below summarises the pipeline as well as the standards applicable to the gas network.

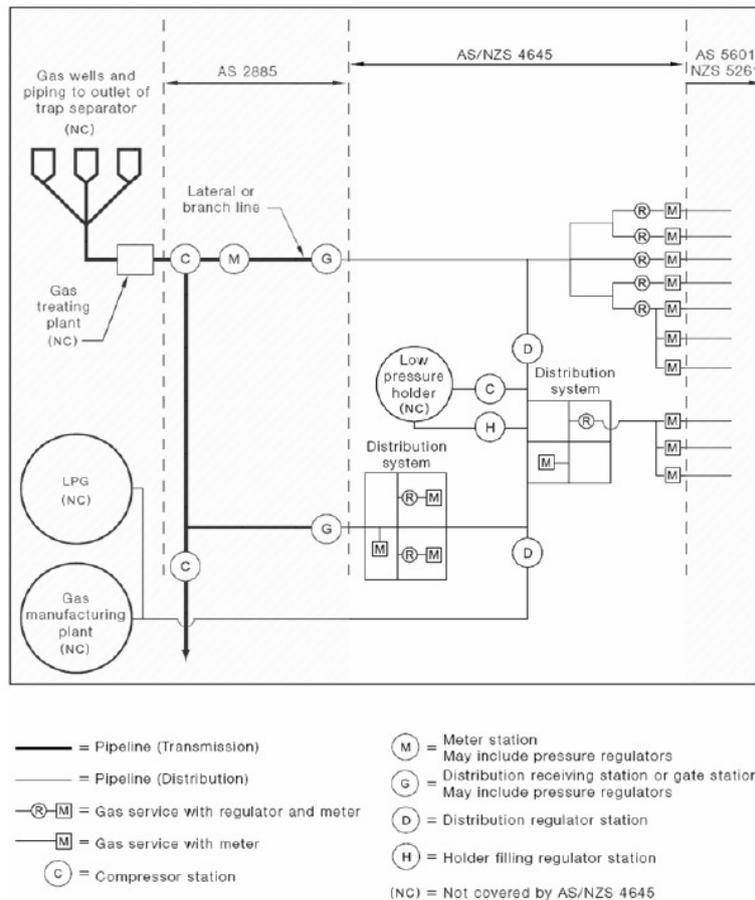


Figure 6 - Reproduction from AS/NZS 4645.1: 2008 in the Gas and Service Installation Rules.⁶⁶

⁶³ Ibid, p. 13.

⁶⁴ Evoenergy. 2021. *Hydrogen Test Facility – Results to date*. [online]. Available at <<https://www.evoenergy.com.au/emerging-technology/hydrogen-test-facility>>.

⁶⁵ Evoenergy is actively investigating the capabilities of both the reticulation network, and the piping connection to households and present-day appliances, to assess their suitability to accept much higher proportions of hydrogen gas. Early indications are that there are no barriers to a low level mix of hydrogen, apart from the need to adjust meters and regulators to measure energy consumed and regulate pressure. Conclusions about higher proportions are yet to be arrived at. There is confidence about the suitability of the plastic reticulation network to handle 100% hydrogen.

⁶⁶ Evoenergy. 2014. *ACT Gas Service & Installation Rules*. [online] Available at <<https://www.evoenergy.com.au/developers/service-and-installation-rules>>, p. 31.

c Trucks and tankers

Vehicles for the transport of hydrogen gas include high pressure tube trailers; cryogenic road and rail tankers; and cryogenic ships. The most likely road transport option that would be used within the ACT from production site to decentralised refuelling stations is that of tube trailers. Tube trailers transport hydrogen gas, in a gas form, under pressure, and are most efficient for smaller deliveries over small distances. Cryogenic transport containers transport hydrogen gas in liquid form, at much higher density and in much higher quantities, but at much higher cost.

F Legal frameworks

In the drafting of this report, the relevant “legal frameworks” were loosely categorised into “non-energy” and “energy-related” frameworks. Many of these frameworks are imposed nationally. Some are influenced by the realities of energy production and conveyance that take place outside the ACT, and that need to be managed consistently across State and Territory borders.

Where amendment to the framework is required to take place outside the ACT, we introduce the main aspects of the framework but do not discuss the finer details. Some aspects of these national frameworks do not accommodate hydrogen gas, in the way that it will be used in the ACT. Those aspects are identified in this report as a “gap” or “barrier” to hydrogen industry development.

1 Non-energy

ACT Authority	External Authority	Framework	Comment
WorkSafe ACT	Safe Work Australia	Work health and safety framework ⁶⁷	This is a national framework whereby States and Territories enact laws from a model law. WHS rules aim to eliminate and mitigate work place hazards. Hydrogen gas is a novel resource, however the potential dangers of hydrogen as a flammable gas are well-apparent. The WHS framework is not seen to require amendment in order to contemplate hydrogen gas.
Planning and Land Authority within EPSDD	National Capital Authority	Land use and development framework ⁶⁸	The Territory Plan controls how land in the Territory may be used. The hydrogen refuelling station in Fyshwick is a one-off land use accompanied by some ambiguity. It is not a useful precedent for private investors interested in hydrogen gas opportunities in the ACT. We see the land use and development framework as being an important pathway to the uptake and acceptance of hydrogen gas in the ACT.

⁶⁷ Safe Work Australia publishes the WHS legislation in each State and Territory. Available online at: <<https://www.safeworkaustralia.gov.au/whs-laws-your-jurisdiction>>. In the ACT the main WHS law is the *Work Health and Safety Act 2011* and *Work Health and Safety Regulation 2011*. For the purposes of this report, we also include the other legislation overseen by the Office of the Work Health and Safety Commissioner, namely the *Dangerous Substances Act 2004*, *Scaffolding and Lifts Act 1912*, *Machinery Act 1949* and associated subordinate legislation.

⁶⁸ Key law is the *Territory Plan 2008* made under the *Planning and Development Act 2007*. The following are also part of the framework: *Planning and Development Regulation 2008*, Precinct Codes, Development Codes, and General Codes. The *Territory Plan 2008* cannot be inconsistent with the *National Capital Plan* made under the *Australian Capital Territory (Planning and Land Management) Act 1988 (Cth)*.

ACT Authority	External Authority	Framework	Comment
Environment Protection Authority	EPA (NSW), Dept of Agriculture, Water and Environment (Cth)	Environmental protection framework ⁶⁹	The ACT's Environmental Protection Act aims to prevent pollution and environmental damage. The EPA's relevance, apart from its involvement in land use decisions, is in relation to pollutants. "Gas" is referred to generically in the Act. If any gas causes environmental harm it can come within the purview of the EPA. The odorant ⁷⁰ for hydrogen could be a pollutant, but this is unlikely. The discharge produced from reverse osmosis of the feed water may be subject to environmental assessment and further treatment.
WorkSafe ACT, ACT Construction and Workplace Licensing	Safe Work Australia and Department of Industry, Innovation and Science	Construction industry regulatory framework ⁷¹ (including occupational licensing) ⁷²	Construction occupations are licensed to ensure standardised outcomes. Gas fitting licences for gas fitting occupations depends on the type of gas appliance as defined in the <i>Gas Safety Act 2000</i> . Although the law usually "takes up" the occupational standards formulated at the administrative and industry levels into existing licence categories, it is nonetheless recommended that a specific hydrogen gasfitting licence category should be considered.
ACT Road Transport Authority	National Heavy Vehicle Regulator	Heavy vehicle national framework	Heavy vehicles used to convey hydrogen gas will be governed by the <i>Heavy Vehicle National Law</i> , which is a national scheme.

⁶⁹ The ACT legislation is the *Environment Protection Act 1997*, *Water Resources Act 2007*, *Energy Efficiency (Cost of Living) Improvement Act 2012* and the *Nature Conservation Act 2014*, among others. Available online at: <https://www.environment.act.gov.au/about/legislation_and_policies>. The main Federal legislation is the *Environment Protection and Biodiversity Conservation Act 1999* among others. Available online at: <<https://www.environment.gov.au/about-us/legislation>>.

⁷⁰ Odorants are needed for invisible gases like hydrogen so that leaks can be detected. As mentioned earlier, a leak of hydrogen into an enclosed space could easily combust. Research is being conducted to identify an odorant for hydrogen.

⁷¹ The ACT legislation is the *Building Act 2004* amongst others, available online at: <<https://www.planning.act.gov.au/build-buy-reno/for-industry/industry-resources/legislation>>. More broadly, regulation of the construction industry takes place through the building and plumbing codes, together with the *National Construction Code* ("NCC").

⁷² Key law is the *Constructions Occupations (Licensing) Act 2004* and the *Regulations* made thereunder.

ACT Authority	External Authority	Framework	Comment
Dangerous Substances Licensing Access Canberra	Australian Code for the Transport of Dangerous Goods by Road and Rail	Transport of dangerous goods code	This framework regulates the people and the machines involved in the transport of dangerous goods, such as the consignor, prime contractor and driver, and the vehicles used. Both the driver and the vehicle must be licensed to carry the dangerous goods concerned. Hydrogen gas is already accounted for under the dangerous goods list in table 3.2.3. Requirements are contained in the Code. ⁷³

2 Energy

Regulation of the gas industry is achieved through licensing, compliance with codes, standards and legislation. The relationship of consumers with utilities is heavily regulated.

The boundary between a gas distribution network and a customer's premises is at the point of supply, which is the outlet at the meter assembly. We are not of the opinion that any amendment is required to the definition of gas network.

ACT authority	External authority	Framework	Comment
Independent Competition and Regulatory Commission ("ICRC")	Australian Energy Market Commission ("AEMC") and Australian Energy Market Operator ("AEMO")	National Gas Law ("NGL") and Rules ("NGR") ⁷⁴	This framework contains the key definitions relating to gas and pipelines. It only covers "covered" transmission and distribution pipelines. The NGL and NGR are applied in the ACT to regulate the transmission and distribution of natural gas under the national energy market framework. The AEMC can make subsequent amendments to the NGR using its powers in the National Gas Law.

⁷³ National Transport Commission. 2020. *Australian Code for the Transport of Dangerous Goods by Road and Rail* ("the Australian Dangerous Goods Code"). [online] Available at: <<https://www.ntc.gov.au/codes-and-guidelines/australian-dangerous-goods-code>>.

⁷⁴ The ACT's *National Gas (ACT) Act 2008* applies the *National Gas (South Australia) Act 2008 (SA)*. The Schedule of the SA Act sets out the National Gas Law ("NGL") which describes the subject matter and making of the National Gas Rules by the AEMC.

ACT authority	External authority	Framework	Comment
ICRC	Australian Energy Regulator (“AER”) and AEMO	National Energy Customer Framework (“NECF”) ⁷⁵	This framework governs the relationship that energy retailers have with grid-connected customers. This includes rights, obligations and consumer protection in conjunction with consumer’s rights under the Australian Consumer Law. Importantly, it is the AER that decides pricing for covered pipeline services (the ICRC has no pricing role with respect to gas). Guidelines are written by the AER, and procedures by the AEMO. ⁷⁶ NERL Retailers operating in the ACT and utilities licensed under the <i>Utilities Act 2000</i> must adhere to any relevant Industry Codes. ⁷⁷
ICRC and ACT Utilities Technical Regulator (“UTR”)	N/A	Safety and licencing framework ⁷⁸	The ACT’s <i>Utilities Act 2000</i> and <i>Utilities (Technical Regulation) Act 2014</i> provide a framework of utility licensing, approved industry and technical codes, and compliance. “Gas” has the same definition as under the NGL. In the absence of NGL reform, the ACT would need to step outside the national scheme to bring hydrogen gas pricing (see above), regulation and industry development within the ACT’s own control.

⁷⁵ Key laws are the *Competition and Consumer Act 2010* (Cth) and the *National Energy Retail Law (ACT) Act 2012* (“NERL”) and Regulations made thereunder, amongst others. Available online at: <https://www.environment.act.gov.au/energy/reliable-and-affordable-energy/national_energy_customer_framework>. The NERL focuses on protections for grid-connected customers. The ACT’s *Utilities Act 2000* and *Utilities (Technical Regulation) Act 2014* provide for relevant, approved industry and technical codes, and compliance.

⁷⁶ AEMC. 2020. *National Energy Consumer Framework*. [online] Available at: <<https://www.aemc.gov.au/regulation/energy-rules/national-energy-retail-rules/national-energy-customer-framework>> accessed 14/07/2020.

⁷⁷ The current version of the *Consumer Protection Code* issued by the ICRC commenced on 1 July 2020. The code contains guaranteed service levels and rebates enforced on gas distributors which, in the ACT, is Evoenergy. This code also applies to any NERL retailer selling electricity or gas in the ACT.

⁷⁸ Other laws under the safety umbrella are the *Gas Safety Act 2000* and the *Utilities Act 2000*.

ACT authority	External authority	Framework	Comment
ICRC and UTR	Energy NSW	Transmission pipeline licensing framework ⁷⁹	NSW licensed pipelines (transmission pipelines) currently deliver natural gas to the ACT and Queanbeyan region. This framework is relevant to the extent that the ACT wants to receive, or is forced to receive, hydrogen gas into the Territory via the pipelines concerned. A minor section of the transmission line operated by East Australia Pipeline Ltd is located in the ACT. Licencing is through the ICRC.

⁷⁹ Main legislation is the *Pipelines Act 1967 (NSW)*, *Pipelines Regulation 2013 (NSW)* and *Environmental Planning and Assessment Act 1979 (NSW)*. According to Energy NSW:

Pipelines licensed in NSW under the Pipelines Act 1967 are usually designed, constructed, operated and maintained in accordance with Australian Standard AS 2885 - Pipelines - Gas and Liquid Petroleum. Where pipelines do not carry gas or liquid petroleum gas as defined under AS2885, a pipeline proponent may suggest an alternative Standard for approval by the Secretary of the Department of Planning, Industry and Environment.

Statement from Energy NSW's website. [online] Available at: <<https://energy.nsw.gov.au/government-and-regulation/our-role-networks/pipelines>>.

G Authorities and markets

Regulators play an important role in ensuring that participants comply with the law. The National Competition Council makes decisions on the classification of natural gas pipelines and recommendations for the regulation of third-party access to monopoly infrastructure.⁸⁰ The gas pipeline network is a major infrastructure facility and a natural monopoly. Other entrants could not develop another facility side by side to that which is presently in place, to provide the same service. Thus, a competitive regime must be created based on access to the existing facility.

The National Competition Council classifies gas assets into either “full regulation”,⁸¹ “light regulation”⁸² or “uncovered”.⁸³ By default (under the National Gas Law) “covered” pipelines are subject to “full regulation” (also referred to as “access arrangement regulation”). Access to “uncovered” pipelines is a matter for commercial negotiation, without the involvement of a regulator.⁸⁴

The AER makes decisions on access arrangements to covered pipelines. Such a decision will set out the terms and conditions of access to the pipeline service. Access arrangements are made in accordance with the *National Gas (ACT) Act 2008* for a period of five years. The access arrangement contains terms and conditions for aspects of the contract such as:

- tariffs based on the freight haulage and capacity of freight haulage;
- nationally mandated technical specifications for the gas; and
- the pricing zone for the ACT, Queanbeyan and Palerang gas distribution network.

1 Who’s who in the energy market

Name	Details	Role in the market
AEMC	Established by Section 5 of the <i>Australian Energy Market Commission Establishment Act 2004</i> (SA)	AEMC is a rule maker. It aims to establish a level playing field. It has powers and functions under the National Gas Law, and makes the NGR and the National Energy Retail Law (as must be unanimously approved by the participating jurisdictions). Its jurisdiction with respect to gas is tied to the present definition of gas under the NGL.

⁸⁰ *Competition and Consumer Act 2010* (Cth), Section 29B.

⁸¹ Pricing for “full regulation” assets is determined by the AER.

⁸² Pricing for “light regulation” assets is overseen by the AER.

⁸³ Pricing for “uncovered” assets is agreed directly with users and the National Gas Rules, unless by approved exemption from a Commonwealth Minister.

⁸⁴ National Competition Council. 2013. *Gas Guide*, page 12. [online]. Available at: <<https://ncc.gov.au/index.php/making-an-application/guides>>.

Name	Details	Role in the market
AEMO	Established in 2009 by the Council of Australian Governments (“COAG”) and the Ministerial Council of Energy (“MCE”) ⁸⁵	AEMO is a market operator. It manages the wholesale gas markets of eastern and south Australia. Its jurisdiction with respect to gas is tied to the present definition of gas under the NGL.
AER	Established by Section 44AE of the <i>Competition and Consumer Act 2010</i> (Cth)	AER regulates access to pipelines and pricing for the conveyance of gas through those pipelines. It has powers and functions under the NGL and the National Energy Customer Framework. As already mentioned, the ACT does not have unique regulations concerning gas network pricing or gas retail pricing.
ICRC	Established under Section 5(a) of the <i>Independent Competition and Regulatory Commission Act 1997</i>	ICRC is a regulator of the industry in the ACT. It issues gas transmission and gas distribution licences to utilities and approves or determines industry codes under the <i>Utilities Act 2000</i> .
UTR	Established under Section 77 of the <i>Utilities (Technical Regulation) Act 2014</i>	Amongst other things, the UTR audits the performance and compliance of regulated utility services such as gas. It also forms technical codes for GS&I Rules, which reference compliance with the Australian Standard for gas (AS 4564). ⁸⁶ All work associated with the consumer piping downstream of the point of supply is governed by legislation, codes or standards. The requirements for this work can be found in the <i>Gas Safety Act 2000 (ACT)</i> and <i>AS/NZS 5601.1 Gas installations</i> .

⁸⁵ In 2011 COAG agreed to merge the MCE with the Ministerial Council on Mineral and Petroleum Resources to form the Standing Council on Energy and Resources (SCER).

⁸⁶ AS 4564 specifies the characteristics of general purpose natural gas. Through its technical definition of the gas it describes (the Wobbe index), the standard can be interpreted to permit a small amount of hydrogen gas to be present in a natural gas stream without taking the blended gas outside the parameters of the standard.

Name	Details	Role in the market
Evoenergy	Trading name for ActewAGL Distribution, ultimately owned by Icon Water Limited and Jemena Ltd in a 50-50 split.	Evoenergy is a service provider (also referred to as “gas distributor”). It owns the ACT, Bungendore, Jerrabomberra, Nowra and Queanbeyan gas networks. ⁸⁷ Evoenergy issues the GS&I Rules which set out the requirements for the safe, reliable and efficient connection of a gas connection service from a gas distribution pipeline to a customer’s premises.
ActewAGL, Origin Energy	Major gas retailers in the ACT.	Retailers buy gas from producers, and pay the haulage costs (through pipelines) to the pipeline owners. They then sell the gas to the end customer, charging the cost of the gas, the delivery cost paid to the pipeline owners, and a margin for expenses and profit.
Icon Water	Icon Water Limited is an unlisted public company owned by the ACT Government.	Icon Water is a supplier of water entitlements in the ACT. Hydrogen producers could draw on Icon Water for their supply of water.
Jemena Ltd	Largest utility in NSW. Owns \$11 billion of gas and electricity major utility infrastructure. ⁸⁸	Jemena is a service provider. It owns the Eastern Gas Pipeline (Licence 26 Bombala to Sydney) which delivers two thirds of the ACT’s consumer gas.
East Australian Pipeline Limited	Utility in NSW. Owns \$22 billion of energy infrastructure.	APA Group owns Licence 16 Moomba to Sydney transmission pipeline. It has assets located in the ACT/Queanbeyan region.

2 Regulators within the ACT

a Independent Competition and Regulatory Commission

The ICRC is the jurisdictional regulator in the ACT.⁸⁹ ICRC issues entities with licenses to operate as a gas distribution or transmission network utility under the *Utilities Act 2000* (ACT).

ICRC’s objectives include:

- to “encourage safe, reliable, efficient and high quality utility services at reasonable prices”;⁹⁰ and

⁸⁷ Evoenergy. *Why are our consumers important to us?* [online]. Available at: <<https://www.evoenergy.com.au/consumer-engagement-program>>.

⁸⁸ Jemena. *Who we are.* [online] Available at: <<https://jemena.com.au/about/about-us/who-we-are>>.

⁸⁹ See *National Energy Retail Regulations* (SA), Reg 4.

⁹⁰ *Utilities Act 2000*, Section 3(a).

- to “ensure that the Government’s programs about the provision of utility services are properly addressed”.⁹¹

Part 4 of the *Utilities Act 2000* (ACT) provides for Industry Codes which cover details such as connections to a network; guaranteed service levels scheme within the meaning of the National Energy Retail Law (ACT); the metering of utility services; and arrangements between licensed distributors and suppliers concerning the use of a network. Part 4 also applies to persons holding a retailer authorisation under the National Energy Retail Law (ACT) (“NERL retailers”).

Evoenergy is licensed to provide gas distribution and connection services in the ACT, Queanbeyan and Palerang. A small section of gas transmission pipeline in the ACT operated by East Australia Pipeline Ltd is also licensed by ICRC.

b Technical Regulator within EPSDD

The *Utilities Act 2000* (ACT) provides a regulatory framework for utility services, including gas utilities. The *Utilities (Technical Regulation) Act 2014* provides further technical detail and obligations. The administering directorate of this framework is the Environment, Planning and Sustainable Development Directorate (“EPSDD”). The Director-General of EPSDD is the Technical Regulator of utility services in the ACT.⁹²

The purpose of technical codes set out in the *Utilities (Technical Regulation) Act 2014* is to protect the integrity of regulated utility networks and regulated utility services; ensure proper connection of customers’ premises to a regulated utility network; and establish design features, performance requirements and emergency planning, amongst other things.⁹³ Licenced utilities must comply with technical codes.⁹⁴ Unlicensed regulated utilities must apply to the technical regulator for an operating certificate.⁹⁵

The functions of the Technical Regulator are, amongst other things, to prepare and consult with respect to proposed codes; monitor and enforce compliance with technical codes; and audit performance and provide advice to the Minister and ICRC. In all respects the focus is on ensuring that gas safety standards are met.

The *Utilities (Gas Service and Installation Rules Code) Determination 2013* (“the Code”) is an instrument under the Act. Under the Code, gas distributors must produce, publish and adopt Gas Service and Installation Rules (“GS&I Rules”) which set out the requirements for safe, reliable and efficient connection from a gas distribution network to a customer’s premises. The *GS&I Rules* allow a gas distributor to refuse to provide gas supply to a customer if the consumer piping installation has not been certified in accordance with the *Gas Safety Act 2000* (ACT).⁹⁶

⁹¹ *Utilities Act 2000*, Section 3(h).

⁹² Utilities Technical Regulation. 2020. [online] Available at: <https://www.accesscanberra.act.gov.au/app/answers/detail/a_id/2203/~/utilities-technical-regulation>.

⁹³ *Utilities (Technical Regulation) Act 2014*, Section 11.

⁹⁴ *Ibid*, Section 25(2)(a)(iv).

⁹⁵ *Ibid*, Section 43.

⁹⁶ *Utilities (Gas Service and Installation Rules Code) Determination 2013*, code 5.3.

c Planning and Land Authority within EPSDD

The Planning and Land Authority is established under the *Planning and Development Act 2007* (“P&D Act”).⁹⁷ The Authority has wide-ranging functions and responsibilities. For present purposes it is the power to propose amendments to the Plan that is of key importance.⁹⁸ No use or development of land in the ACT can go ahead unless it is permitted under the Territory Plan in the location in which it is proposed, and the actual development is further approved by the Authority.

The Authority has the role of putting forward draft Plan variations to the Legislature, of its own volition, after following certain prescribed processes under the P&D Act.⁹⁹ Further, the Minister may give written directions to the Authority about the general policies the Authority must follow, or to require the Authority to vary or review the Plan.¹⁰⁰

Thus, if Plan changes are required for the uptake of a hydrogen gas capability in the ACT, the Authority would be a key player in that process.

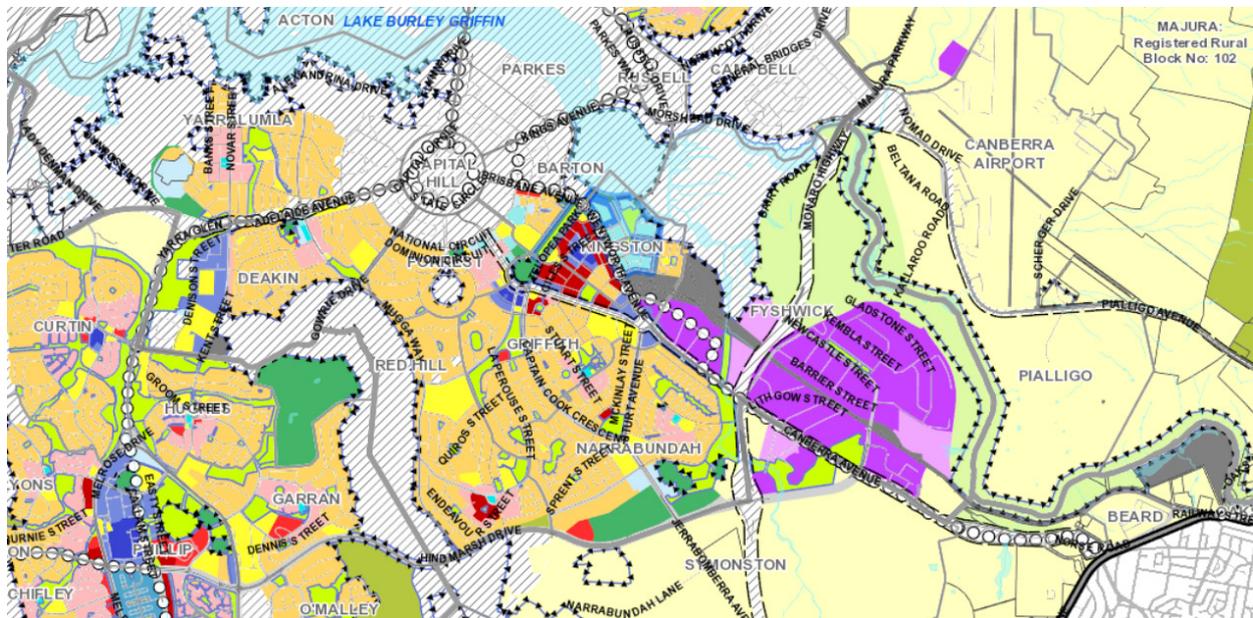


Figure 7 - Territory Plan of the Fyshwick region.¹⁰¹

d Environment Protection Authority

The Environment Protection Authority (“EPA”)¹⁰² is established under Section 11 of the *Environment Protection Act 1997*. The Authority’s functions are to administer the Act, with regard to the objects of

⁹⁷ *P&D Act*, Section 10.

⁹⁸ *Ibid*, Section 12(1)(b).

⁹⁹ *Ibid*, Part 5.3.

¹⁰⁰ *Ibid*, Section 14(1).

¹⁰¹ The ACT’s pilot hydrogen electrolyser and refilling station projects are to be found in the purple shaded area on Canberra Avenue west of the Monaro Highway (which in Figure 7 is to the left of the Monaro Highway).

¹⁰² Environment, Planning and Sustainable Development Directorate. *Territory Plan Overview*. [online] Available at: <https://www.planning.act.gov.au/planning-our-city/territory_plan/territory_plan_master_page>.

the Act. The EPA has the ability to direct that an Environmental Impact Statement (“EIS”) be prepared to authorise an activity, in circumstances where:

- an approval is required for the activity, and that approval pertains to a development application (“DA”) process under the *Planning and Development Act 2007* (“the P&D Act”) where that application must be considered in the impact track;¹⁰³
- an application for an environmental authorisation is made by a person because the activity falls within Schedule 1 of the EPA Act;¹⁰⁴ or
- the EPA specifies that a person should hold an environmental authorisation with respect an activity.¹⁰⁵

The EPA is also called upon for the purposes of Territory Plan variation procedures, and is an agency that must be consulted for the purposes of development applications in the less-contentious merit track. The manner in which the Territory Plan is varied will influence the EPA’s supervision of hydrogen-related activities which may in any event be referred to in Schedule 1 of the EPA Act. Given the EPA’s general jurisdiction with respect to environmental harm, it can choose to become involved in hydrogen development if it feels that threshold is met, without necessarily requiring its legislation to be amended. EPA intervention is however unlikely for so long as industry development moves forward in accordance with proper standards.

e WorkSafe ACT

The *Work Health and Safety Act 2011* (ACT) (“the WHS Act”) is a framework for the health and safety of workers. It is intended to be part of a set of laws protecting the interests of workers on a nationally-consistent basis. The framework considers workers, workplace representation, unions and employer organisations, advice and training in relation to work health and safety as well as scrutiny, compliance and enforcement measures.¹⁰⁶ The Act imposes non-transferable duties to ensure, as far as is reasonably practicable, the health and safety of persons who it is reasonably foreseeable would be at the workplace.

The regulator under the WHS Act is the WHS Commissioner.¹⁰⁷ The regulator has functions under Part 8 of the WHS Act, including the function of promoting and supporting education and training on matters relating to work health and safety.¹⁰⁸ WorkSafe ACT is the directorate supporting the ACT Work Safety Commissioner. In its management and enforcement of work health and safety laws, WorkSafe ACT applies a “blended” approach, involving education and compliance.¹⁰⁹

¹⁰³ *Planning and Development Act 2007*, Section 123 (unless an EIS exemption is granted).

¹⁰⁴ *Environment Protection Act 1997*, Section 42.

¹⁰⁵ *Ibid*, Section 43.

¹⁰⁶ *Work Health and Safety Act 2011*, Section 3.

¹⁰⁷ *Ibid*, Dictionary. See also Schedule 2 Section 2.22.

¹⁰⁸ *Ibid*, Section 152.

¹⁰⁹ The laws within WorkSafe ACT’s scope are the *Work Health and Safety Act 2011*, *Scaffolding and Lifts Act 1912*, *Machinery Act 1949*, *Dangerous Substances Act 2004*, *Dangerous Goods (Road Transport Act) 2009*, *Fuels Rationing Act 2019*, *Workers Compensation Act 1951* and *Long Service Leave Act 1976*.

WorkSafe ACT also has limited licensing functions under the *Work Health and Safety Act 2011* (“WH&S Act”) and the *Dangerous Substances Act 2004*,¹¹⁰ whereby licences and permits are granted to individuals. Much of the education about specific codes, standards, licensing or certification occurs in the construction and workplace licensing space.

The ACT’s WHS legislation, like that of other jurisdictions, is based on non-delegable duties of persons conducting businesses and undertakings, to provide, *inter alia*, “safe systems of work”. The WHS Regulations refer to environments of danger such as hazardous atmospheres caused by flammable gas. They are not seen to require specific amendment for the introduction of hydrogen gas, although education and training that takes place with a view to ensuring that businesses and undertakings provide safe systems of work will need to be adapted and revised at the working level, not the legislative level. A hazard mitigation strategy would be to require certain modules of learning prior to occupational licencing.¹¹¹

Nonetheless the ACT should ensure that WHS regulations are not a barrier to hydrogen industry development and hydrogen uptake, and adequately cover workplaces handling hydrogen gas. Of particular relevance will be Chapter 7 of the *Work Health and Safety Regulation 2011*, which makes provision for labelling, data sheets and access to safety data sheets to people who need them.

Schedule 15 of the *Work Health and Safety Regulation 2011* is also notable. It defines the threshold amount of “hazardous chemicals” that characterise a workplace as a facility for the purposes of the overall regulation.¹¹² Hydrogen is mentioned as bringing a workplace into the major hazard facility category if the amount stored exceeds 50 tonnes. One respondent felt that as the ACT’s hydrogen uptake increased, this would be too low. Another felt that the 50t threshold was too high already. Given this divergence of opinion no recommendation for amendment has emerged.

f Construction Occupations Registrar

The Construction Occupations Registrar is appointed under Part 9 of the WH&S Act. The Registrar may make determinations about training “if the registrar is satisfied on reasonable grounds that the training is reasonably necessary for the development or enhancement of skills or knowledge of licensees in the construction occupation or class”.¹¹³ These determinations are required to be made in the form of a disallowable instrument, and therefore must be notified and presented to the Legislative Assembly under the *Legislation Act 2001*.

Importantly, the Construction Occupations Registrar licences gas fitters and gas appliance (type A and type B) workers. The occupation of gasfitter, which will be centrally relevant to the uptake of hydrogen in the ACT, is a construction occupation under the WH&S Act.¹¹⁴ Gas fitting work is a signpost definition under the *Construction Occupations (Licensing) Act 2004*, referencing the *Gas Safety Act 2000*.¹¹⁵ The definition of gas under the *Gas Safety Act 2000* refers to “a gas (LPG) in its

¹¹⁰ Noting that hydrogen gas is an explosive risk, not a toxic risk.

¹¹¹ See *Work Health and Safety (Managing Risks of Hazardous Chemicals in the Workplace) Code of Practice 2015* (Cth) for references to hydrogen in the workplace.

¹¹² Table 15.6.2 Item 24 addresses hydrogen. The threshold quantity (t) is 50. See *Work Health and Safety Regulation 2011*, Schedule 15.

¹¹³ *Construction Occupations (Licensing) Act 2004*, Section 104B.

¹¹⁴ *WH&S Act*, Section 7.

¹¹⁵ The relevant definitional trail for “gasfitter” and “gas” ends up with a definition of “gas” in the *Gas Safety Act 2000* that does not specifically include hydrogen. This should be clarified.

vapour phase composed predominantly of 1 or more of the following hydrocarbons: (i) propane; (ii) propene (propylene); (iii) butane (iv) butene (butylene)". This is ambiguous as to whether it picks up AS/NZS 4564 (Specification for general purpose natural gas) definition, which permits the blending of up to 10% hydrogen in the stream, or whether it is more exclusively tied to the definition of hydrocarbons, as per the NGL.

Licensing of gasfitters is divided into classes in Part 6 of the *Construction Occupations (Licensing) Regulation 2004* ("the COL Regulation"). Different types of gas fitting licences are described in the COL Regulation.¹¹⁶

Gas appliance worker licences can be for type A gas appliances and type B gas appliances, and can be granted on a restricted and unrestricted basis. Items such as portable barbeques are not covered by this scheme, because those items are not connected to a "consumer piping system", which is a central element of the defined work for which licensing is required.¹¹⁷

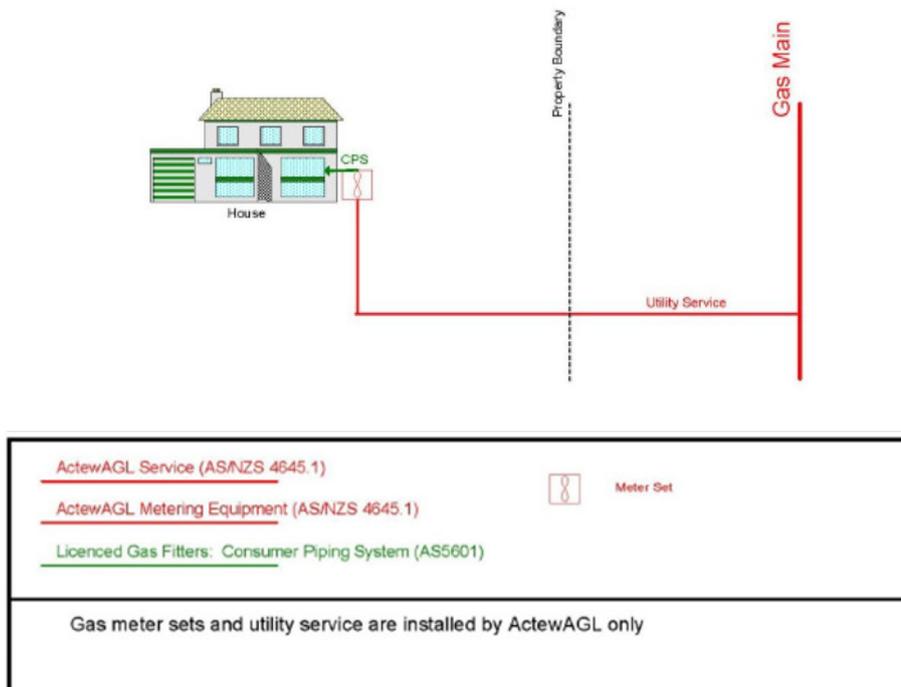


Figure 8 - "Scope of works for licensed gas fitters" showing that the consumer piping system starts from directly after the metering equipment.¹¹⁸

3 Regulators external to the ACT

a Australian Energy Market Commission (AEMC)

The AEMC was established by Section 5 of the *Australian Energy Market Commission Establishment Act 2004* (SA) as a body corporate independent of any directions by the South Australian Minister. It

¹¹⁶ COL Regulation, Schedule 1, Part 1.7.

¹¹⁷ Gas Safety Act 2000, Section 6A.

¹¹⁸ GS&I Rules, p. 27.

has rule-making, market development and other functions conferred by the National Energy Laws.¹¹⁹ The three overarching laws are the National Electricity Law (“NEL”), the National Gas Law (“NGL”) and the National Energy Retail Law (“NERL”). These laws are in force in the ACT *via* the application statute, namely the *National Gas (ACT) Act 2008*.

In the performance of its functions, AEMC must have regard to any relevant objectives set out in the National Energy Laws. The national gas objective promotes:

*...efficient investment in, and efficient operation and use of, natural gas services for the long-term interests of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural gas.*¹²⁰

The AEMC-made rules generally relate to:

- the operation of the national electricity and gas markets;
- the safe, secure and reliable operation of those systems;
- participants in the energy retail market; and
- the provision of connection services to retail customers.

The National Gas Rules include rules that provide the basis for third party access to transmission and distribution pipelines.¹²¹ AEMC also makes rules with respect to AEMO’s gas trading exchange functions and the operation of a gas trading exchange.¹²² These rules have the force of law.¹²³ Amendment of the National Gas Rules is outside the ACT’s jurisdiction. Although the ACT can lobby

¹¹⁹ Section 3 of the *Australian Energy Market Commission Establishment Act 2004* (SA) provides:

The National Energy Law means

- (a) *a National Electricity Application Act; or*
- (b) *the National Electricity Law; or*
- (c) *the National Electricity Regulations; or*
- (d) *the National Electricity Rules; or*
- (e) *a National Gas Application Act; or*
- (f) *the National Gas Law; or*
- (g) *the National Gas Regulations; or*
- (h) *the National Gas Rules; or*
- (i) *a National Energy Retail Law Application Act; or*
- (j) *the National Energy Retail Law; or*
- (k) *the National Energy Retail Regulations; or*
- (l) *the National Energy Retail Rules.*

¹²⁰ Part 3 Division 1 of the *National Gas (SA) Act 2008*. Note the repeated references to “natural gas”.

¹²¹ AEMC. 2020. Gas. [online] Available at: <<https://www.aemc.gov.au/energy-system/energy-system>>.

¹²² *National Gas Law* – Schedule, Section 72 – Subject matter for *National Gas Rules*.

¹²³ Part 4 of the *National Gas (SA) Act 2008*.

for change, like any other participating jurisdiction, the NGR themselves are outside the control of the ACT.¹²⁴

The National Gas Law is relevant for the use of the gas “grid” which extends into the ACT, and to how ACT industry and residents interact with the rest of the gas network. “Gas” is referred to as “*natural gas*”, in the sense of “*naturally occurring hydrocarbons, or a naturally occurring mixture of hydrocarbons and non-hydrocarbons, the principal constituent of which is methane*”. Hydrogen gas is not within the scope of this definition.

That said, there is nothing about the National Gas Law that perpetually cedes the ACT’s sovereignty¹²⁵ with respect to the governance of its own territory. Failing collaborative change within a time period that suits the ACT’s policy objectives, the ACT could consider forcing the issue within its own territorial limits. The ACT could seek to regulate the distribution network in the ACT and its users in a manner that accommodates production, injection points, usage and pricing of hydrogen gas within a blended hydrocarbon and synthetic gas mixture that complies with existing up-to 10% allowance for appliances, and which allows for even greater proportions of hydrogen gas as evolving pipeline and appliance standards allow. It would not be the first time that the ACT has enacted its own legislation with respect to an issue of national interest, even of national controversy, in a way that is out of step with the rest of Australia.

The relevant modification would be made to the *Utilities Act 2000 (ACT)*. It would licence a utility to inject hydrogen gas into the secondary network in the ACT, owned by Evoenergy.¹²⁶ This might not be consistent and efficient in the first instance, and would likely be criticised by the other jurisdictions that have signed-on to the NGL and by the institutions that govern its operation.

Indeed, why not consider the establishment of a “regulatory sandbox” that applies to the consumption of a blended hydrogen/natural gas across the entire gas infrastructure network serving the ACT? As per the AEMC’s *Final Report – Regulatory Sandboxes – Advice to COAG Energy Council on Rule Drafting* (26 March 2020):¹²⁷

*A regulatory sandbox is a framework within which participants can trial innovative concepts in the market under relaxed regulatory requirements at a smaller scale, on a time-limited basis and with appropriate safeguards in place.*¹²⁸

These recommendations were made by the Report:

The recommended regulatory sandbox toolkit includes three new tools designed to be used sequentially:

¹²⁴ Noting, however, that changes to the NGR must be unanimously approved by participating jurisdictions, in which sense the ACT has a form of control by veto.

¹²⁵ The word “sovereignty” is here used in a qualified sense, in that the ACT’s powers are described and granted under Commonwealth legislation, the *Australian Capital Territory (Self Government) Act 1988 (Cth)*, pursuant to which the ACT Executive has power to govern with respect to the “[u]se and supply of energy” (Section 37 and Schedule 4).

¹²⁶ Noting that the ACT is a 50% shareholder in Evoenergy through its 100% ownership of one of the JV partners, Icon Water.

¹²⁷ AEMC. 2020. *Final report | Regulatory Sandboxes – Advice to COAG Energy Council on Rule Drafting*. [online]. Available at: <https://www.aemc.gov.au/sites/default/files/documents/regulatory_sandboxes.pdf>.

¹²⁸ *Ibid*, page i.

1. *an innovation enquiry service to provide guidance and feedback that can help facilitate trials that are feasible under current laws and rules*
2. *a new regulatory waiver power for the Australian Energy Regulator (AER), that can provide temporary exemption for trials from regulatory obligations arising out of the existing rules or from the registration requirements in the laws*
3. *a new AEMC trial rule change process that can temporarily change existing rules or temporarily introduce a new rule of limited application to allow a trial to go ahead.*¹²⁹

An investigation and assertion of this concept, within AEMC and National Cabinet, could lead to direct regulatory change without a “sandbox” as a precursor for such change. Other jurisdictions may be induced to recognise that hydrogen gas could be delivered into the grid at locations closer to end users, and that the national scheme should adapt rather than dictate. If that does happen, then the ACT’s experiment will be seen to have been in the interests of national gas reform, rather than being oppositional. If hydrogen delivers a competitive advantage to the ACT, measured in terms of cost, social benefit, or a combination of the two, other jurisdictions would be encouraged to follow suit, thereby bringing about the collaborative change that all would agree would be better suited to the objective.

b Australian Energy Regulator (AER)

The Australian Energy Regulator, established by Section 44AE of the *Competition and Consumer Act 2010* (Cth), monitors and enforces the National Energy Customer Framework (“NECF”).¹³⁰ The NECF regulates the connection, supply and sale of energy to end users on the grid. The NECF provides energy-specific consumer protections that operate alongside protections in the Australian Consumer Law.¹³¹

The AER has a broad range of functions and powers. The AER is primarily responsible for monitoring compliance with the national energy laws, as well as investigating breaches of the energy law and rules referred to the AER by AEMO. The AER administers energy retailer authorisations, as well as retailer exemptions.¹³² When exercising its powers and functions, it must have regard to the “national gas objective”. The AER sets the revenues that regulated service providers can recover and the maximum prices they can charge for the delivery of gas through the pipelines they own and/or operate. It does not regulate the wholesale or retail price of the gas conveyed by the pipeline network.

Assuming that the ACT maintains a collaborative stance, then the AER will be centrally important to the development of a hydrogen gas industry, and where that occurs. Capital projects will need access points to the network. They will introduce new competitive and infrastructural considerations in the pricing of asset usage and maintenance. Existing network owners would no doubt insist that the introduction of hydrogen into gas networks at a high scale be enabled by market mechanisms that recognise their existing investment and their desired returns. Capital works, such as upgrades to

¹²⁹ Ibid.

¹³⁰ The NECF is comprised of the *National Energy Retail Law*, the *National Energy Retail Regulations* and the *National Energy Retail Rules*.

¹³¹ *Competition and Consumer Act 2010* (Cth), Schedule 2.

¹³² See *AER (Retail) Exempt Selling Guideline – version 5 – March 2018* for details of deemed, registrable and individual exemptions.

existing network assets to accommodate hydrogen, can be expected to be and to become part of the regulated assets of the network owners, and would be subject to returns that are regulated by the AER.

c Australian Energy Market Operator (“AEMO”)

Broadly speaking, AEMO is responsible for the energy security of Australia’s gas and electricity markets. AEMO has a number of statutory functions and system functions under the National Gas Law. AEMO aims to deliver energy security. Accordingly, the primary statutory function is the operation and administration of markets for natural gas in accordance with the Rules and the Procedures “for ensuring a safe, secure, reliable and efficient declared transmission system”. AEMO also has gas trading exchange functions and capacity auction functions.¹³³ AEMO may also trade in natural gas.¹³⁴

AEMO interacts with transmission pipeline service providers and facility owners. AEMO has service envelope agreements with transmission pipeline service providers.¹³⁵ AEMO may also require, as a condition of permitting the connection of a facility to the declared transmission system, that the facility owner enter into an operating agreement with AEMO.¹³⁶

AEMO’s focus is on matters that are at the very highest level of natural gas supply. Hydrogen adaptations at the downstream level are likely to interfere with the marketisation of natural gas at the origins of the pipeline network, and will therefore be of interest to AEMO. To do anything about such a development, AEMO’s functions would need to encompass a more widely defined concept of gas than is presently the case under the NGL.

d Safe Work Australia

The model work health and safety (“WH&S”) laws are kept up to date by the national policy body Safe Work Australia. Safe Work Australia was established as a statutory agency under the *Safe Work Australia Act 2008* (Cth). The objective of this Act is to harmonise occupational health and safety legislation. This is intended to be achieved through national uniformity of the occupational health and safety framework, comprised of the Act, Regulation and model codes of practice.¹³⁷ Model laws do not automatically apply in the ACT unless the ACT adopts the law through an Act of Parliament. This statutory instrument would be put forward by the regulator, the ACT Work Safety Commissioner.¹³⁸

Model laws in relation to work safety are part of the Federal framework. They will need to be considered as part of the national hydrogen adoption effort rather than as a directly relevant topic in this report.¹³⁹

¹³³ *National Gas (SA) Act 2008*, Schedule – Chapter 1, Part 6, Division 1.

¹³⁴ *Ibid*, Division 2.

¹³⁵ *Ibid*, Section 91BE.

¹³⁶ *Ibid*, Section 91BF.

¹³⁷ *Inter-Governmental Agreement for Regulatory and Operational Reform in Occupational Health and Safety*, Clause 1.2

¹³⁸ Safe Work Australia. *Law and Regulation*. [online] Available at: <<https://www.safeworkaustralia.gov.au/law-and-regulation>>.

¹³⁹ Please refer to F-2.e above for observations regarding the operation of the ACT’s WH&S legislation in the context of hydrogen uptake.

e Australian Building Codes Board

The Australian Building Codes Board (“ABCB”) develops and maintains codes and standards through the National Construction Code (“NCC”),¹⁴⁰ comprised of the Building Code of Australia (“BCA”)¹⁴¹ and the Plumbing Code of Australia (“PCA”).¹⁴² The NCC was established by intergovernmental agreements prior to the *Australian Building Codes Board Intergovernmental Agreement 2020*, which continues its existence.¹⁴³ The ABCB reports to the Building Minister’s Forum (“BMF”).

ABCB is responsible for advice on policy development to strengthen regulation nationally, recognising that the States and Territories have primary responsibility for regulating building and construction.¹⁴⁴ In determining any changes to the NCC and requirements the ABCB aims to ensure that:

- *there is a rigorously tested rationale;*
- *the proposals are effective and proportional to the issues being addressed such that the code will generate benefits to society greater than the costs (that is, net benefits);*
- *there is no regulatory or non-regulatory alternative that would generate higher net benefits; and*
- *the competitive effects of the code have been considered and the regulation is no more restrictive than necessary in the public interest.*¹⁴⁵

ABCB is not responsible for the licensing of construction workers. This report focuses on occupational licensing, and does not go to the detail of construction practice codes, apart from identifying standards that may be relevant to the hydrogen gas industry. Construction practice code reform in light of the development of a hydrogen gas capability would be another area for attention at the national level, as required, most probably via the good offices of the ABCB.

f Department of Planning and Environment (NSW)

The *Pipelines Regulation 2013* (NSW) under the *Pipelines Act 1967* (NSW) sets up a framework for certain pipelines to be licensed and registered, surveyed, and operated in a safe manner.¹⁴⁶ This requires the lodgement of pipeline management plans for the pipeline management system, and the reporting of accidents and emergencies to the Secretary of the NSW Department of Agriculture, Water and the Environment.

¹⁴⁰ *Australian Building Codes Board Intergovernmental Agreement 2020*, clause 6.

¹⁴¹ Also known as volumes one and two of the NCC.

¹⁴² Also known as volume three of the NCC.

¹⁴³ The prior agreements were the Agreements of the Parties signed on 1 March 1994, as amended on 27 July 2001 by the Parties, the Agreement of the Parties on 26 April 2006, the Agreement of the Parties on 30 April 2012, and the Agreement of the Parties on 31 January 2018.

¹⁴⁴ *Australian Building Codes Board Intergovernmental Agreement 2020*, Recitals.

¹⁴⁵ *Ibid*, clause 6.1.b.

¹⁴⁶ In accordance with *AS 2885*.

Accordingly, the infrastructure for the gas supply into the ACT is governed by a NSW framework for licensed pipelines. In this regard a frequent topic in consultations held for the purposes of this report was embrittlement of high carbon content steel pipes that can be caused by hydrogen gas in high concentrations. This concern is assumed by most respondents to be a barrier to the easy, large scale uptake of 100% hydrogen through transmission pipelines.

At the time of writing NSW has no plans to upgrade pipeline¹⁴⁷ infrastructure to mitigate the risk of embrittlement. The presently relevant standards applied to those pipelines are the standards that together make up AS 2885.¹⁴⁸

That said, there is general industry confidence that the transmission pipelines can safely accommodate around at least 10% hydrogen from an operational perspective, and that this provides the hydrogen industry nationally with a significant opportunity for initial growth. Ultimately if Australia does follow an international trend to zero GHG emissions by 2050, with a consequent phase out of natural gas use, owners of these pipelines will need to adapt in some way.

g National Capital Authority

The Territory Plan, which is the ruling document for the land use and zoning in the ACT, cannot be inconsistent with the National Capital Plan (“NCP”). The NCP is made under Section 10 of the *Australian Capital Territory (Planning and Land Management) Act 1988* (Cth). The matters to be covered by the NCP include general standards necessary for the character of the National Capital to be maintained and enhanced, and special and desirable requirements for the development of any part of the ACT. The National Capital Authority must give works approval for development within “Designated Areas” of the NCP. Within these areas the NCP may set out detailed conditions of planning, design and development.

One would expect hydrogen industry development to be the very thing that the NCA would support, in maintaining Canberra’s character as a modern, forward-looking, international city. Further, should hydrogen industry infrastructure be proposed for a Designated Area, it is not clear why similar norms to those developed by the Territory Plan for energy infrastructure outside Designated Areas would not similarly be followed by the NCP.

Nonetheless, it is worth noting that the NCP does not presently incorporate a land use definition that would permit hydrogen gas production in any area over which it has direct planning jurisdiction. The “public utility” land usage under the NCP positively excludes such an activity, stating that the land use includes:

¹⁴⁷ “Pipeline” in this context means “a pipe or system of pipes for the conveyance of any substance, whether in a gaseous, liquid or solid state but does not include a pipe or system of pipes for the conveyance of petroleum within the adjacent area, as defined in the *Petroleum (Offshore) Act 1982* (NSW)”.

¹⁴⁸ These are *AS 2885.0 - 2008, Pipelines—Gas and liquid petroleum, Part 0: General requirements*; *AS 2885.1 - 2012, Pipelines—Gas and liquid petroleum, Part 1: Design and construction*; *AS 2885.2 - 2007, Pipelines—Gas and liquid petroleum, Part 2: Welding*; *AS 2885.3 - 2012, Pipelines—Gas and liquid petroleum, Part 3: Operation and maintenance*; and *AS/NZS 2885.5:2012, Pipelines—Gas and liquid petroleum, Part 5: Field pressure testing*. See *Pipelines Regulation 2013* (NSW), Regulation 3 (Definitions).

headwork and network undertakings for the provision of sewerage and drainage services or the reticulation of water, electricity, or gas except for gas manufacture and storage [underlining supplied]¹⁴⁹

The geographical intersection of land on which the ACT would propose to situate hydrogen gas manufacture or storage and the jurisdiction of the National Capital Authority will need to be considered, and NCP amendment sought, where a conflict emerges.

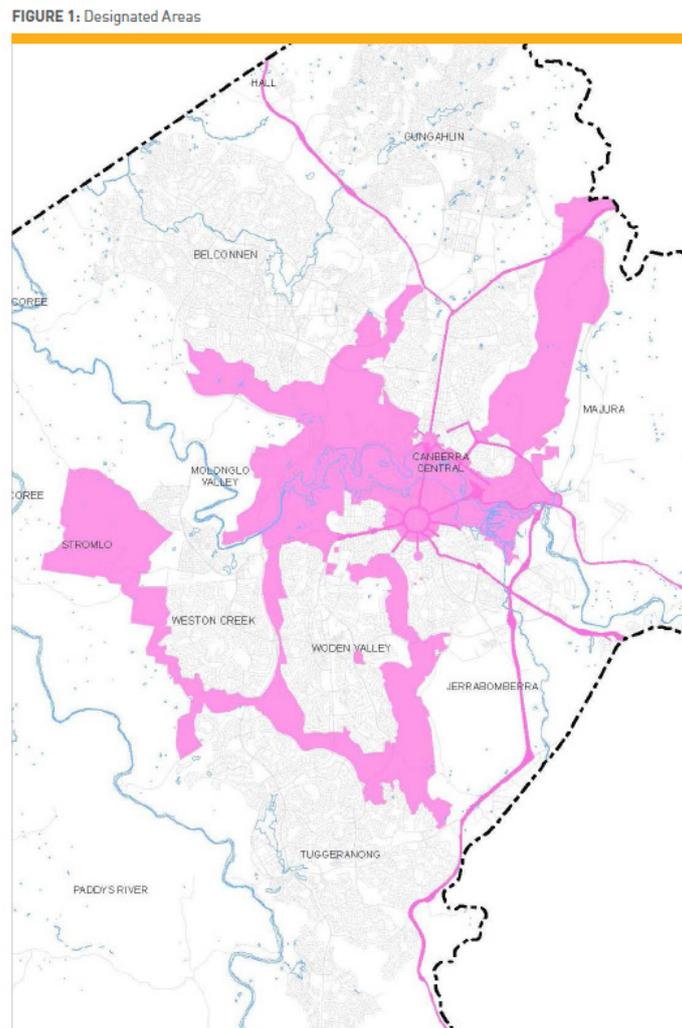


Figure 9 - NCP Designated Areas. Source: National Capital Plan

h National Transport Commission

The National Transport Commission regulates rail and road transport through the development of model laws, codes and guidelines such as the Heavy Vehicle National Law (“HVNL”)¹⁵⁰ and road user charges. It does this under the authority of the *National Transport Commission Act 2003* (Cth), which itself is supported and augmented by an agreement that is in place between the Commonwealth, the States, the Northern Territory and the ACT in relation to that Act.

¹⁴⁹ National Capital Plan, *Appendix A – Land use definitions*

¹⁵⁰ A heavy vehicle is a vehicle that weighs over 4.5 tonnes.

Hydrogen transportation vehicles are already subject to regulation. The National Transport Commission would be relevant to legislative change to the extent that hydrogen-powered heavy vehicles coming within its jurisdiction somehow required individual regulation.

H Recommendations – Land use, production and refuelling

1 The ACT planning system

What can or cannot be done on or with a block of land in Canberra depends on the uses that are permitted and approved under Federal and local planning documents, and under the individual Crown lease for the block concerned.

The Federal Government, through the National Capital Authority (“NCA”), has overarching control of land use through its broader National Capital Plan. This operates at a level of generality, except with respect to areas of specific interest to the NCA, such as in “Designated Areas”.

The ACT Territory Plan, under the *Planning and Development Act 2007* (“P&D Act”), sets out the specific areas of the ACT that may be used for particular purposes. It carefully defines each permitted use. There are, for example, zones and sub-zones for residential, commercial, industrial, community facilities, parks and recreation, and transport and service uses.

Property in the ACT can only be used in compliance with its Crown lease. Development approval is required to exploit a use, in the sense of the “development” involved in that exploitation. To use land for a purpose, or in a way, that is not currently permitted under a Crown lease, the leaseholder must first establish that the proposed new use is permitted in the zone in which the block is situated, and then apply for a variation of the lease to permit that use.

More significantly, if the purpose is not permitted because of the combined effect of the National Capital Plan and the Territory Plan, or of either of them, then the obstacle in the planning document/s concerned would need to be removed by variation of the relevant Plan itself. This typically occurs through rezoning, however the impediment may be removed by varying the words of the Plan (such as its definitions). Once that were to be achieved, the leaseholder would apply for the newly-permitted use under the planning document to be introduced into the Crown lease for the block, and would have to meet any other development conditions to exploit those new use rights, including any applicable lease variation charge (a statutory charge that captures all or part of the increase in value arising from the variation).

Not all land in the ACT is held under Crown leases. However all land is subject to the Territory Plan. Thus, the ACT Government itself is constrained in any use and development intentions it may have with respect to unleased land, and follows the practice of leasing it to itself in compliance with the Plan.¹⁵¹

Under the P&D Act:

*The Territory, the Executive, a Minister or a territory authority must not do any act, or approve the doing of an act, that is inconsistent with the territory plan.*¹⁵²

This leads to an important question for the purposes of this report. Is the use of land for hydrogen-related purposes fettered by the Territory Plan, and if so how should that be addressed? There are

¹⁵¹ The use of the word “itself” is not entirely accurate, in that it is the Territory Executive that has the function of managing Territory Land on behalf of the Commonwealth, and the Territory as a body politic that is the user of leased land in any particular instance.

¹⁵² *P&D Act*, Section 50.

two such uses that are of importance. They are the industrial purpose of hydrogen production, and the transport/consumer purpose of refilling fuel-cells in vehicles with hydrogen gas.

2 Territory Plan changes for hydrogen gas uptake

The key part of the Territory Plan for these purposes is its Dictionary. It is here that land uses are defined. Any land use proposed for the ACT must find a “home” in the Plan.

The ActewAGL electrolyser and hydrogen refuelling station location in Fyshwick is a good example of the need for the Territory Plan to be updated to incorporate a clearer use definition for both the production and sale of hydrogen. Concepts centred around traditional petrol and service stations and the use of petrol as a fuel have led to constrained definitions that do not adequately cover the production and use of hydrogen.

The block on which the ActewAGL electrolyser and hydrogen refuelling station in question is situated is in a “TSZ2 - Services Zone”. In this zone, “liquid fuel depots” and “service stations” are prohibited developments. It was approved as a “municipal depot”, the definition of which under the Territory Plan is as follows:

*Municipal depot means the use of land for the storage of any plant, machinery, vehicles, light rail vehicles or materials used in the course of a municipal undertaking, whether or not facilities are included for the parking, servicing and repair of plant, machinery or vehicles.*¹⁵³

On one view it is difficult to conceive that “production” (of hydrogen) is captured in a definition dealing with storage (of various transport related equipment). That said, the approval of the ActewAGL facility was assisted by the first of the Transport Zone 2 (“TSZ2”) objectives, which is to:

*[m]ake provision for essential municipal services such as water, energy, transport and waste disposal*¹⁵⁴

One would think that making “provision for” energy is broad-enough to permit hydrogen production. But it might also be considered to be less specific than is ideal. Further, it is not clear how it is that refuelling is covered, unless the devices at that site are considered to “service” the vehicles that are refilled at that location, by the act of refilling.¹⁵⁵

The thinking that allowed for the development of the ActewAGL pilot project is not something that can be extended to the production and sale of hydrogen on traditional commercially-operated “service

¹⁵³ *Territory Plan 2008 NI2008-27, “13. Definitions”.*

¹⁵⁴ *Ibid, “8.1 - TSZ1 – TSZ2 Objectives and Development Tables”*

¹⁵⁵ Noting also that “service station” is a prohibited development in TSZ-2 Services Zone.

station” sites. A better legal platform should be prepared for the advent and commercialisation of hydrogen gas for transport purposes.^{156 157 158}

The Territory Plan is also relevant to the siting of major hydrogen gas production facilities such as might be contemplated if the ACT was to take a lead “first mover” role in the utilisation of the distribution network in the Territory for the blending of hydrogen gas with incoming natural gas supply.¹⁵⁹

Definitions which are important to consider when looking at the introduction of hydrogen can be found in *Appendix B – Potentially relevant Territory Plan definitions*. Particular notes with respect to the Territory Plan zones that are relevant in the context of utilities, service stations and fuel are available at *Appendix C – Territory Plan zone objectives for consideration*.

3 Service stations cannot produce hydrogen gas for refuelling purposes

Recommendation 1

Broaden “service station” uses to allow hydrogen production on site, and clearly allow hydrogen storage and sale. For example, add the words “production, storage and sale of hydrogen gas for refuelling purposes”. Also consider flow-on changes to development codes. Move “service station” as redefined out of the prohibited development list in TSZ2.

A service station is defined as the use of land for the fuelling and/or servicing of motor vehicles. In our opinion, that definition allows for refuelling with hydrogen, but would benefit from added clarity in this regard. However it would not permit the production of hydrogen, as is presently accomplished by the Fyshwick electrolyser. This would introduce a localised hydrogen capability into the zones in which “service station” is presently a permitted use, whether such use is required to be assessed in either the merit or impact tracks under the Territory Plan. Subject to other code requirements, such as size of block and any separation requirements, existing refuelling stations could then be re-equipped for the effective production, storage and sale of hydrogen.

¹⁵⁶ See Recommendations 1, 2 and 3.

¹⁵⁷ This is not to suggest that all service station operators will jump at the chance to implement local production and/or refuelling. Toyota estimates the cost to build a medium-sized retail refuelling station for a hydrogen refueller in the USA or Europe as being in the region of AUD2.3 million. Due to the cost of hydrogen refuelling stations it makes sense to promote hydrogen vehicle use in densely populated areas of big cities.

¹⁵⁸ ABC news. September 14 2017. *Hydrogen cars: what are they and when will we drive them?* [online] Available at: <<https://www.abc.net.au/news/2017-09-14/hydrogen-car-explainer-what-are-they-and-when-will-we-drive-them/8946184>> accessed on 16 November 2020.

¹⁵⁹ See Recommendations 4, 5 and 7.

4 Liquid fuel depots cannot produce, store or sell hydrogen gas for refuelling purposes

Recommendation 2

Broaden “*liquid fuel depot*” uses to allow hydrogen production on site, and hydrogen storage and sale. For example, re-name the land use as “*fuel depot*”, and add references to “*hydrogen gas*” (including the production of same). This would involve special drafting so as to not withdraw the existing definition from those that currently comply. Consider clarification of “*municipal depot*” for same purpose, and flow-on changes to development codes stemming from each of the changes. Move “*liquid fuel depot*” as redefined out of the prohibited development list in TSZ2.

A “*liquid fuel depot*” under the Territory Plan may be used for “*the bulk storage or wholesale distribution of petrol, oil, petroleum products or other inflammable liquids or the retail distribution of drums containing petrol, oil, petroleum products or other inflammable liquids*”. As the technology and commerciality of hydrogen gas improves, the production and storage of hydrogen gas will find greater acceptance, and such uses should be introduced into this definition, as appropriate.

5 Hydrogen refuelling points not exempted from development approval

Recommendation 3

Extend exemption afforded to electric vehicle charging points to hydrogen refuelling points. For example, add the words “*or a hydrogen fuel cell vehicle refuelling point*”.

The P&D Regulations currently provide an exemption from development approval for an electric vehicle charging point, if it is in compliance with *AS/NZS 60079.10 (explosive atmospheres)*.¹⁶⁰ In the context of hydrogen refuelling, a refuelling point would always be a storage location, even if not also a production location. Refuelling stations could be service stations that cannot be approved or do not wish to be approved for production, or specialised locations for new dispensing methods, constructed to an appropriate Australian standard.

Related to the issue of refuelling, and to the issue of exemptions from full development approval, is the issue of the overall safety of hydrogen refuelling. Naturally, there are risks associated with sub-standard refuelling practices. This review has been informed by experts in the field that a specific, regimented process must be followed to ensure that the hydrogen gas refuelling device is properly connected and communicating with the vehicle. The expectation is that hydrogen vehicle manufacturers will supply the special units for personal vehicle refuelling and will take the lead in shaping the standards and protocols involved. The national standards and safety framework will evolve from there.

The policing of the standards that are developed, and the use of proper machinery and practices, can be expected to be undertaken in the same manner as presently applies to fuel dispensing. This would involve the EPA (from the perspective of environmental harm, if considered applicable), Worksafe ACT (from the perspective of worker safety), and ActewAGL Distribution, as is presently the

¹⁶⁰ *Planning and Development Regulation 2008*, Reg 1.113.

case with respect to electric vehicle charging points. It would therefore occur in a similar way to the introduction of electric vehicles and charging stations.



Figure 10 - Toyota's portable refuelling station for its Mirai hydrogen cars

6 Zoning to enable injection of hydrogen gas into the gas reticulation network

Recommendation 4

Review the Territory Plan and consider “*power generation station*” as a land use where hydrogen electrolyzers can be located for grid injection.

Amendment to the Territory Plan should be considered by EPSDD and the Planning and Land Authority, in conjunction with Evoenergy, to identify where major production facilities might be suitably located, and subject always to wider policy considerations. The land uses presently allowed under the Territory Plan at appropriate points for the injection of hydrogen gas into the distribution network could then be extended to include “*power generation station*” as re-defined according to Recommendation 5.

7 Power generation stations cannot generate hydrogen gas

Recommendation 5

Broaden definition of “*power generation station*” to include the generation of hydrogen gas. For example, replace “*electricity*” with “*electricity and/or hydrogen gas*” and delete the word “*fuel*” for clarity.

Under the Territory Plan, “*power generation station*” is defined as “*equipment and associated buildings constructed for the generation of electricity utilising gas, coal, renewable energy technology or other fuel sources*”. The wording is inapt to capture the production of hydrogen gas simpliciter.

A change in the definition of “*power generation station*” to accommodate hydrogen production, would carry through to the umbrella definition “*major utility installation*”. The change to the definition of “*power generation station*” referred to in this recommendation would leave no doubt that hydrogen production is a power generation activity and a major utility installation activity. This change would also unify the ability to generate hydrogen gas in the ACT’s two industrial zones, IZ1 and IZ2.

I Recommendations – Conveyance, production/injection, usage

1 The place of the ACT in the national gas market

The provision of utility services is heavily licenced and regulated under the utilities framework, national gas retail law and consumer protection schemes.

Key barriers to the supply of a hydrogen blend into the distribution network are:

- technological constraints and knowledge gaps¹⁶¹ causing uncertainty in the safety of a hydrogen blend to be distributed to consumers;
- commercial interests of existing industry players, concerned about returns from existing investment and competition from new operators;¹⁶²
- overarching uncertainty about the direction of national energy policy and how policy objectives will be incentivised to encourage hydrogen gas production.

Hydrogen grid distribution feasibility studies underway in South Australia¹⁶³ and New South Wales¹⁶⁴ are likely to generate recommendations that can help explain and mitigate risks to distributors, retailers and end-users.

The technical assessment required to pave the way for the introduction of hydrogen gas is the easier of the challenges that need to be overcome. The myriad of governments, regulators and commercial players involved in the operations and exploitation of the gas network, the incumbency of natural gas in that network and in the capabilities of the appliances at the end of that network, the level of investment required to commercialise a new energy source, and the complexity of the legal instruments and arrangements that support the traditional hydrocarbon gas can cause one to have a sense of hopelessness with respect to the reform and modernisation that is called for.

The magnitude of the changes in thinking that are required was well typified in an exchange between a senior official of the Australian Energy Market Commission and a questioner at an energy conference, in May 2019, that proceeded as follows:

¹⁶¹ An odorant is yet to be approved for use with hydrogen. There are unresolved concerns about the suitability of non-plastic pipes in the higher pressure transmission and distribution network segments. A new approach to keeping leakage from joints and meters within acceptable limits will need to be adopted by the gas distributor.

¹⁶² See e.g. Santos. 15 September 2020. *Santos welcomes Government's focus on unlocking new gas supply*. [online]. Available at: <<https://www.santos.com/news/santos-welcomes-governments-focus-on-unlocking-new-gas-supply/>>.

¹⁶³ Hydrogen Park South Australia project. This is an electrolysis plant generating hydrogen gas for 5% blending (and up to 10% in the future) in the existing SA gas network to 710 properties using renewable electricity. More information about the project is available online at: <<https://www.agig.com.au/hydrogen-park-south-australia>>.

¹⁶⁴ Jemena Power to Gas Demonstration project. This is a five-year trial to generate hydrogen using a 500kW electrolyser to convert excess renewable energy (both solar and wind) into hydrogen gas. The trial seeks to demonstrate how existing gas pipeline infrastructure can be used to store excess renewable energy. More information about the project is available online at <<https://jemena.com.au/about/innovation/power-to-gas-trial>>.

UNIDENTIFIED SPEAKER: Hydrogen raises the question of just how integrated should our thinking on climate policy be. We've had a lot of discussion about the electricity sector, not just today, for the last couple of years. But if hydrogen takes off, like globally, the Australian electricity system might grow by multiples, by ten times its current size. How do we have a meaningful discussion about market reform when the breadth of possibilities is as wide as that?

MR NELSON: Well, that's a hard question to answer. So one of the first things I would say is, we can't just look at electricity or just look at gas. I mean, it's been clear, we've been involved obviously, and others in the room would have been, in the development of the National Hydrogen Strategy which is ongoing at the moment, and some of those discussions have brought that point out very clearly. It can't just be about our gas system, it can't just be about electricity. It can't just be about transport, it can't just be about industry. It has to be some combination of all of them, but how do you do that without getting lost in this high level debate where your variations are so high?

So I don't really have the answer for you. But it's a balance of looking broadly across a variety of scenarios and trying to ensure policy in the electricity space is geared to that. But taking just electricity, one thing I would say is, we haven't been good at doing that. We have tended to look at generation in a bucket, networks in a bucket and retail in a bucket, and consumers pay total system costs. We do have to have integrated policy.¹⁶⁵

In considering the legal reform that would enable the introduction of hydrogen gas and promote the new technologies that produce and utilise the gas, it is useful to bring things back to basics. Impediments to the uptake of hydrogen gas should be removed from the law, so as to at least facilitate its ability to enter the marketplace and compete with carbon-based energy sources. Once that is done, the industry, network and market will be required to stop thinking in “natural gas” terms, and start thinking in “best practice” energy terms. Further legal change will then fall into place more naturally, in terms of regulations, AER determinations, access arrangements, competition mechanisms, and the like.

Marking out a pathway for a hydrogen industry, so as to invite the investment required and to make consumers comfortable in terms of social welfare and physical safety, must come first. Market incentives and technology enhancements will no doubt continue to evolve, but can only be made possible by getting the project underway, rather than having it languish in the “too hard basket”.

In the main, the ACT legal frameworks that would support hydrogen uptake in the ACT are broadly drafted and do not require extensive amendments. Indeed, this report concludes that the degree of change at the legislative level is not great at all. Where the regulatory framework becomes more specifically about the use of hydrogen gas, much of the change will be brought about through new standards to be applied by various administrative functionaries, rather than by explicit statutory or regulatory change. However, not all of the existing regulatory mechanisms will be suitable for all the various ways of using hydrogen gas, because they have been specifically drafted with only natural gas in mind. It is here that new categories should be considered to ensure coverage and coherency. Examples of new categories are refuelling stations, different levels of grid injection, and occupational competencies. Here, also, it is considered that the initial steps in achieving a framework to allow for

¹⁶⁵ Tim Nelson, Executive General Manager - Strategy and Economic Analysis, Australian Energy Market Commission, during a keynote presentation at the Energy Users Association of Australia national conference (1 May 2019). [online]. Available at <<https://www.aemc.gov.au/news-centre/speeches/sorting-fact-fiction>>.

the uptake of hydrogen as an energy source are not extensive. Whether such changes would “fit into” or “initiate” a coherent national energy policy is the bigger question.

2 **Headline gas definition in National Gas Law does not acknowledge hydrogen gas**

Recommendation 6

Collaborative change to the National Gas Law, to allow hydrogen gas to enter and be conveyed by pipelines. This could be done by amending the definition of natural gas to admit of the presence of an allowable percentage of hydrogen. This expanded definition of “*natural gas*” to include hydrogen would then become a law of the ACT as applied by the *National Gas (ACT) Act 2008*. In so far as changes to regulations under the National Gas Law and to the National Energy Retail Law were to be required, they would also carry over to the ACT.

The *National Gas (SA) Act 2008* is a gas law of the South Australian Parliament. It has been applied in the ACT, together with the Regulations made under it, as a law of the ACT. Ministers and Commonwealth bodies with authority under the National Gas Law (“NGL”) and National Gas Regulations (“NGR”) are recognised as having power to exercise their functions with effect in relation to the ACT.¹⁶⁶ Revisions to the SA laws are automatically applied in the ACT when made.¹⁶⁷

If changes to the gas laws and relevant standards and codes required to bring hydrogen into the gas distribution grid were made to the South Australian legislation, those changes would automatically apply in the ACT. All States and Territories and the Federal Government have planning underway for the future uptake of hydrogen. There has been much work on this within COAG/National Cabinet, leading to the publication of the National Hydrogen Strategy in 2019, and the commissioning of report such as this one.

The ACT should continue to engage in this process, putting its particular views on maximising the environmental benefits of any changes and how it should be done. Each individual jurisdiction’s legislation reproduces the SA legislation. The ACT Government should collaborate with the NGL governments for the amendment of the “head” legislation to admit of hydrogen gas in the gas stream. This would create consistency across the entire national framework. The ability to achieve such an outcome and its timing is uncertain.

At this point it is helpful to convey a basic understanding of the overarching purpose and function of the NGL. As stated in the NGL:

*The objective of this Law is to promote efficient investment in, and efficient operation and use of, natural gas services for the long term interests of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural gas.*¹⁶⁸ [underlining supplied]

The NGL regulates access and use of covered pipelines, being covered transmission pipelines and covered distribution pipelines. The pipelines are the way in which gas reaches consumer and industrial markets. They are owned and operated by “service providers” (for example, Jemena, Endeavour Energy), transporting natural gas produced by “producers” (such as Santos,

¹⁶⁶ *National Gas (ACT) Act 2008*, s 11.

¹⁶⁷ *Ibid*, ss 8 and 9, see the phrase “*as in force from time to time*”.

¹⁶⁸ *NGL*, s 23.

BHP/ExxonMobil) to “retailers” (the biggest being companies like AGL, Energy Australia and Origin) who on-sell the gas to residential, business and industrial consumers. In this way the NGL encourages competition and provides the “service providers” with a reasonable opportunity to recover the efficient costs incurred in providing the service.¹⁶⁹

The long title of the NGL puts it more plainly, describing itself as:

An Act to establish a framework to enable third parties to gain access to certain natural gas pipeline services; and for other purposes. [underlining supplied]

The *National Gas (ACT) 2008* (ACT) is the enabling legislation that applies the nationally coordinated framework for energy regulation in the ACT from the South Australian “head” legislation. It comprehensively sets up the gas market, the regulators involved, the National Gas Rules,¹⁷⁰ and the role of various Ministers in all of this.

The framework as it applies in the ACT consists of:

- the *National Gas (ACT) Act 2008*;
- the *National Gas (ACT) Law*, and
- the *National Gas (ACT) Regulation*.

Currently, the national framework relates to “*natural gas*”,¹⁷¹ which is defined as follows:

natural gas means a substance that -

- (a) *is in a gaseous state at standard temperature and pressure; and*
- (b) *consists of naturally occurring hydrocarbons, or a naturally occurring mixture of hydrocarbons and non-hydrocarbons, the principal constituent of which is methane; and*
- (c) *is suitable for consumption;*

On its own, the phrase “*mixture of naturally occurring hydrocarbons and non-hydrocarbons*” would allow for the presence of some hydrogen, which does in fact occur in small amounts in current natural gas. The additional statement that the “*principal*” constituent is to be methane would allow for presumably quite high fractions of hydrogen as long as methane, as present in natural gas, was still dominant. However even if these definitional work-arounds could be accepted, a greater difficulty arises from the phrase “*naturally occurring mixture*”. This is presumably intended to mean a thing that has singularly been extracted out of the ground as a mixture, and not a thing that is partly that

¹⁶⁹ NGL, s 24.

¹⁷⁰ *National Gas Rules Version 55* is the current version. The *National Gas Rules* govern access to natural gas pipeline services and elements of broader natural gas markets. The Rules have the force of law, and are made under the *National Gas Law*. Copies of the *National Gas Rules* are available for inspection at the AEMC’s office in Sydney.

¹⁷¹ *National Gas (South Australia) Act 2008* sch 1 ch 1 pt 1 s 2.

mixture and partly a gas that has been produced by industrial means, such as is the case with hydrogen gas.¹⁷²

These definitional problems specifically exclude a pure synthesised gas like hydrogen gas from the definition. Important definitions in the NGL (for example, “*declared wholesale gas market*”, “*end user*”, and “*haulage*” to name but a few) are defined only in the context of natural gas.

Another concept used in the Act:

processable gas means a substance that -

- (a) *is in a gaseous state at standard temperature and pressure; and*
- (b) *consists of naturally occurring hydrocarbons, or a naturally occurring mixture of hydrocarbons and non-hydrocarbons, the principal constituent of which is methane;*

also excludes hydrogen gas mixtures, for similar interpretive reasons.

Changing the definition of natural gas in the NGL and tracking uses of that expression in the remainder of the legislation will be essential for enabling covered pipelines to carry hydrogen gas. Although every draftsman has their own ideas, this change could be effected by adding the following text at the foot of the definition of “*natural gas*”:

and includes a gas as defined above which has been blended with synthetically produced hydrogen gas at any time before it is consumed and which contains a proportion of synthetically produced hydrogen gas, within a range of proportions prescribed by regulation.

The adoption of Recommendation 6 would also carry over into the major piece of legislation in the ACT that will facilitate the commercialisation of hydrogen gas, namely the *Utilities Act 2000* (ACT). That Act presently tracks the same definition as that used in the NGL.

Nonetheless, we reiterate that it is the wider mindset under the NGL that will have to be reassessed. The national gas objective is a prime example. How will the NGL “*promote efficient investment in, and efficient operation and use of, natural gas [and hydrogen gas] services for the long term interests of consumers of natural gas [and hydrogen gas] with respect to price, quality, safety, reliability and security of supply of natural gas [and hydrogen gas]*” when the environmental sustainability of the two energy sources are as opposed as they are?

¹⁷² See e.g. Faruk Civan, in *Encyclopedia of Energy*, 2004. “*The typical nonhydrocarbon components [of natural gas] can be classified as acid gases, such as hydrogen sulfide and carbon dioxide; inert gases, such as nitrogen and helium; odorous sulfurous gases, such as hydrogen sulfide and various mercaptans; and other impurities, such as water and mercury vapors and sulfur dissolved in gas*”. [online]. Available at: <<https://www.sciencedirect.com/topics/engineering/nonhydrocarbon-gas>>.

3 Complexity and delay in negotiating and agreeing changes to the NGL

Recommendation 7

Widen scope of the ACT utilities legislation to allow a utility to be regulated in the ACT in relation to entry of hydrogen gas into the ACT's distribution network and its conveyance by the network. This would allow the licensing of a utility to provide the gas (as more broadly defined) in the ACT under the *Utilities Act 2000*.

The ACT prides itself in being a climate change leader. If it appears that Recommendation 6 is not likely to come to fruition within a timeframe that suits the ACT, then there is an opportunity for the ACT to “go it alone” and make its own legislative amendments to enable hydrogen to be injected into the ACT's gas stream.

As we have stated above:

...there is nothing about the National Gas Law that perpetually cedes the ACT's sovereignty with respect to the governance of its own territory. Failing collaborative change within a time period that suits the ACT's policy objectives, the ACT could consider forcing the issue within its own territorial limits. The ACT could seek to regulate the distribution network in the ACT and its users in a manner that accommodates production, injection points, usage and pricing of hydrogen gas within a blended hydrocarbon and synthetic gas mixture that complies with existing up-to 10% allowance for appliances, and which allows for even greater proportions of hydrogen gas as evolving pipeline and appliance standards allow. It would not be the first time that the ACT has enacted its own legislation with respect to an issue of national interest, even of national controversy, in a way that is out of step with the rest of Australia.

The relevant modification would be made to the Utilities Act 2000 (ACT). It would licence a utility to inject hydrogen gas into the secondary network in the ACT, owned by Evoenergy. This might not be consistent and efficient in the first instance, and would likely be criticised by the other jurisdictions that have signed-on to the NGL and by the institutions that govern its operation.

However, another possible response would be for other jurisdictions to recognise that hydrogen gas could be delivered into the grid at locations closer to end users, and that the national scheme should adapt rather than dictate. If that does happen, then the ACT's experiment will be seen to have been in the interests of national gas reform, rather than being oppositional. If hydrogen delivers a competitive advantage to the ACT, measured in terms of cost, social benefit, or a combination of the two, other jurisdictions would be encouraged to follow suit, thereby bringing about the collaborative change that all would agree would be better suited to the objective.¹⁷³ [footnote omitted]

Legislative change of this sort would require political and economic justification. If pursued, it would undoubtedly be said, by the existing institutions and upstream players, that the distribution network in the ACT should not be “out of step” with the national gas energy framework, and that the framework assumes (a) the same gas and (b) national market settings that consistently relate to the same gas.

¹⁷³ See G-3.a above.

However, that is not necessarily correct. The NGL regulates the gas “highway”. The definition of “pipeline” under the NGL excludes:

*any tanks, reservoirs, machinery or equipment used to remove or add components to or change natural gas (other than odourisation facilities) such as a gas processing plant...*¹⁷⁴
[underlining supplied]

The production of natural gas itself is outside the regulated pipeline network. Equally, hydrogen gas production would be outside that network as well.¹⁷⁵ If economically feasible, a hydrogen production facility within the ACT could inject hydrogen into the ACT’s “own” pipeline.

Whether this would require ActewAGL (“Evoenergy”) to seek amendments to the access arrangement approved by the AER for the ACT, Queanbeyan and Palerang gas distribution network is an issue that is beyond the scope of this report, but would need to be considered.^{176 177} In that scenario, ActewAGL Distribution could still make its covered pipeline services available for the distribution of natural gas to local gas retailers, but would be selling hydrogen gas to them as well, by injecting a small proportion of hydrogen gas into the gas stream. The market downstream of the local hydrogen production point could then operate according to commercial settings that have been *augmented* by the ACT Government, rather than being *replaced*.¹⁷⁸

Nonetheless, unilateral action would be disruptive, and it is easier for a lawyer to assume what could be done than it would be to actually put in practice.

4 Scope of ACT gas safety legislation does not include any proportion of hydrogen gas.

Recommendation 8

Broaden the definition of gas in the *Gas Safety Act 2000* and the *Dangerous Substances Act 2004*.

The *Gas Safety Act 2000* (ACT) contains the standards for the gas conveyed in the consumer piping system. Consumer piping in this context is the piping between the meter and the gas appliance. “Gas” for the purposes of grid-connected uses is defined in the dictionary of the Act as either natural gas (as defined under the NGL) or LPG. Gas is defined in this Act as:

(a) *natural gas; or*

¹⁷⁴ NGL, s 2, definition of “pipeline”, subparagraph (g).

¹⁷⁵ With respect to Canberra’s gas supply, the covered pipeline starts at the prescribed exit flanges for Moomba and Longford as described in Schedule 2 of the NGR.

¹⁷⁶ See *Evoenergy (ActewAGL) ACT, Queanbeyan and Palerang - Access arrangement 2016-21* [online] Available at: <<https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/evoenergy-actewagl-act-queanbeyan-and-palerang-access-arrangement-2016-21/final-decision>>.

¹⁷⁷ Technical issues such as delivery points, interconnection and operating pressures, and financial issues around the cost/revenue matrix associated with any pipeline upgrades, are some of the access arrangement issues that come to mind.

¹⁷⁸ Self-evidently, Evoenergy would need to support any such strategies, and collaborate in developing and implementing them.

- (b) a gas (LPG) in its vapour phase composed predominately of 1 or more of the following hydrocarbons: propane; propene (propylene); butane; butane (butylene)

Natural gas is not used as a definition on its own in any other part of the Act. All of the references in the Act are to “gas” (gas appliance, gas appliance work, gas safety legislation, gas accidents, gasfitting work, etc). Nonetheless, even the wider definition does not describe or include hydrogen gas. The Act could usefully be further liberalised by broadening the definition of “gas” to include any flammable gas for use as a fuel. This would capture biogas and compressed natural gas (“CNG”), two gases that are not presently covered in the definition.¹⁷⁹

One of the largest concerns raised by stakeholders around the grid distribution of hydrogen gas, both from the perspective of the end-user and wider distribution networks, was the need to be vigilant, for safety reasons, about the potential embrittlement failure of steel pipes and about leakage of the much smaller hydrogen gas molecule. Safety concerns about the distance from gas meter to appliance within the ACT consumer piping system (“CPS”) is a consumer issue. The ACT Government will have the responsibility to conduct testing regimes to ensure safety. Stakeholders have suggested that information about hydrogen, such as the embrittlement of pipes, propensity to leak through sealant, and high flammability in confined spaces should be captured in amendments to the gas installation standard, and thus standards for the CPS, in standard AS/NZS 5601.

Multiple stakeholders have indicated that they are investigating the risk of hydrogen gas leakage and the suitability of plastic pipe use. Existing surveys on the current distribution system (such as those conducted every five years by the Utilities Technical Regulator) may require modified techniques.

It was apparent from stakeholder discussions that technical understanding of the issues that may arise in the network is not settled. Some concerns are linked to lack of understanding and knowledge. At the same time, there is a considerable amount of cross-jurisdictional activity currently underway with respect to relevant standards.¹⁸⁰ However the awareness of this is low, and there were only a few collaboration pathways mentioned during stakeholder meetings

While not strictly a legal observation, we suggest that the ACT Government provide better support to the already quite skilled people in the ACT so that they can engage with and participate in the reviews of standards and codes that are being undertaken in other jurisdictions and within other agencies concerning the effects of different hydrogen blends and associated matters. The exchange of information will be useful in getting up to speed with the system checks and installation works that will be required for the blending of gas within the natural gas network. Greater engagement of ACT Government representatives with relevant activities and colleagues in other jurisdictions will be informative and will help accelerate the pace of change.

The purpose of the *Dangerous Substances Act 2004* (ACT) is to protect the health and safety of people, and to protect property and the environment from damage, from the hazards associated with dangerous substances. Despite this, the Act does not apply to the transmission, distribution and use of natural gas to which the *Gas Safety Act 2000* or *Utilities Act 2000* applies, or to the transmission, distribution and use of LPG to which the *Gas Safety Act 2000* applies.

¹⁷⁹ Section 6H of the *Gas Safety Act 2000* (ACT) keeps up with changing standards by relying on identified standards “as in force from time to time” or their substitutes. Amendments to the standards do not need to be notified under the *Legislation Act 2001* (ACT) to become law.

¹⁸⁰ See Appendix E – Section 2.

These provisions specifically refer to “*natural gas*” and “*LPG*”. Accordingly, it would be preferable, in considering and implementing Recommendation 8, to also remove the word “*natural*” in the exclusion provision in the *Dangerous Substances Act 2004*.^{181 182}.

5 Standards for “general purpose natural gas” and odorant are lagging

Recommendation 9

Encourage development of standards so that 100% hydrogen is included as “*general purpose natural gas*” or has its own standard, and for hydrogen-specific odorant within Australian gas distribution systems, and then formulate the regulations to accommodate them.

AS/NZS 4564 (Specification for general purpose natural gas) serves as a specification for general purpose natural gas.¹⁸³ It has an emphasis on the safety of the gas for use in natural gas appliances and for use as fuel in natural gas vehicles. Natural gas conforming to the standard is suitable for transportation through pipelines.

The parts of the standard that are of interest are the definition of “*natural gas*” and the implications that the Wobbe index used in the standard has with respect to that definition.

1.2.6 Natural gas

A gaseous fuel consisting of a mixture of hydrocarbons of the alkane series, primarily methane but which may also include ethane, propane and higher hydrocarbons in much smaller amounts. It may also include some inert gases, plus minor amounts of other constituents including odorizing agents. Natural gas remains in the gaseous state under the temperature and conditions normally found in service.

...

1.2.10 Wobbe Index

The number expressed in MJ/m³ produced when the higher heating value of the gas is divided by the square root of the relative density of that same gas.

The specifications for natural gas under the standard are further elaborated in the following table.

¹⁸¹ *Dangerous Substances Act 2004*, Section 7(1)(a). The acronym LPG does not require to be amended, unless “*LPG*” is itself amended in the *Gas Safety Act 2000*.

¹⁸² Compliance with a corresponding duty under the *Work Health and Safety Act 2011* satisfies the same duty under the *Dangerous Substances Act 2004* (Section 8A(1) of the latter). Any provision of the *Dangerous Goods Act 2004* that is inconsistent with a provision of the *Work Health and Safety Act 2011* has no effect to the extent of the inconsistency (Section 8A(2) of the former).

¹⁸³ The relevant project committee of Standards Australia is Committee AG-010 Natural Gas Quality Specifications.

TABLE 3.1
SPECIFICATION LIMITS

Characteristics and components	Limit	
Wobbe Index	Minimum	46.0 MJ/m ³
	Maximum	52.0 MJ/m ³
Oxygen	Maximum	0.2 mol %
Hydrogen sulfide	Maximum	5.7 mg/m ³
Total sulfur	Maximum	50 mg/m ³
Water content	Maximum	Dewpoint 0°C at the highest MAOP in the relevant transmission system (in any case, no more than 112.0 mg/m ³)
Hydrocarbon dewpoint	Maximum	2.0°C at 3500 kPa gauge
Total inert gases	Maximum	7.0 mol%

NOTES:

- 1 m³ means 1 cubic metre of dry gas at the standard conditions (see Clause 1.2.8).
- 2 The sulfur level upstream of the point(s) of addition of odorant needs to be such as to allow for any increase due to the odorant.
- 3 The hydrocarbon dewpoint limit is intended to ensure that condensation, and in particular retrograde condensation, does not occur to an excessive extent. For some general purpose natural gas supply systems that are confined to only one State, the relevant government body in that State may provide for localized departure from the specified limit (see Clause 1.1.2). This would only apply where local conditions are favourable and it is possible to avoid excessive condensation with a higher hydrocarbon dewpoint limit.
- 4 *Higher heating value*: It is expected that for all practical gases available, or likely to be available commercially, higher heating values would be in the range of 37 to 42 MJ/m³.
- 5 *Relative density*: It is expected that for all practical gases available, or likely to be available commercially, relative density values would be in the range of 0.55 to 0.70.
- 6 For applications such as natural gas vehicles requiring compression to higher pressure than the maximum transmission pressure it may be necessary to use a gas dryer to remove moisture from the gas to prevent liquid water or hydrate formation.
- 7 See Appendix A for explanatory information.

Figure 11 - Extract of the specification limits of natural gas from AS 4564-2005: page 7

AS4564 does not actually specify an amount of hydrogen that can be mixed with what is typically referred to as “natural gas” without moving outside the parameters of the standard. However the review was informed on a number of occasions that the Wobbe index limit used in defining the standard is sufficiently wide as to tolerate an amount of hydrogen in the gas stream. This appears to be in the range of 10% to 14%, but no assurances were provided.

Nonetheless it appears clear enough that the industry can introduce a small amount of hydrogen gas into the stream now, and remain within the constraints of AS 4564, but that a new and improved standard, or a new standard, must be introduced to go further.

6 Standards for “distribution networks” do not address higher hydrogen levels

Recommendation 10

Review network management, steel pipe systems and plastics pipe systems standards, in particular locations of meters and odorant levels, consistently with changes to standard for “general purpose natural gas” and/or new hydrogen standards. Update *GS&I Rules* in accordance with changes in *AS/NZS 4645*.

The *GS&I Rules* are issued by Evoenergy under the Gas Service and Installation Rules Code created under the *Utilities (Technical Regulation) Act 2014*. The standards applicable for the installation of gas metering equipment include:

- *AS/NZS 4645 - Gas distribution networks;*
- *AS/NZS 5601 – Gas installations; and*
- *AS/NZS 60079 – Explosive atmospheres.*

AS/NZS 4645 is in three parts:

- *Part 1: Network management*
- *Part 2: Steel pipe systems*
- *Part 3: Plastics pipe systems.*

Part 1 sets out “means of compliance” so that an acceptable level of risk is achieved. The standard requires review for hydrogen gas uptake with respect to the use of special sealants in installation, the management of leaks, and maintenance and repair. The readiness of Evoenergy to manage its network for higher levels of hydrogen should be assessed.

Another important area for consideration is prohibited meter set locations.¹⁸⁴ The *GS&I Rules* cover the gas connection from a gas distribution pipeline to the customer’s premises at the point of supply, which is also the network boundary, and is defined as the “*outlet of the meter set*”.

The *GS&I Rules*, made under the *Utilities (Technical Regulation) Act 2014*, will need major amendment to accommodate the uptake of hydrogen gas through the ACT distribution network. The ACT Government should conduct a thorough and urgent review of Evoenergy’s proposed updated rules. A part of particular interest, because it concerns the risk of explosion, is extracted below:

3.3.3 Prohibited meter set locations

In accordance to AS/NZS 4645.1 but subject to additional requirements of Section 3.4 of these GS&I Rules, meter sets/ regulator sets must not be installed in the following locations:

- (1) *a lift shaft or lift motor room; or*
- (2) *a room specifically intended for electrical switchgear; or*
- (3) *a fire-isolated stairway or passage; or*
- (4) *a fire hydrant duct or hose reel cabinet; or*
- (5) *a sprinkler or hydrant pump room; or*
- (6) *near a source of ignition; or*

¹⁸⁴ *GS&I Rules – 3.3.3.*

- (7) *in a position that would obstruct egress from a building.*
- (8) *In a position where the meter set would be subject to physical damage unless adequately protected. Specifically, physical protection for the metering equipment (including meters, regulators, filters, valves, meter bars, exposed inlet piping and vent line) must be installed where the meter set location is within one (1) metre of roads, driveways, car parking areas, garages, loading docks etc., or other areas where there is mobile plant, equipment or vehicles moving within one (1) metre of the meter location.*
- (9) *In an area where excessive temperatures or sudden excessive changes in temperature may occur.*
- (10) *In an area of excessive vibration.*
- (11) *In the foundation area under a building.*
- (12) *In a cavity wall, unless installed in a ventilated enclosure with external access and the cavity is sealed (see Figure 1(e) & Figure 1(f)).*
- (13) *In a position where access for meter reading or maintenance is restricted.*
- (14) *In an unventilated position.*
- (15) *On the ground, or on a floor which is frequently wetted, or on a floor which contains material which may corrode the meter.*
- (16) *Where a service riser is not separated from an earth electrode by 500 mm.*

The Utilities Technical Regulator will need to coordinate how the code and rules should be updated by Evoenergy to allow for higher levels of hydrogen gas supply through the distribution network to the point of supply, in accordance with AS/NZS 4645 *Part 1: Network management*.

7 Standards for safe installation and usage to flow through to ACT legislation

Recommendation 11

Encourage national review of standards/codes to acknowledge effects of hydrogen blending when fitting gas appliances, and unique considerations of pure hydrogen gas appliances during gas fitting.

The *Gas Safety Act 2000* (ACT) lists the relevant standards (for the installation of gas appliances on the consumer piping system) as follows:

- *AS/NZS 1375 - Industrial fuel fired appliances;*
- *AS/NZS 3814 - Industrial and commercial gas fired appliances; and*
- *AS/NZS 5601 - Gas installations.*

These standards need to be checked for relevance to hydrogen in each case. To win the public's confidence in the uptake of hydrogen gas the ACT Government will need to rely on relevant standards being in place, which gasfitters and other gas workers can then observe and fulfill.

J Recommendations – Occupational licencing

1 Gasfitting/gas appliance licences inadequate for hydrogen work safety

Recommendation 12

Amend legislation to update trades licensing for new hydrogen gas compatible appliances and hydrogen fuel cell vehicles, whether by introducing new skills requirement within existing categories, or originating new licence categories.

Recommendation 13

Units of competency to award construction occupation license need to be updated to reflect the skills required to work with hydrogen gas.

The *Constructions Occupations (Licensing) Act 2004* (ACT) identifies construction occupations that require licensing, and details the management and administration of licensing. The *Construction Occupations (Licensing) Regulation 2004* is particularly important, detailing the particular classifications for works and the grounds on which demerit points may be issued for insufficient compliance with licences (per Part 8 of the Act). The specificity of compliance identified in the Regulations will require substantial amendment to the Regulations and possibly amendment to the New licence or combination licence for gasfitters

Regulatory risk management might require education of all engineers, gasfitters, and mechanics about working with hydrogen gas in a similar way to that in which the industry was trained to work with asbestos. Obviously, the two substances cannot be equated in risk terms, with asbestos being a very different substance, nonetheless the “newness” of hydrogen gas and its different characteristics may call for the design and development of a new licence (or combination electrical and gas work licence). This would be referenced in the schedule to the *Construction Occupations (Licensing) Act 2004*.

Key examples where amendment may be required include the following:¹⁸⁵

- Gasfitter is a construction occupation under the Act.¹⁸⁶ There are two different series of licences for gasfitters and workers who install gas appliances.¹⁸⁷ A specific hydrogen related licence for hydrogen gas appliances should be considered, rather than amending/updating existing licences.

¹⁸⁵ Although not reversing any of the recommendations made with respect to licensing and competencies, we make reference to the following passage at K-5 of this report: “Stakeholders have suggested that there may not be a need for new gasfitter licence types for commercial or household fittings, because at low hydrogen concentrations there is likely to be no change to pressure in the gas distribution network to houses. However, the better view is that new training should be introduced under existing licences to ensure the safety of consumers with respect to sealing issues.”

¹⁸⁶ *Constructions Occupations (Licensing) Act 2004*, Section 7.

¹⁸⁷ *Ibid*, Sections 12 and 13.

- A new licence category should also be considered for hydrogen fuel cell vehicles due to the combined gasfitting and electrical work experience required.¹⁸⁸
- Units of competency to award construction occupation license need to be updated to reflect the skills required to work with hydrogen gas.¹⁸⁹ New units of competency to award a new construction occupation license could be listed in the schedule.
- The Registrar may make determinations about training for licensees.¹⁹⁰ This certainly should be an important task in light of the introduction of this new material and the technologies associated with it.¹⁹¹
- Schedule 2 of the Act establishes the demerit system and lists the standards that must be complied with under the relevant legislation. This will require review if additional licences come under the scope of “construction occupation”.

¹⁸⁸ Construction occupation classes for “gasfitter” are advanced gasfitter; general gasfitter; journeyperson gasfitter; LPG gasfitter (vapour phase); LPG gasfitter (liquid phase); restricted automotive – NGV; restricted automotive – LPG forklifts; and restricted automotive – NGV forklifts.

¹⁸⁹ *Construction Occupations (Licensing) Regulation 2004*, Section 13 and *Construction Occupations (Licensing) (Qualification) Declaration 2019*.

¹⁹⁰ *Ibid*, Section 47A.

¹⁹¹ The training for gasfitters and gas appliance workers is listed in *Construction Occupations (Licensing) (Qualification) Declaration 2019 Schedule 1 – Qualification requirements by construction occupation*.

K Redux and future issues

We recap on some of the issues already discussed, and mention some other issues raised in the course of consultations, as now follows.

1 Framework for distribution capabilities

Technical experts advise that hydrogen could enter the grid in two ways – either the hydrogen is produced, blended and injected into the grid at the point of electrolysis, or the hydrogen is produced at an electrolysis station and then transported to the injection point by vehicular transport using national road infrastructure.

a Pipeline only distribution

Under this method of distribution, the hydrogen could be produced outside the ACT, or produced within the ACT, and in each case directly injected into an available pipeline for its transportation through the pipeline infrastructure to end-users.

The ACT's gas supply travels to the ACT through pipelines located in NSW that are licensed under the *Gas Safety (Gas Quality) Regulations 2007* (NSW). They are License 16 and "License 21" (Moomba to Sydney line), and License 26 and License 29 (Bass Strait line).¹⁹² Under those Regulations the quality of gas must comply with AS 4564 which states:

The gas shall not contain –

- a) *materials, dust, and other solid or liquid matter, waxes, gums, gum forming constituents, and unsaturated or aromatic hydrocarbons to an extent which might cause damage to, or interference with the proper operation of pipes, meters, regulators, control systems, equipment or appliances, or which might cause the gas to be harmful or toxic to persons having contact with it in normal work operations or usage;*
- b) *unsaturated or aromatic hydrocarbons to an extent which causes unacceptable sooting;*
- c) *other substances to the extent that they cause damage to, or problems in operation of pipelines or appliances or that cause the products of combustion to be toxic, or hazardous to health, other than substances that are usually found in natural gas combustion products.*

This standard does not expressly refer to hydrogen gas as a "contaminant". However, the amount of concern expressed about the issue of embrittlement, by the technical experts that were consulted for the purposes of this report, indicate that hydrogen in the gas mix, in growing proportions, will be a "substance... that [may] cause damage to, or problems in operation of pipelines." This concern applies to pipes made of steel that are susceptible to hydrogen embrittlement.¹⁹³ Further, for so long

¹⁹² See E-1 above.

¹⁹³ Technical experts consulted for the purposes of this report indicated that the danger of steel embrittlement caused by hydrogen gas is greater where the steel has higher levels of carbon. No experts were willing to vouch for the ability of the existing steel pipe infrastructure to handle 100% hydrogen gas.

as appliances do not have the capability to operate at hydrogen levels of more than 10%, the potential to cause damage to “*appliances*”, as also referred to in AS 4564, cannot be discounted.

Stakeholders indicated that plastic reticulation pipes are likely to be suitable for the carriage of hydrogen, and that the ACT’s steel piping might not be affected by embrittlement, because the distribution network operates at much lower pressure than high-pressure large transmission interstate pipelines.

The limits of the existing transmission infrastructure is of significance to a jurisdiction like the ACT, which is, colloquially and literally, “*at the end of the [pipe] line*”. This significance can be demonstrated in simple SWOT terms as follows:

- Strength - Canberra has a secondary network made up of medium pressure steel pipes (handling around 1,050 kPa), and a reticulation network comprised of PE and PA11 plastic pipes (handling around 210 kPa).¹⁹⁴ These are able to handle much higher proportions of hydrogen gas than high pressure steel pipes. Although this may not completely differentiate the ACT from other jurisdictions, technical experts rated the quality of the ACT network highly.
- Weakness – the ACT has a relatively small population, therefore the economics of increased hydrogen production for local use may not be as attractive to investors as in other jurisdictions. Innovative models will need to be considered for establishing hydrogen production in the ACT, noting also the existing level of investment in hydrocarbon energy sources.
- Opportunity – the uncertainty surrounding the ability of the carbon steel pipes making up the high pressure transmission network suggests that localised injection may be better suited for the purpose of increasing the hydrogen gas mix to much more significant levels than the 10%-13% currently under consideration.
- Threat – the ACT may be held back from its own “hydrogen future” by delays in the development of standards by all jurisdictions, acting collaboratively. This could be the scenario if other jurisdictions are unable to improve the physical capabilities of pipelines within their territories at the pace or to the level desired by the ACT’s own energy policy.

As previously suggested in this report, the limitations of a licensing system under the NSW legislation, based on AS 4564’s hydrogen gas reticence, need not prevent the ACT moving more quickly along the path of increased hydrogen uptake.¹⁹⁵

¹⁹⁴ A view was expressed during consultations for the purposes of preparing this report that this part of the network is physically capable of accepting at least 10% hydrogen and that the risk of damage to the pipes by hydrogen through the “embrittlement” effect is exaggerated. See E-6.b above.

¹⁹⁵ The complex interplay of national laws that relate to gas as a form of energy rely on definitions under the National Gas Law. If the ACT Government moves along the road towards the production and delivery of hydrogen gas to ACT consumers at a pace which outstrips the recognition of hydrogen as part of the “national” gas mix, it would need to connect itself to consumer/competition and retail laws by defining the coverage of those laws so as to include hydrogen. This would be an “inside the ACT” issue.

b Vehicle-to-pipeline distribution

Other than in early stage pilot projects, it seems unlikely that hydrogen for pipeline injection would first be transported by vehicle, however the possibility can still be considered.

Safety standards are managed through the hazardous materials provisions under the WHS Act. Hydrogen transport vehicles would be heavy vehicles that are regulated under the National Heavy Vehicle Law. Hydrogen gas itself is regulated under the *Australian Dangerous Goods Code*.¹⁹⁶ No amendment is required from that particular aspect.

2 Grid-related concerns

Evoenergy expects that there will be multiple entry points for hydrogen gas into the “grid” in the future. UTR expects one common site for hydrogen to enter the network, and expects that it will be in Fyshwick.

Prior to making decisions in relation to the location of target injection points, it would be prudent to finalise research on matters which kept coming up in the course of consultations for the purposes of preparing this report, such as:

- the risk of hydrogen gas stratification at low flow speeds;
- how well hydrogen gas mixes into natural gas;
- what happens to the mixing of the gases at higher altitudes; and
- the concentrations of hydrogen gas that existing gas appliances can realistically handle.

The risk of areas at a higher altitude in Canberra (foothills/hills) receiving more hydrogen in the gas mix than lower lying places was frequently raised. Views were also expressed that at low use hours (for example at 2am in the morning), the gas mixture in the distribution network might stagnate and separate, with hydrogen rising to those higher up areas. However, on the issue of gases un-mixing at low flow speeds and higher altitudes, a credible scientific view was expressed that it is impossible for a gas mixture to separate spontaneously. The physical reason for this is that once two gases are mixed, intermolecular collisions dominate gravitational forces by a very large amount, and keep the constituents constantly mixed. An analogy could be drawn with dissolving sugar in a cup of tea. Some stirring is required to dissolve it, but once dissolved, the sugar will never spontaneously settle out again.

Accordingly, it was apparent that experts in the field are of the view that once mixed, there is no possibility of subsequent spontaneous separation. We raise the issue only because there was uncertainty expressed by certain individuals who are involved in gas regulation and who therefore could be expected to have their own expertise on the subject matter. It is important that these concerns are addressed via testing and education as needed.

¹⁹⁶ From 1 July 2018 to 30 September 2021, Edition 7.6 of the *Australian Dangerous Goods Code* applies. Available online at: <<https://www.ntc.gov.au/codes-and-guidelines/australian-dangerous-goods-code>>.

3 Market mechanisms to support hydrogen usage

The review was informed that lower electricity prices would be required to reach the scale of production necessary to make the hydrogen industry profitable. It was said that at current electricity prices hydrogen vehicle refuelling can be profitable, but that the industrial level of production required to produce enough hydrogen for injection into the grid would not be financially viable. A way around this cost barrier or, more correctly, a way of insisting upon the take-up of hydrogen gas, could be through the use of market mechanisms such as mandatory green gas targets or procurements, as has been done successfully with renewable electricity.

The ACT Government has received a number of separate reports examining hydrogen and green gas issues. There are efforts underway at the Federal level and in NSW to develop “certification of origin” systems for green/clean gas. These are intended to allow open trading of renewable hydrogen and biogas where points of production and use are separate. This would be analogous to trading in renewable electricity. Noting that the ACT Government has legislated a net zero GHG target for 2045, it will become essential to be able to trace the origins and associated GHG emissions of any gases entering the Territory.¹⁹⁷ It would make sense to develop an approach to this topic.

Closer to home, and very recently, another green gas-related report commissioned by the ACT Government made these recommendations:¹⁹⁸

- 1 *Consider the introduction of a target for renewable energy gas supply in the ACT under the Climate Change and Greenhouse Gas Emission Reduction Act 2010. A target of 10% from 2025 for both the gas sector and 10% for the transport sector from 2025 could be appropriate.*
- 2 *Investigate potential sources of low cost Green Gas from local and interstate sources and consider becoming a first mover in the procurement of Green Gas via competitive processes.*
- 3 *Consider mandating the replacement of unaccounted for gas in the network with Green Gas as a short term measure.*
- 4 *Move to treat all ACT waste in an international best practice manner that maximises the contribution of Green Gas that it produces.*
- 5 *Work to establish mandatory mechanisms that progress the reduction over time in GHG emissions to zero in 2045 in a manner that does not unnecessarily disadvantage Green Gas uptake or lead to higher than necessary costs for ACT citizens.*

4 Future production methods

If landfill gas is converted into hydrogen gas, carbon monoxide (CO) could be produced as a toxic by-product. However, CO converts easily to CO₂, and it is possible to react the CO by-product with water to create more hydrogen gas. This would be the cheapest and most “decarbonising” way of

¹⁹⁷ Environment, Planning and Sustainable Development Directorate. 2019. *ACT Climate Change Strategy 2019-2025*.

¹⁹⁸ ITP Thermal. 2020. *Green gas trading – a tool for a zero emissions ACT. Report for ACT Government, ITP July 2020.*

producing hydrogen gas in the ACT because electrical power used in the production of hydrogen in electrolyzers is not required.

5 Water usage

Water is needed to provide hydrogen, although it is a surprisingly modest requirement. This can at times appear to be a barrier, however this is not hydrogen-specific. Icon Water would be a provider of the water used to produce the hydrogen, and the relationship it would have with the hydrogen producer would be a normal commercial arrangement. If the hydrogen producer were to draw raw water from the environment then this would be an entitlement and licensing issue, which would be the same for any other commercial water user in the ACT. We do not recommend any changes to way the water entitlements are currently allocated.

No necessary amendment to the current legal framework for water, in order to facilitate the uptake of hydrogen in the ACT, was detected in preparing this report. In times of drought, or if conditions need to be imposed on waste water from the hydrogen production process, then the EPA and/or Icon Water is equipped to impose special conditions on the quality and volume of discharge into our environment.

6 Supply limitations

On-site hydrogen production at the Fyshwick refuelling station is currently limited. The maximum electrolyser capacity is 20kg of hydrogen per day. The station has been built to service approximately 20 hydrogen vehicles that have been leased from Hyundai (the Nexo model), each with a 6kg hydrogen tank. While one upgrade to the electrolyser could allow for up to 60kg of hydrogen production per day, the station will be unable to cope with a significant increase without another electrolyser or further upgrades.

As such, the ACT's current capacity to facilitate hydrogen-powered vehicles is limited unless the electrolyzers are upgraded to increase hydrogen production capacity, and storage solutions are found. The same site could be used to accommodate many more vehicles if the entire infrastructure of tanks, compressors, filling points and electrolyzers were replicated as needed. The ACT Government could accelerate the process via procurement or reverse auctions, as it has done for renewable electricity.¹⁹⁹

7 Suitability of gas appliance fittings

Stakeholders have flagged the importance of considering backwards compatibility with current infrastructure. For businesses such as food court restaurants, the pricing of the hydrogen gas will be an issue, because meters are not typically installed within buildings so as to measure usage in individual enclosed tenancies. More precise gasfitting regulations and equipment would be required in order to guard against escape of the incredibly small and light hydrogen molecule from meters that are otherwise fully operable with natural gas. Stakeholders have suggested that there may not be a need for new gasfitter licence types for commercial or household fittings, because at low hydrogen concentrations there is likely to be no change to pressure in the gas distribution network to houses. However, the better view is that new training should be introduced under existing licences to ensure the safety of consumers with respect to sealing issues.

¹⁹⁹ See K-3 above.

Existing gas appliances are currently certified to handle hydrogen gas within the standard tolerance level of up to 10% hydrogen gas. It is currently unknown whether appliances will need to be replaced or simply modified when a greater percentage of hydrogen gas is injected into the network. This will only be known once the exact hydrogen concentration and mix (natural gas or bio-methane, or some other mix) is determined. If the end result is that appliances will need to be upgraded due to the hydrogen gas injection, then socio-economic barriers, access to the network and commercial viability considerations will need to be addressed.

Blending hydrogen into the gas mix will require the flow rate of the blended gas to the appliance to be increased so that there is no change to the rate of energy delivered per minute. Natural gas is already metered and sold by the megajoule so there are no direct pricing issues caused by adoption of a gas mix. Utility providers will need to adjust gas meters to ensure the energy value of the increased gas volume flow used by the customer for heating and cooking purposes is measured correctly.

Additionally, concerns around the safety and placement of meters have been raised. There is already a debate about the suitability of meters located within buildings, when such placement was allowed, and the need for them to be relocated at the taxpayers' expense due to the possibility of leakage from the connection point to the meter in an enclosed space. This risk would be amplified by the use of hydrogen. What needs to be done will depend on a study of the hydrogen gas mix and the metering technology that becomes available in the future.

8 Training standards for gas fitting on fuel cells

Due to the nature of hydrogen fuel cells, changes in regulation for the training and licensing of gas fitters has been identified as an area for further consideration.

Licensing of gasfitters takes place on a skills and qualifications basis. Qualifications are obtained often through the Canberra Institute of Technology or another organisation registered to provide training, likely approved by the Australian Skills Quality Authority ("ASQA"). The skills component is addressed through supervised practical experience. In sum, while gas fitting licensing requirements are detailed in the major qualifications schedule under the *Constructions Occupations (Licensing) Act 2004* and Regulation, actual training methods have no legislative basis.

Stakeholders have highlighted limitations of current licensing. Higher qualifications required to deal with pressures of gas exceeding 21kPa are pre-existing but insufficient for hydrogen vehicles, which will have a pressure exceeding the 21kPa limit by a factor of 1,000. Also, current gasfitting licenses only permit restricted electrical work in relation to the trade, such as the disconnecting and reconnecting of an appliance. Working with new-technology such as fuel cells, which are comprised of both gas and electrical complex systems, will require new training and new aptitude. Consequently, it is recommended that new or revised qualifications to specifically work with fuel cells be devised, in line with standards that are developed by Standards Australia and industry.

L Conclusion

Quite rightly, the ACT prides itself as being a climate change leader. Canberra is now poised to further enhance its reputation as an innovative and climate conscious city through the introduction of a hydrogen gas capability that is facilitated by the right kind of legislative reform.

Energy-related law is typically developed and delivered by Federal agencies and through cooperative efforts at the national level. Further, the ACT is a small jurisdiction entirely enclosed, geographically, within NSW. The existing gas transmission network presently delivers gas sourced from outside NSW to the ACT across NSW through two major transmission pipelines. The ACT cannot send gas back down those pipelines into other markets outside the ACT. By itself using more hydrogen gas it can enable Australia to use less hydrocarbon gas. Giving this a “value” in and of itself is an important part of the incentives needed at the national level to help the ACT meet its ambitions.

The ACT can accept gas with a percentage of hydrogen included in it if that mix is delivered to the ACT in the transmission pipeline. Further, the ACT might see fit to develop its own industrial-level hydrogen production capability to inject hydrogen at points within the distribution network which are physically located in the ACT. Green trading solutions may be developed to credit the ACT for its investment and use of hydrogen gas that is delivered to us here in the ACT. Because of its dependence on external certification actions, either nationally or with other states or industry groups, the timing of green gas trading is uncertain, but could be within the next few years if key stakeholders were to act quickly. Hydrogen is receiving considerable national attention, especially as a fuel for transport purposes. The ACT already has “runs on the board” in this regard, with its electrolyzers producing hydrogen for fuel-cells in vehicles, a convenient lower-scale production option which is an important step in understanding and popularising this energy resource.

This review of legislation has shown that there are a range of areas that do need to be addressed. Changes to standards and gas laws having national effect, and that take place in a coordinated manner, will deal with many issues. The various areas where action is needed in the ACT do not seem overly difficult to resolve.

The ACT has already taken its first steps in its hydrogen-powered future with the development of the Fyshwick electrolyser and refuelling station. Clarifications and variations to the Territory Plan would send a clear message that the ACT is in “the business of hydrogen”, and would allow for and indeed encourage and necessitate the kind of safety regulations and education and training that will serve the ACT well once grid injection and blending is decided upon at the national level. And this is where we recommend the ACT Government should start.

From there, the ACT should consider that it has every right, and every ability, to lead the national effort, and to do so either by collaboration or example.

Appendix A – List of stakeholders consulted

The input of the following stakeholders and representative governmental officials, who were consulted in the preparation of this report, has been highly valuable and is highly appreciated:

- ActewAGL
- Construction and Workplace Licensing, ACT Government
- Clean Energy Innovation, ACT Government
- Department of Planning, Industry and Environment, NSW Government
- Energy Policy, ACT Government
- Energy Productivity, NSW Government
- Environment Protection Policy, ACT Government
- Environment Protection Authority (ACT)
- Evoenergy
- Fair Trading (NSW)
- Gas Inspectorate, ACT Government
- Icon Water
- NSW Government
- Technical Safety Regulation, NSW Government
- Utilities Technical Regulation, ACT Government
- Workplace Safety and Industrial Relations, CMTEDD, ACT Government
- WorkSafe ACT

Appendix B – Potentially relevant Territory Plan definitions

The following definitions in the Territory Plan were considered as potentially having relevance to the introduction of hydrogen in the ACT.

Term	Definition under the Territory Plan	Applicability to hydrogen
Hazardous industry	<i>means an industry, not being a general, light, offensive or mining industry, which by reason of the process involved, or the method of manufacture of the materials used or produced represents a significant source of hazard to human health or life or property, for any reason.</i>	Consider whether the definition should be allowed to apply to the production of hydrogen gas at any point prior to the stage at which the 50t storage capability under Schedule 15 of the <i>Work Health and Safety Regulation 2011</i> comes into play. This is not to say that hydrogen production may not be hazardous, however it may be a better policy choice to carve-out in the same manner as “ <i>general, light, offensive or mining industry</i> ” have been carved out.
Liquid fuel depot	<i>means the use of land for the bulk storage or wholesale distribution of petrol, oil, petroleum products or other inflammable liquids or the retail distribution of drums containing petrol, oil, petroleum products or other inflammable liquids.</i>	This definition does not extend to either the production or sale of hydrogen gas. See Recommendation 2.
Major pump station	<i>means a pump station having a capacity greater than 500 litres per second in the case of water supply; 50 litres per second in the case of sewage; or a natural gas compression station operating at greater than 1000 kPa pressure.</i>	This definition does not extend to either the production or sale of hydrogen gas, such gas not being “natural gas”. There is no reason for the reference to “natural” to be maintained, because hydrogen gas storage and/or injection would routinely involve pressures higher than 1,000 kPa.
Major electrical sub-station	<i>means switching and transformer equipment handling voltages greater than 66kV.</i>	Not relevant to the introduction of hydrogen. No amendment is seen to be needed for the introduction of hydrogen.
Major service conduits	<i>means the major bulk water supply and reticulation mains having a diameter equal to or greater than 675mm, trunk sewers having a diameter equal to or greater than 750mm, stormwater main drains having a</i>	From a technical perspective, this definition would apply to the introduction of hydrogen gas to the extent and in the locations that gas mains handling/intended to handle hydrogen gas and having a

	<i>diameter equal to or greater than 900mm or comprising open drains or waterways, transmission lines having a voltage greater than 66kV, gas mains having a diameter greater than 100mm, and major telecommunication cable ducts having a width equal to or greater than 1000mm.</i>	diameter greater than 100mm are presently located or are intended to be constructed. No amendment is seen to be needed for the introduction of hydrogen.
Major utility installation	<p>This an umbrella term and includes the following terms relevant to hydrogen:</p> <ul style="list-style-type: none"> • <i>major electrical sub-station;</i> • <i>major pump station;</i> • <i>major service conduits; and</i> • <i>power generation station.</i> 	None of these definitions extend to the production of hydrogen gas. Major service conduits usage does extend to the carriage of hydrogen gas. See individual recommendations relating to each individual term.
Mining industry	<i>means an industry, not being a light, general, hazardous or offensive industry, which extracts minerals, coal, oil, gas or construction materials by such processes as underground or open-cut mining, quarrying, dredging, the operation of wells or evaporation pans, or by recovery from ore dumps or tailings, and includes primary processing operations carried out at or near mine sites as an integral part of the mining operation and works to rehabilitate the site.</i>	The definition of mining industry is not applicable to hydrogen in that it is not mined or refined from the ground. No amendment is seen to be needed for the introduction of hydrogen.
Minor service reticulation	<i>means the water supply, sewerage, stormwater and gas pipe reticulation, electricity lines and telecommunication cables which are normally located in road easements or easements within leases.</i>	This definition would apply to the introduction of hydrogen gas to the extent and in the locations referred to, ie. gas pipe reticulation in road easements or easements within leases. No amendment is seen to be needed for the introduction of hydrogen.
Power generation station	<i>means equipment and associated buildings constructed for the generation of electricity utilising gas, coal, renewable energy technology or other fuel sources.</i>	An electrolyser does not generate electricity, nor is gas utilised for the production of the energy that is produced. This should be expanded to include the generation of hydrogen by electrolysis. See Recommendation 5.
Service station	<i>means the use of land for the fuelling and/or servicing of motor vehicles, whether</i>	Due to the general nature of this definition and the use of the words “fuelling vehicles”, this definition

or not the land is also used for any one or more of the following purposes:

- a) the sale by retail of spare parts and accessories for motor vehicles;*
- b) washing and greasing of motor vehicles;*
- c) installation of accessories;*
- d) the retail sale of other goods, within an ancillary retail area not greater than 150m² in area;*
- e) providing toilet facilities, amenities and service for motorists;*
- f) repairing of motor vehicles (other than body building, panel beating or spray painting); and*
- g) the hiring of trailers.*

applies to the sale of hydrogen gas but not to its production. See Recommendation 1.

Appendix C - Territory Plan zone objectives for consideration

The following zone objectives in the Territory Plan, being zones/objectives that relate to utilities, service stations and fuel, were considered as potentially having relevance to the introduction of hydrogen in the ACT.

Zone	Zone objectives	Applicability to hydrogen
TSZ1 Transport Zone	<ul style="list-style-type: none"> a) <i>Make provision for a transport network that can provide for the efficient, safe and convenient movement of people and goods.</i> b) <i>Ensure that major roads, light rail and transport infrastructure are developed in a comprehensive manner, including the provision of appropriate landscaping, street furniture and lighting, traffic control devices, and noise attenuation measures.</i> c) <i>Provide for active travel and public transport.</i> 	Liquid fuel depot and service station are prohibited developments within this zone. Major service conduit is a permitted development that would be assessed under the merit assessment track. No amendment to objectives is seen to be needed for the introduction of hydrogen.
TSZ2 Services Zone	<ul style="list-style-type: none"> a) <i>Make provision for essential municipal services such as water, energy, transport and waste disposal.</i> b) <i>Ensure that development is carried out in an economic, safe, environmentally sensitive manner and does not unacceptably affect the health and safety of any nearby residents.</i> c) <i>Ensure that there is minimal impact on adjacent land uses due to any municipal services development</i> d) <i>Ensure that development is compatible with the surrounding landscape, especially in areas of high visibility, and that appropriate measures are taken to soften the impact of development on the landscape.</i> e) <i>Limit the impact of electro-magnetic interference from development on electrical appliances in nearby premises.</i> f) <i>Enable the development of transport facilities that are accessible and efficient for passengers and goods handling.</i> 	Liquid fuel depot and service station are prohibited developments within this zone. Hazardous waste facility and major utility installation are permitted uses, along with municipal depot. No amendment to objectives is seen to be needed for the introduction of hydrogen. See Recommendations 1 and 2.
IZ1 General	<ul style="list-style-type: none"> a) <i>Support the diversification and expansion of the ACT's industrial base and employment growth.</i> 	Service station, liquid fuel depot, major utility

Industrial Zone	<ul style="list-style-type: none"> b) <i>Facilitate investment in a wide range of industrial and related activities, with efficient land utilisation and provision of infrastructure.</i> c) <i>Provide convenient access for ACT and regional residents to industrial goods, services. and employment opportunities</i> d) <i>Make provision for transport-related businesses in locations accessible to major road, rail and air links.</i> e) <i>Encourage the clustering of industrial activities according to the principles of industrial ecology.</i> f) <i>Ensure that industrial development achieves high environmental standards of cleaner production, waste disposal, noise and air quality.</i> g) <i>Encourage the design and construction of industrial and commercial buildings that are energy efficient, functional and flexible.</i> h) <i>Ensure that development along major approach routes and major roads meets appropriate standards of urban design.</i> i) <i>Make provision for manufacturing, warehouse and transport land uses requiring large land areas accessible to main interstate road and rail connections.</i> j) <i>Ensure that the use of the land for predominantly industrial purposes is not jeopardised by the uncontrolled development of higher rent commercial uses such as retailing and offices</i> k) <i>Provide small-scale services to meet the needs of the local workforce.</i> 	<p>installations, and hazardous industry are permitted uses within this zone. Please refer to the conclusions as to the present meaning of these permitted uses in Appendix B. In summary, production of hydrogen gas could be referred to as a “hazardous industry” although that need not necessarily be the case. A service station may sell hydrogen gas under its existing definition. See also Recommendations 1, 2 and 5.</p>
IZ2 Industrial Mixed Use Zone	<ul style="list-style-type: none"> a) <i>Support the diversification and expansion of the ACT’s industrial base and employment growth.</i> b) <i>Facilitate investment in a wide range of industrial and related activities, with efficient land utilisation and provision of infrastructure.</i> a) <i>Provide convenient access for ACT and regional residents to industrial goods, services and employment opportunities, including by encouraging active travel and access to public transport.</i> b) <i>Ensure that industrial development achieves high environmental standards of cleaner production, waste disposal, noise and air quality.</i> 	<p>Service station, liquid fuel depot and major utility installations are permitted uses within this zone. Hazardous industry is a prohibited development. Please refer to commentary with respect to IZ1, above.</p>

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- c) *Encourage the design and construction of industrial and commercial buildings that are energy efficient, functional and flexible.*
 - d) *Ensure that development along major approach routes and major roads meets appropriate standards of urban design.*
 - e) *Accommodate industry-associated retailing, services and other commercial uses without jeopardising an adequate supply of industrial land.*
 - f) *Provide for a range of commercial and service activities at a scale that will protect the planned hierarchy of commercial centres and the Territory's preferred locations for office development.*
 - g) *Meet the need for a mix of lower rent bulky goods retailing, specialised industrial, commercial and service activities alongside general industry*
 - h) *Preserve and promote viable industries that can coexist with more commercially oriented uses.*
 - i) *Make provision for small-scale services that support surrounding industrial activities, or which meet the needs of the local workforce.*
 - j) *The following Zone Objectives apply specifically to West Fyshwick:*
 - i. *Encourage Canberra's regional role for food processing, wholesaling, distribution and marketing.*
 - ii. *Cluster uses which are compatible with and complementary to existing facilities, particularly with regard to food processing and warehousing and the markets, including some small scale food retailing.*
 - iii. *Protect the safety and amenity of food related enterprises.*
 - iv. *Promote buildings along Canberra Avenue that maintain and enhance a character appropriate for a major approach road to the Central National Area*

CZ3 Services Zone	<ul style="list-style-type: none"> a) <i>Provide for a range of conveniently located services and lower rent commercial activities.</i> b) <i>Ensure that commercial development supports but does not undermine the function of the CZ1 Core Zone and the CZ2 Business Zone.</i> 	<p>Under this zone, a service station is permitted development, and so is a municipal depot. Prohibited developments in this zone include</p>
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| <p>c) <i>Accommodate retail uses or entertainment facilities requiring larger sites</i></p> <p>d) <i>Encourage a mix of land uses which contribute to an active and diverse character.</i></p> <p>e) <i>Maintain and enhance environmental amenity and encourage a standard of urban design consistent with the function of the Zone.</i></p> <p>f) <i>Undertake development using best practice environmentally sustainable development principles.</i></p> <p>g) <i>Promote active living and active travel.</i></p> <p>h) <i>Encourage an attractive, safe, well-lit and connected pedestrian environment with convenient access to public transport.</i></p> <p>i) <i>Provide a high quality public realm by facilitating active uses on ground floor level that connects with the wider open space, pedestrian and cycle networks to promote active travel and active living.</i></p> | <p>hazardous waste facility, liquid fuel depot and major utility installation. The CZ-3 zone is the most built up and most populated of the zones considered. A policy decision will need to be made about the siting of electrolyzers for the production of hydrogen gas in these areas, noting that this zone is likely the predominant location for existing service stations. No stakeholder suggested that there are clear or inherent dangers associated with the operation of an electrolyser. The ActewAGL pilot project can serve as a guide.</p> |
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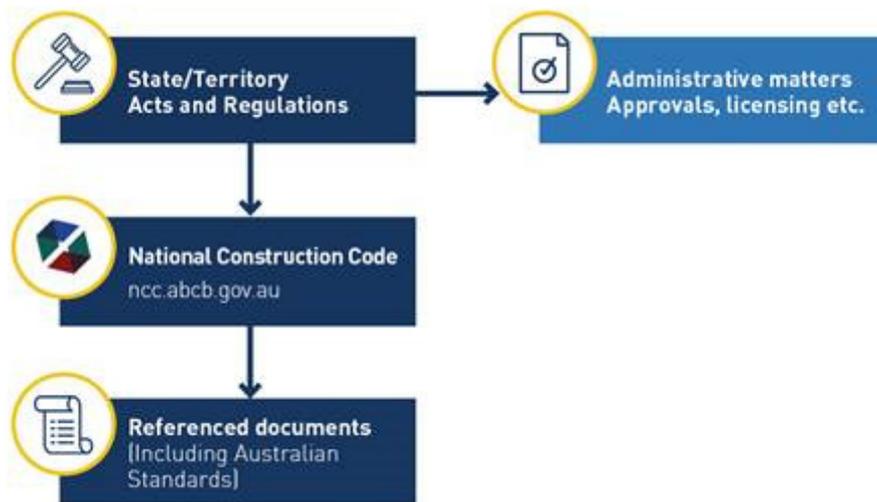
Appendix D – Additional comments on key energy, transport and safety legislation

1 Building Act 2004

The *Hydrogen Industry Legislation* report²⁰⁰ identifies the *Building Act 2004* and *Building (General) Regulation 2008* as relevant ACT legislation under the heading “Economic effects and access”.

The *Building Act 2004* gives legal effect to the building code and associated standards, and details offences where there has been a failure to comply. The *Building Act 2004* adopts the Building Code of Australia (“BCA”) and the Australian Capital Territory Appendix to the BCA as the relevant building code for the ACT. The Australian Building Codes Board develops the BCA within its National Construction Code.

The regulatory framework for the NCC operates as shown below:²⁰¹



The ACT Appendix was last remade under the *Building (ACT Appendix to the Building Code) Determination 2019 (No 3)*. The *Building (General) Regulation 2008* provides further definition for ACT purposes. A focus of the ACT Appendix relates to GHG emissions and energy efficiency.

The building legislation here referred to may need to be calibrated as a result of the introduction of a hydrogen gas capability in the ACT, however it is not seen to be legislation that requires unilateral amendment by the ACT in order to enable such introduction.

²⁰⁰ Clayton Utz. 2019. *Hydrogen Industry Legislation – a report scoping out legislation, regulations and standards relevant to the development of a national hydrogen industry in Australia*. Department of Industry, Innovation and Science. p. 36.

²⁰¹ NCC. *Regulatory Framework*. [online] Available at: <<https://ncc.abcb.gov.au/ncc-online/Regulatory-Framework>> accessed 17 June 2020.

2 Electricity (National Scheme) Act 1997

This Act applies the National Electricity Law which is in the Schedule to the *National Electricity (South Australia) Act 1996* (SA), and is referred to as the *National Electricity (ACT) Law*. The regulations made under Part 4 of the *National Electricity (South Australia) Act 1996* (SA) are also in force, referred to as the *National Electricity (ACT) Regulation*. There are no additional definitions in the law as it applies in the ACT.

The National Electricity Law describes the functions and powers of AER in Part 3, of AEMC in Part 4 and the role of AEMO in Part 5. The National Electricity Rules are in Part 7. Part 9 details the immunities of AEMO and of network service providers.

There is a possibility that the introduction and popularisation of hydrogen will cause changes in the operation of the national electricity market. However, for the time being this is not relevant to the current scope of this report.

3 Heavy Vehicle National Law (ACT) Act 2013

This law establishes a national scheme for regulating heavy vehicles on roads in a safe, environmentally friendly, productive and efficient manner.²⁰² The regulations prescribe standards, maximum mass and dimensions as well as safety duties. Non-compliance with heavy vehicle standards is subject to fines. No amendment is necessary to accommodate hydrogen transport trucks. However vehicle design standards need to be considered at the national level.

4 Motor Vehicle Standards Act 1989 / Road Vehicles Standards Act 2018

This is Federal legislation (the latter is soon to commence, thereby superseding the former). It is noted that the Hyundai NEXO FCEVs was the first hydrogen-powered vehicle to achieve Australian Design Rule certification, and that such certification was obtained relatively recently. As has been the case for the introduction of battery-electric vehicles, Federal approvals will be required to allow the more widespread importation and use of fuel-cell electric vehicles (“FCEVs”) on Australian roads.

5 National Energy Retail Law (ACT) Act 2012

The effect of the Act is to adopt the law set out in the equivalent South Australian Act and, in limited circumstances, to apply the equivalent NSW laws. This is consistent with the intention to create a national energy framework. As there is no specific definition of “gas” included in this Act, no amendment is required, as long as the headline definition applicable under the National Gas Law is amended nationally or specifically for the ACT.²⁰³

6 Scaffolding and Lifts Act 1912

The *Scaffolding and Lifts Regulation 1950* and its principal Act make provision for safety measures that workers should undertake in the presence of gas. Gas is not defined in the Regulation and is

²⁰² See *National Transport Commission (Road Transport Legislation – Heavy Vehicle Standards Regulations) Regulations 2006*.

²⁰³ See Recommendations 6 and 7.

therefore assumed to take its ordinary meaning, and its meaning which best achieves the purpose of the Act, which would be to include gas in the form of hydrogen.²⁰⁴

Nonetheless, a technical review could be conducted to ensure that the Regulations are updated to take into account the specific characteristics of hydrogen that could pose a health and safety risk (for example, the proper distance to mitigate the risk of a hydrogen explosion in the presence of electrical apparatus for the purposes of Regulation 133(61)).

7 Utilities Act 2000 / Utilities (Technical Regulation) Act 2014

This Act is intended to be consistent with the National Energy Retail Law (ACT). It covers regulated utility services, which for gas means:

- the transmission of gas through a gas transmission network;
- the distribution of gas through a gas distribution network; and
- the supply of gas from a gas network to premises.

The Act regulates the infrastructure up to the gas outlet to the premises concerned. The term “infrastructure” with respect to a gas network is widely defined, as “pipelines”, “meters”, “any equipment”, and “any other thing ancillary to any other part of the infrastructure”.²⁰⁵

The ICRC, the conservator of flora and fauna, and regulated utility service providers who will be affected must be consulted when draft technical codes are issued by the technical regulator.²⁰⁶ The technical codes themselves are disallowable instruments. They routinely reference AS or AS/NZS standards which must be adhered to in the provision of the networks and services concerned. The safety of the piping system from gas meter to appliance (the consumer piping system, or “CPS”) is a consumer issue.

Again, the following discussion first assumes that the definition of “gas” in these ACT statutes no longer references the definition of “natural gas” under the National Gas Law.²⁰⁷

There is some conjecture as to whether the existing provisions of the *Utilities (Technical Regulation) Act 2014* and the *Utilities Act 2000* would be wide enough to cover local hydrogen generation by electrolysers and related or unrelated hydrogen storage facilities. Here a three-way divergence must be recognised.

Utility regulation is concerned with the use of a physical network, and the safety of same. Hydrogen generation and storage may be related to an existing network, in that the hydrogen is intended to be injected into that network for distribution and sale. For that kind of activity to take place in the ACT, it is recommended that gas generation and storage be specifically referred to in the *Utilities Act 2000*. This would imitate the way in which “electrical generation” is presently referred to, separately to

²⁰⁴ See *Legislation Act 2001*, Section 139 (principle of statutory interpretation).

²⁰⁵ *Ibid*, Section 52, definition of “infrastructure”, subparagraph (b).

²⁰⁶ *Ibid*, Section 13.

²⁰⁷ See Recommendations 6 and 7.

supply of electricity.²⁰⁸ The Minister may prescribe infrastructure for “*the provision of electricity, gas, another form of energy, water or sewerage*” as a regulated utility service under the Act, however clarity and consistency is to be preferred.²⁰⁹

The second “divergence” involves the possible creation of “mini-networks”. Many electrolysers will not be connected to the existing gas network at all. They could provide hydrogen for the exclusive commercial use of the producer itself. Additionally, an entity may own an electrolyser and sell hydrogen to a nearby commercial customer or customers via its own dedicated pipes. The situation described is not unlike the concept of a “*discrete district network*” as was introduced into the *Utilities (Technical Regulation) Act 2014* to handle situations such as solar installations on a warehouse. The statute uses an example of electricity generated by solar panels on the roof of a warehouse being provided by way of cabling to nearby buildings for their use. That example is telling because the relevant statutory provisions do a much better job capturing solar power generation (“*converting a form of energy to another form of energy*”) than they do with respect to gas generation (for which ambiguous expressions such as “providing” and “storing” would need to be relied upon).²¹⁰ This, too, should also be considered for amendment.

The third “divergence” involves the use of electrolysers and the storage and transportation of gas by road and rail tankers, which takes place outside a “*network*”. This category includes hydrogen gas production for vehicular refuelling purposes. It could also include hydrogen gas production for the purposes of injection into an existing distribution pipeline, in circumstances where it is transported by road or rail tankers to the injection point. A policy decision will need to be made as to the manner of licensing and regulation that the ACT believes is appropriate for these “outside network boundary” generation and distribution and sale activities, with any relevant statutory amendments to be devised accordingly.

Dangerous incidents and notifiable incidents are broadly drafted using ordinary meaning of words and will apply to hydrogen gas leaks / explosions etc. The *Utilities (Technical Codes) Determination 2000* provides requirements of the Gas Safety and Operating Plan Code, which is submitted by the operator of a gas network.

Offences under the *Utilities (Technical Regulation) Act 2014* to note are:

- connection to a regulated utility network without the permission of the responsible utility;²¹¹ and
- abstraction of gas from a gas network without authorisation of the responsible utility.²¹²

²⁰⁸ See *Utilities Act 2000*, Section 9(1)(c) and (d) respectively.

²⁰⁹ *Utilities (Technical Regulation) Act 2014*, Section 10.

²¹⁰ *Ibid*, Section 9(2).

²¹¹ *Ibid*, Section 37.

²¹² *Ibid*, Section 39.

Appendix E – Hydrogen gas-related codes and standards

1 Notes

- (a) International standards can be adopted wholly or in a modified manner by specific countries. For example, AS/NZS 60079 (Australia/New Zealand) is a modified adoption of IEC 60079 (International).
- (b) There can be multiple international and national standards for the manufacture of the same equipment, test methods, installation, safety and other practices.
- (c) The set of standards below covers the field but may not be entirely complete. There could be more relevant standards which are not explored. Each component in a specific industry has a code of practice within each nation and on an international basis. Different organisations like ISO, SAE, ASTM can sometimes provide codes for the same components or practices.
- (d) Which code to adopt is decided by legislation, regulators and/or purchasers.
- (e) Generally speaking, “piping” refers to piping within a facility, and “pipeline” refers to transmission pipes (over long distance).
- (f) An old existing standard can be modified or extended to a new area (eg hydrogen application) if circumstances evolve. For example, ASME 4564 could possibly be extended to hydrogen pipeline construction (either with modifications or amendments or as it is).
- (g) Amendments to Australian standards are typically prepared by industry committees that report to Standards Australia.

2 New Australian Standards adopted by SA Me-093 Hydrogen Technologies Committee

Number/ID	Name	Jurisdiction
AS 16110.1:2020	Hydrogen generators using fuel processing technologies, Part 1: Safety (ISO 16110-1:2007, MOD)	Australia
AS ISO 16110.2:2020	Hydrogen generators using fuel processing technologies, Part 2: Test methods for performance	Australia
AS ISO 14687:2020	Hydrogen fuel quality – Product specification	Australia
AS 22734:2020	Hydrogen generators using water electrolysis – Industrial, commercial, and residential applications (ISO 22734:2019, MOD)	Australia
SA TS 19883:2020	Safety of pressure swing adsorption systems for hydrogen separation and purification (ISO/TS 19883:2017, MOD)	Australia
AS ISO 16111:2020	Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride	Australia
AS ISO 19881:2020	Gaseous hydrogen – Land vehicle fuel containers	Australia
AS 19880.3:2020	Gaseous hydrogen – Fuelling stations, Part 3: Valves (ISO 19880-3:2018, MOD)	Australia

3 Australian Standards noted as relevant by CSIRO report

The CSIRO National Hydrogen Roadmap report notes the below list of existing Australian standards for gap analysis.²¹³ These standards may require amendment or modifications to utilise hydrogen within the gas network or for vehicle fuelling and other uses.

Number/ID	Name	Jurisdiction	General description
AS 4564	Specification for general purpose natural gas	Australia	<ul style="list-style-type: none"> • Key standard defining gas and its quality, heating value, density, Sulphur, Wobbe index, characteristics and components. • Prescribes the standard of quality for natural gas conveyed through a transmission pipeline or a distribution pipeline. • Applies to natural gas from petroleum, landfill, biogas, coal seam and other sources where these sources provide gas for direct or blended supply on a commercial basis.

²¹³ CSIRO. 2018. Bruce S, Temminghoff M, Hayward J, Schmidt E, Munnings C, Palfreyman D, Hartley P, *National Hydrogen Roadmap*. Available at <https://www.csiro.au/en/Do-business/Futures/Reports/Energy-and-Resources/Hydrogen-Roadmap>.

Number/ID	Name	Jurisdiction	General description
AS 2885	Pipelines – Gas and liquid petroleum (5 parts)	Australia	<ul style="list-style-type: none"> Requirements are based on experience and practices for typical high-pressure hydrocarbon transmission pipelines used in Australia. Prescribes requirements for the safe design, construction, inspection, testing, operation and maintenance of a land or a submarine pipeline. Necessary for the protection of the general public, the operating personnel and the environment, as well as the protection of the pipeline against accidental damage. Intended for pipelines constructed from steel pipe used for the transport of gas or liquid petroleum.
AS 4645	Gas distribution networks Part 1: Network Management (3 sub-parts)	Australia	<ul style="list-style-type: none"> Specifies the requirements for safe management of a fuel gas distribution network.²¹⁴ Addresses all facilities between the outlets of all city gate supply points or equivalent (being wherever pressure is reduced to below 1050kPa), or for an LPG network the point of entry to the network operator’s facility and the outlet of the consumer’s meter assemblies.
AS 4568	Preparation of a safety and operating plan for gas networks	Australia	<ul style="list-style-type: none"> Describes the fundamental elements to be addressed in the preparation of a Plan (or Undertaking) by a distribution network operator for the safe and reliable operation of new and/or existing gas reticulation networks supplying fuel gases suitable for domestic, commercial or industrial utilisation. Does not address a Plan for systems covered by AS5601. Directed primarily at the Plan, which would in turn refer to other documents for supporting details and practices. AS 4645 describes the management and operation of a gas network.
AS/NZS 5263.0	Gas appliances – General requirements	Australia	<ul style="list-style-type: none"> Specifies general requirements and test methods for appliances and equipment which use natural gas, town gas, liquefied petroleum gas and tempered liquefied petroleum gas (“TLP”) as a fuel, and which are intended for domestic, commercial or light industrial use to an energy input limit of 1000 MJth/h or any lower limit specified.
AS/NZS 5601.1	Gas installations – Part 1: General installations	Australia	<ul style="list-style-type: none"> Mandatory requirements and means of compliance for the design, installation and commissioning of gas installations associated with the use or intended use of fuel gases such as natural gas, LPG, or biogas. Needs to be reviewed / modified / amended based on AS 4564 gas quality. <i>AS/NZS 5601 Gas installations</i> is the primary standard for gas fitting work and Type A gas appliance work in the ACT. Type A is domestic and light commercial. Type B gas appliance work must also comply with <i>AS/NZS 1375 Industrial fuel-appliances</i> and <i>AS/NZS 3814 Industrial and coal gas-fired appliances</i>. Type B are commonly found in industries.
AS 3814	Industrial and commercial gas-fired appliances	Australia	<ul style="list-style-type: none"> Sets out the minimum requirements for the design, construction and safe operation of Type B appliances that use any gas, or gases as a gaseous fuel in any combination or with other fuels to produce flame, heat, light, power or special atmosphere. Construction requirements relate only to matters affecting gas-firing systems or to any interconnection between the gas-firing system and the safety requirements of the appliance. Refer to AS 1375 for additional information re safety principles for industrial appliances. The original equipment manufacturer (OEM) should ensure that the design is in accordance with that standard before installing. Refer to AS/NZS 5601.1 for installation requirements for appliances covered by this Standard.

4 Other Australian codes and standards

Other Australian Codes and standards downloaded from the Australian standards website by searching “hydrogen” or other web searches are cross referenced in the standards as listed below. Australian standards that mention hydrogen are generally relevant to transporting small amounts hydrogen gas in cylinders and trucks.

²¹⁴ SAI Global. 2005. *Gas distribution network management*. [online] Available at: <https://infostore.saiglobal.com/en-au/Standards/AS-4645-2005-121610_SAIG_AS_AS_255210/>.

Number/ID	Name	Jurisdiction	General description
AS 1518	External extruded high-density-polyethylene coating system for pipes	Australia	<ul style="list-style-type: none"> Part of AS 2885 External corrosion protection coating system for pipelines.
AS 4822	External field joint coatings for steel pipelines	Australia	<ul style="list-style-type: none"> Part of AS 2885 External corrosion protection coating pipeline welded joints (at construction field).
AS/NZS 3862	External fusion bonded epoxy coating for steel pipes	Australia	<ul style="list-style-type: none"> Part of AS 2885 External corrosion protection coating system for pipelines.
AS 1375	Industrial fuel-fired appliances	Australia	<ul style="list-style-type: none"> AS/NZS 5601 Gas installations is the primary standard for gas fitting work and Type A gas appliance work in the ACT. Type A is domestic and light commercial. Type B gas appliance work must also comply with AS/NZS 1375 Industrial fuel-appliances and AS/NZS 3814 Industrial and coal gas-fired appliances. Type B are commonly found in industries.
AS 1678.2.1.007-1977	Emergency procedure guide - Transport – Hydrogen (compressed)	Australia	<ul style="list-style-type: none"> Not relevant to gas networks. Could be relevant to transport. Provides guidance for drivers, emergency services and others involved in the transport of dangerous goods, in dealing safely with emergency situations.
AS 2508.2.002-1992	Safe storage and handling information card - Hydrogen (compressed)	Australia	<ul style="list-style-type: none"> Not relevant to gas networks. Could be relevant to transport. Sets out essential information on hazards and safe handling practice for personnel employed in stores and warehouses in which this material is stored.
AS B10-1931	Cylinders for the storage and transport of permanent gases (air, hydrogen, etc.); Status: Superseded;	Australia	<ul style="list-style-type: none"> Not relevant to gas networks. Could be relevant to transport. Applies to cylinders having a capacity exceeding 4 fluid ounces but not exceeding 500 pounds water capacity for the storage and transport of permanent gases.

5 International standards noted as relevant by CSIRO report

The following international standards have been developed or are being developed specifically for the hydrogen industry as per “The National hydrogen roadmap” report by CSIRO. ISO develops and publishes International standards, but does not provide certification or conformity assessment.²¹⁵

a Safety standards

Number/ID	Name	Jurisdiction	General description
ISO/TR 15916	Basic considerations for the safety of hydrogen systems	International	<ul style="list-style-type: none"> Provides guidelines for the use of hydrogen in gaseous and liquid forms as well as its storage in these or other forms (hydrides). Identifies the basic safety concerns, hazards and risks, and describes the properties of hydrogen that are relevant to safety.
ISO 26142	Hydrogen detection apparatus – Stationary applications	International	<ul style="list-style-type: none"> Defines the performance requirements and test methods of hydrogen detection apparatus designed to measure and monitor hydrogen.

²¹⁵ ISO. *Innovations moving transport forward*. [online] Available at: <<https://www.iso.org/home.html>>.

b Hydrogen production standards

Number/ID	Name	Jurisdiction	General description
ISO/DIS 22734 [Under development and an update of earlier ISO 22734:2011]	Hydrogen generators using water electrolysis process – Industrial, commercial, and residential applications	International	<ul style="list-style-type: none"> Defines the construction, safety, and performance requirements of modular or factory-matched hydrogen gas generation appliances, herein referred to as hydrogen generators, using electrochemical reactions to electrolyse water to produce hydrogen.
ISO/DIS 14687 [Under development and an updated of earlier ISO 14687-1:1999]	Hydrogen fuel quality – Product specification	International	<ul style="list-style-type: none"> Specifies the quality characteristics of hydrogen fuel in order to ensure uniformity of the hydrogen product for utilization in stationary proton exchange membrane (PEM) fuel cell power systems.
ISO 16110-1:2007	Hydrogen generators using fuel processing technologies – Part 1: Safety	International	<ul style="list-style-type: none"> Aims to cover all significant hazards, hazardous situations and events relevant to hydrogen generators, with the exception of those associated with environmental compatibility (installation conditions). Applies to packaged, self-contained or factory matched hydrogen generation systems with a capacity of less than 400 m³/h at 0 °C and 101,325 kPa, herein referred to as hydrogen generators.
ISO 16110-2:2010	Hydrogen generators using fuel processing technologies – Part 2: Test methods for performance	International	<ul style="list-style-type: none"> Provides test procedures for determining the performance of packaged, self-contained or factory matched hydrogen generation systems with a capacity less than 400 m³/h at 0 °C and 101,325 kPa, referred to as hydrogen generators.
ISO/TS 19883:2017	Safety of pressure swing adsorption systems for hydrogen separation and purification	International	<ul style="list-style-type: none"> Identifies safety measures and applicable design features that are used in the design, commissioning, and operation of pressure swing adsorption systems for hydrogen separation and purification.

c Carbon capture and storage standards (for 'grey hydrogen' production)

Number/ID	Name	Jurisdiction	General description
ISO/TR 27912:2016	Carbon dioxide capture – Carbon dioxide capture systems, technologies and processes	International	<ul style="list-style-type: none"> Describes the principles and information necessary to clarify the CO₂ capture system.
ISO 27913:2016	Carbon dioxide capture, transportation and geological storage – Pipeline transportation systems	International	<ul style="list-style-type: none"> Specifies additional requirements and recommendations not covered in existing pipeline standards for the transportation of CO₂ streams from the capture site to the storage facility where it is primarily stored in a geological formation or used for other purposes.
ISO 27914:2017	Carbon dioxide capture, transportation and geological storage – Geological storage	International	<ul style="list-style-type: none"> Establishes requirements and recommendations for the geological storage of CO₂ streams, the purpose of which is to promote commercial, safe, long-term containment of carbon dioxide.
ISO/TR 27915:2017	Carbon dioxide capture, transportation and geological storage – Quantification and verification	International	<ul style="list-style-type: none"> Presents a review of publicly available literature identifying materially relevant issues and options relating to “good practices” for quantifying and verifying GHG emissions and reductions at the project level.
ISO 27917:2017	Carbon dioxide capture, transportation and geological storage – Vocabulary – Cross cutting terms	International	<ul style="list-style-type: none"> Defines a list of cross-cutting terms commonly used in the field of carbon dioxide capture, transportation and geological sub-surface storage including through storage in association with enhanced oil recovery (EOR) operations.
ISO/TR 27918:2018	Lifecycle risk management for integrated CCS projects	International	<ul style="list-style-type: none"> Designed to be an information resource for the potential future development of a standard for overall risk management for CCS projects.

Number/ID	Name	Jurisdiction	General description
ISO/TR 27912:2016	Carbon dioxide capture – Carbon dioxide capture systems, technologies and processes	International	<ul style="list-style-type: none"> Describes the principles and information necessary to clarify the CO2 capture system and provide stakeholders with the guidance and knowledge necessary for the development of a series of standards for CO2 capture.
ISO/DIS 27916 [under development]	Carbon dioxide capture, transportation and geological storage – Carbon dioxide storage using enhanced oil recovery (CO2 EOR)	International	<ul style="list-style-type: none"> Applies CO2 injected in enhanced recovery operations for oil and other hydrocarbons (CO2-EOR) for which quantification of CO2 that is safely stored long-term in association with the CO2-EOR project is sought.

d Standards for hydrogen-fuelled transport

Number/ID	Name	Jurisdiction	General description
ISO19884 [under development]	Gaseous hydrogen – Cylinders and tubes for stationary storage	International	<ul style="list-style-type: none"> Specifies the requirements for the design, manufacture and testing of stand-alone or manifolded (for some specific tests such as bonfire) cylinders, tubes and other pressure vessels of steel, stainless steel, aluminium alloys or of non-metallic construction material. Intended for the stationary storage of gaseous hydrogen of up to a maximum water capacity of 10 000 l and a maximum allowable working pressure not exceeding 110 MPa, of seamless metallic construction (Type 1) or of composite construction (Types 2, 3 and 4), referred to as pressure vessels.²¹⁶
ISO 16111	Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride	International	<ul style="list-style-type: none"> Defines the requirements applicable to the material, design, construction, and testing of transportable hydrogen gas storage systems, referred to as "metal hydride assemblies" (MH assemblies) which utilize shells not exceeding 150 l internal volume and having a maximum developed pressure (MDP) not exceeding 25 MPa.
ISO/DIS 17268 [under development]	Gaseous hydrogen land vehicle refuelling connection devices	International	<ul style="list-style-type: none"> Design, safety and operation characteristics of gaseous hydrogen land vehicle ("GHLV") refuelling connectors.
ISO/DIS 19881 [under development]	Gaseous hydrogen – Land vehicle fuel containers	International	<ul style="list-style-type: none"> Contains requirements for the material, design, manufacture, marking and testing of serially produced, refillable containers intended only for the storage of compressed hydrogen gas for land vehicle operation.
ISO/DIS 19882 [under development]	Gaseous hydrogen – Thermally activated pressure relief devices for compressed hydrogen vehicle fuel containers	International	<ul style="list-style-type: none"> Establishes minimum requirements for pressure relief devices intended for use on hydrogen fuelled vehicle fuel containers that comply with ISO 19881.
ISO/DIS 19880-1 [under development]	Gaseous hydrogen – Fuelling stations – Part 1: General requirements	International	<ul style="list-style-type: none"> Minimum design, installation, commissioning, operation, inspection and maintenance requirements for the safety, and, where appropriate, the performance of public and non-public fuelling stations that dispense gaseous hydrogen to light duty road vehicles.
ISO/FDIS 19880-3 [under development]	Gaseous hydrogen – Fuelling stations – Part 3: Valves	International	<ul style="list-style-type: none"> Provides the requirements and test methods for the safety performance of high pressure gas valves that are used in gaseous hydrogen stations of up to the H70 designation.
ISO/DIS 19880-5 [under development]	Gaseous hydrogen – Fuelling stations – Part 5: Hoses and hose assemblies	International	<ul style="list-style-type: none"> Specifies the requirements for wire or textile reinforced hoses and hose assemblies suitable for dispensing hydrogen up to 70 MPa nominal working pressure, in the operating temperature range of –40 °C to 65 °C.
ISO/DIS 19880-8 [under development]	Gaseous hydrogen – Fuelling stations – Part 8: Fuel quality control	International	<ul style="list-style-type: none"> Specifies the protocol for ensuring the quality of the gaseous hydrogen at hydrogen distribution facilities and hydrogen fuelling stations for proton exchange membrane ("PEM") fuel cells for road vehicles.

²¹⁶ ISO. 2019. *Gaseous Hydrogen – Cylinders and Tubes for Stationary Storage*. [online] Available at: <https://global.ihs.com/doc_detail.cfm?&document_name=ISO%20FDIS%2019884&item_s_key=00745630&item_key_date=811015>.

Number/ID	Name	Jurisdiction	General description
ISO 13984:1999	Liquid hydrogen – Land vehicle fuelling system interface	International	<ul style="list-style-type: none"> Specifies the characteristics of liquid hydrogen refuelling and dispensing systems on land vehicles of all types in order to reduce the risk of fire and explosion during the refuelling procedure and thus to provide a reasonable level of protection from loss of life and property.
ISO 13985:2006	Liquid hydrogen – Land vehicle fuel tanks	International	<ul style="list-style-type: none"> Specifies the construction requirements for refillable fuel tanks for liquid hydrogen used in land vehicles as well as the testing methods required to ensure that a reasonable level of protection from loss of life and property resulting from fire and explosion is provided.
ISO/TS 15869:2009	Gaseous hydrogen and hydrogen blends – Land vehicle fuel tanks	International	<ul style="list-style-type: none"> Specifies the requirements for lightweight refillable fuel tanks intended for the on-board storage of high-pressure compressed gaseous hydrogen or hydrogen blends on land vehicles.
ISO 17268:2012	Gaseous hydrogen land vehicle refuelling connection devices	International	<ul style="list-style-type: none"> Defines the design, safety and operation characteristics of gaseous hydrogen land vehicle (GHLV) refuelling connectors consisting of, as applicable, a receptacle and a protective cap (mounted on vehicle), and a nozzle.
ISO/TS 19880-1:2016	Gaseous hydrogen – Fuelling stations – Part 1: General requirements	International	<ul style="list-style-type: none"> Recommends the minimum design characteristics for safety and, where appropriate, for performance of public and non-public fuelling stations that dispense gaseous hydrogen to light duty land vehicles.

6 ISO standards appearing in Australian Standards website

Other International Codes and standards obtained from the Australian Standards website by searching the word “hydrogen”.²¹⁷ These are relevant to hydrogen technologies and may prove useful for developing regulations.

Number/ID	Name	Jurisdiction	General description
ISO 12619-9:2017	Road vehicles — Compressed gaseous hydrogen (CGH ₂) and hydrogen/natural gas blends fuel system components	International	<ul style="list-style-type: none"> Specifies general requirements and definitions of compressed gaseous hydrogen (CGH₂) and hydrogen/natural gas blends fuel system components, intended for use on the types of motor vehicles defined in ISO 3833.
ISO 23273:2013	Fuel cell road vehicles — Energy consumption measurement — Vehicles fuelled with compressed hydrogen	International	<ul style="list-style-type: none"> Specifies the essential requirements for fuel cell electric vehicles (“FCEV”) with respect to the protection of persons and the environment inside and outside the vehicle against hydrogen-related hazards.
ISO 23828:2013	Fuel cell road vehicles — Energy consumption measurement — Vehicles fuelled with compressed hydrogen	International	<ul style="list-style-type: none"> Specifies the procedures for measuring the energy consumption of fuel cell passenger cars and light-duty trucks that use compressed hydrogen and which are not externally chargeable.
ISO/PAS 15594:2004	Airport hydrogen fuelling facility operation	International	<ul style="list-style-type: none"> Specifies the fuelling procedures, hydrogen boil-off management procedures, hydrogen storage requirements, and characteristics of the ground support equipment required to operate an airport hydrogen fuelling facility.
ISO 2626:1973	Copper-Hydrogen embrittlement test	International	<ul style="list-style-type: none"> Applicable to deoxidized and oxygen-free high-conductivity coppers. Specifies principle, test pieces, and procedure. Embrittlement is revealed by close bending, reverse bending or by microscopic examination
ISO 16573:2015	Measurement method for the evaluation of hydrogen embrittlement resistance of high strength steels	International	<ul style="list-style-type: none"> Provides a method for evaluating the resistance to hydrogen embrittlement (i.e. hydrogen delayed fracture) using constant loading test with hydrogen pre-charged specimens.

²¹⁷ Standards Australia. 2018. [online] Available at: <<https://www.standards.org.au/>> accessed 18 June 2020.

Number/ID	Name	Jurisdiction	General description
ISO 15330:1999	Preloading test for the detection of hydrogen embrittlement — Parallel bearing surface method	International	<ul style="list-style-type: none"> Specifies a pre-loading test which can detect the occurrence of hydrogen embrittlement of fasteners at room temperature.
ISO 9587:2007	Metallic and other inorganic coatings — Pre-treatment of iron or steel to reduce the risk of hydrogen embrittlement	International	<ul style="list-style-type: none"> Establishes stress-relief requirements for high strength steels in order to reduce their susceptibility or degree of susceptibility to hydrogen embrittlement in subsequent pre-treatment, electroplating, autocatalytic plating, chemical conversion and phosphating processes.
ISO 21266-1:2018	Road vehicles -- Compressed gaseous hydrogen (CGH ₂) and hydrogen/natural gas blends fuel systems	International	<ul style="list-style-type: none"> Minimum safety requirements applicable for the functionality of compressed gaseous hydrogen (CGH₂) and hydrogen/natural gas blends on-board fuel systems intended for use on the types of motor vehicles defined in ISO 3833.
ISO 21266-2:2018	Road vehicles -- Compressed gaseous hydrogen (CGH ₂) and hydrogen/natural gas blends fuel systems	International	<ul style="list-style-type: none"> Specifies the test methods for checking the minimum safety requirements specified in ISO 21266-1.

7 Hydrogen pipeline standards being explored for underground storage

The below standards are in the process of being reviewed by ITP Thermal for the purpose of hydrogen underground storage. They are relevant to hydrogen pipelines, pressure vessels, piping within a facility and may prove useful for developing regulations.

Number/ID	Name	Jurisdiction	General description
EIGA 121/14	Hydrogen piping system	European Union	<ul style="list-style-type: none"> Addresses metallic transmission and distribution piping systems carrying pure hydrogen and hydrogen mixtures.
ASME section V	Boiler and pressure vessel code	International	<ul style="list-style-type: none"> For sound construction of high-pressure vessels. Contains requirements and methods for non-destructive examination, which are referenced and required by other BPVC sections.
ASME B31.3	Pressure piping	International	<ul style="list-style-type: none"> Contains requirements for piping typically found in petroleum refineries; chemical, pharmaceutical, textile, paper, semiconductor, and cryogenic plants; and related processing plants and terminals. Addresses materials and components, design, fabrication, assembly, erection, examination, inspection, and testing of piping.
ASME B31.12	H ₂ piping and pipelines	International	<ul style="list-style-type: none"> Contains requirements for piping in gaseous and liquid hydrogen service and pipelines in gaseous hydrogen service.
AS 1210:2010	Pressure vessel code	Australia	<ul style="list-style-type: none"> Prescribes minimum requirements for the materials, design, manufacture, testing, inspection, certification, documentation and dispatch of fired and unfired pressure vessels constructed in ferrous or non-ferrous metals.
AS 1200:2000	Pressure equipment	Australia	<ul style="list-style-type: none"> “Parent” document for use by the pressure equipment industry in Australia and New Zealand. Addresses the design, materials, manufacture, examination, testing, installation, conformity assessment, commissioning, operation, inspection, maintenance, repair, alteration and disposal of pressure equipment (boilers, pressure vessels and pressure piping), but excluding gas cylinders.
AS 4041: R2016	Pressure piping	Australia	<ul style="list-style-type: none"> Prescribes minimum requirements for the materials, design, fabrication, testing, inspection, reports and pre-commissioning of piping subject to internal pressure or external pressure or both
AS 4343:2014	Pressure equipment - Hazard levels	Australia	<ul style="list-style-type: none"> Specifies criteria for determining the hazard levels of various types of pressure equipment to AS/NZS 1200. Also classifies fluids for use with pressure equipment

Number/ID	Name	Jurisdiction	General description
AS 4037: R2016	Pressure equipment - examination and testing	Australia	<ul style="list-style-type: none"> Specifies requirements for non-destructive examination (“NDE”) methods for examining boilers, pressure vessels, piping and their components.
AS 3788: R2017	Pressure equipment - in-service inspection	Australia	<ul style="list-style-type: none"> Specifies the minimum requirements for the inspection, repair and alteration of in-service boilers, pressure vessels, piping, safety equipment, and associated safety controls (hereafter referred to as pressure equipment), and gives guidance in the execution of such activities.

8 Standards recommended by other sources

Other International codes and standards identified through consultation with Australian industrial players working on these issues are as follows. These are relevant to hydrogen technologies and may prove useful for developing regulations.

Number/ID	Name	Jurisdiction	General description
AS2030.1:2009	Gas cylinders - part 1 - General requirements	Australia	<ul style="list-style-type: none"> Specifies requirements for the design, verification and manufacture of all gas cylinders for the storage and transport of compressed, dissolved and liquefied gases, of water capacity ranging from 0.1 kg to 3000 kg.
AS2030.5:2009	Gas cylinders - part 5 - Filling, inspection and testing the refillable cylinders	Australia	<ul style="list-style-type: none"> Specifies requirements for the filling, inspection and testing of refillable gas cylinders for the storage and transport of compressed and liquefied gases, of water capacity ranging from 0.1 kg to 3000 kg.
AS2337.1:2004	Gas cylinder test station - Part 1 General requirements	Australia	<ul style="list-style-type: none"> Prescribes requirements and procedures for a gas cylinder test station to carry out initial and periodic inspection of gas cylinders covered by AS 2030.1. Also specifies requirements for test stations to obtain a certificate of conformity. Specific requirements for inspection and testing of LP Gas fuel vessels, applied in accordance with AS/NZS 1425, and composite (FRP) gas cylinders, are given in AS 2337.2 and AS 2337.3
AS2337.3: R2016	Gas cylinder test station - Part 3 composite cylinders	Australia	<ul style="list-style-type: none"> Refer above (AS2337.1:2004).
NFPA 2	Hydrogen technologies	International	<ul style="list-style-type: none"> Provides fundamental safeguards for the generation, installation, storage, piping, use, and handling of hydrogen in compressed gas (GH2) form or cryogenic liquid (LH2) form.
UL subject 2264 A	Gaseous H ₂ generation appliance - electrolyser technology (awaiting for TC197 WG8)	International	<ul style="list-style-type: none"> Self-contained or factory matched packages of integrated gaseous hydrogen generating systems, herein after referred to as hydrogen generators.
ANSI/CSA CHMC 1 - 2014	Test method for evaluating material compatibility in compressed H ₂ applications - Phase I - metals	USA	<ul style="list-style-type: none"> Provides uniform test methods for evaluating material compatibility with compressed hydrogen applications. The results of these tests are intended to provide a basic comparison of materials performance in applications utilizing compressed hydrogen.
CGA H4	terminology associated for H ₂ fuel cell technologies	USA, Canada	<ul style="list-style-type: none"> Describes technologies and terminology as they apply to hydrogen fuel production, storage, transport, and use.
OSHA:29CFR1910.103	US Dept of Labor, Hydrogen	USA	<ul style="list-style-type: none"> Occupational safety and health standards for hydrogen (hazardous material).
CGA P12	Safe handling of cryogenic liquids	USA, Canada	<ul style="list-style-type: none"> Provides general information about the properties, transportation, storage, safe handling, and safe use of the cryogenic liquids commonly used by industry and institutions.
CGA H10	Combustion safety for steam for producing H ₂	USA, Canada	<ul style="list-style-type: none"> Applies to steam reformers operated with natural gas, refinery off-gas, naphtha, and other light hydrocarbon streams. Specifically applies to large volume hydrogen production plants. Addresses operation, maintenance, and certain design aspects of steam reformers relative to the potential safety hazards of the combustion process.

Number/ID	Name	Jurisdiction	General description
CGA H11	Safe start-up and shutdown practices for steam reformers	USA, Canada	<ul style="list-style-type: none"> Operational safety of steam reformer start-up and shutdown. Emphasis is placed on operational guidance and features that provide safeguards against the hazards.
EIGA Doc 6/02	Safety in storage, handling and distribution of liquid H ₂	European Union	<ul style="list-style-type: none"> Guidance for companies directly associated with the installation of liquid hydrogen storage at the user's premises and the distribution of liquid hydrogen by road, rail and sea. Applies to the layout, design and operation of fixed storages and the transportation of liquid hydrogen in bulk form by tankers or tank containers, by road, sea and rail, to fixed storages at user's premises. Portable containers, such as pallet tanks and liquid cylinders, are excluded from the scope.
NFPA 55	Storage, use and handling of compressed gases and cryogenic fluids in portable and stationary containers	International	<ul style="list-style-type: none"> Facilitates protection from physiological, over-pressurization, explosive, and flammability hazards associated with compressed gases and cryogenic fluids.
SAE J2719	H ₂ fuel quality for fuel cell vehicles	USA	<ul style="list-style-type: none"> Provides background information and a hydrogen fuel quality standard for commercial proton exchange membrane ("PEM") fuel cell vehicles.
SAE J2719/1	Application guidelines for use of H ₂ fuel quality specification	USA	<ul style="list-style-type: none"> Provides guidance for minimizing test requirements based on SAE J2719 while still ensuring fuel quality at hydrogen fuelling stations for PEM fuel cell vehicles ("FCEVs") and internal combustion engine vehicles ("ICEVs") (to the extent that has been determined).
ASTM D7550-09	Standard test method for determination of ammonium, alkali and alkane earth metals in H ₂ and other cell feed gases by Ion Chromatography	International	<ul style="list-style-type: none"> Describes a procedure for determining cations in hydrogen and other fuel cell feed gases. Has been successfully applied to other types of gaseous samples including air, engine exhaust, and landfill samples.
ASTM WK23815	New test method for standard screening method for organic halides contained in H ₂ or other gaseous fuels	International	<ul style="list-style-type: none"> Describes the screening of organic halide content of gaseous fuels using electron capture detection. Although primarily intended for determining organic halides in hydrogen used as a fuel for fuel cell or internal combustion engine powered vehicles, this screening method can also be used, if qualified, to measure organic halides in other gaseous fuels and gaseous matrices.
ASTM D7606-11	Standard practice for sampling of high pressure H ₂ and related fuel cell feed gases	International	<ul style="list-style-type: none"> Describes a sampling procedure of high pressure hydrogen at fuelling stations operating at 35 or 70 megapascals (MPa) using a hydrogen quality sampling apparatus ("HQSA").
ASTM D7634-10	Standard test method for visualisations particulate sizes and morphology contained in H ₂ fuel by microscopy	International	<ul style="list-style-type: none"> Subcommittee D03.14 on Hydrogen and Fuel Cells. D7606-17 Standard Practice for Sampling of High Pressure Hydrogen and Related Fuel Cell Feed Gases D7634-10(2017) Standard Test Method for Visualizing Particulate Sizes and Morphology of Particles Contained in Hydrogen Fuel
ASTM D7649-10	Standard test method for determination of trace carbon dioxide, argon, nitrogen, oxygen and water in H ₂ fuel by jet pulse injection and gas chromatography/mass spectrometer analysis	International	<ul style="list-style-type: none"> Describes a procedure primarily for the determination of carbon dioxide, argon, nitrogen, oxygen and water in high pressure fuel cell grade hydrogen by gas chromatograph/mass spectrometer ("GC/MS") with injection of sample at the same pressure as sample without pressure reduction, which is called "Jet Pulse Injection".

Number/ID	Name	Jurisdiction	General description
ASTM D7650-13	Standard test method for test method for sizing of particulate matter in high pressure H ₂ used as a gaseous fuel with an in-stream filter	International	<ul style="list-style-type: none"> Fuel cells such as proton exchange membrane fuel cells require high purity hydrogen for maximum material performance and lifetime. Collection and measurement of particulate matter 0.2 µm or larger is necessary for assuring a feed gas of sufficient quality to satisfy fuel cell system needs. In addition, internal combustion engines using high pressure hydrogen fuel also require low particulate levels. Specifically, particulate matter has been implicated in the premature failure of pneumatic control components, such as valves within vehicles. This sampling procedure is used to collect and measure samples containing particles 0.2 µm or larger in size.
ASTM D7651-10 (superseded D7651-17)	Gravimetric measurement of particulate concentration in H ₂ fuel	International	<ul style="list-style-type: none"> Primarily intended for gravimetric determination of particulates in hydrogen intended as a fuel for fuel cell or internal combustion engine powered vehicles. Describes operating and quality control procedures required to obtain data of known quality satisfying the requirements of SAE J2719 and the California Code of Regulations, Title 4, Division 9, Chapter 6, Article 8, Sections 4180–4181. The levels of precision and accuracy stated can be applied to other gaseous samples requiring determination of particulates provided the user's data quality objectives are satisfied.
ASTM D7675-15	Standard test method for the determination of total hydrocarbon in H ₂ by FID based total hydrocarbon (THC) analyser	International	<ul style="list-style-type: none"> Describes a procedure for total hydrocarbons ("THC") measurement in hydrogen intended as a fuel for fuel cells on a methane (C1) basis. The determination of total hydrocarbons on a C1 basis is an analytical technique where all hydrocarbons are assumed to have the same response as methane. Sensitivity from 0.1 part per million (ppm(v), µmole/mole) up to 1000 parts per million (ppm(v), µmole/mole) concentration are achievable. Higher concentrations can be analysed using appropriate dilution techniques. Can be applied to other gaseous samples requiring analysis of trace constituents provided an assessment of potential interferences has been accomplished.
ASTM D7941/7941M-14	Standard test method for determination of H ₂ purity analysis using a continuous wave cavity ring-down spectroscopy analyser	International	<ul style="list-style-type: none"> Proton exchange membranes ("PEM") used in fuel cells are susceptible to contamination from a number of species that can be found in hydrogen. Critical that these contaminants be measured and verified to be present at or below the amounts stated in SAE J2719, ISO 14687-2 and ISO 14687-3 to ensure both fuel cell longevity and optimum efficiency. Contaminant concentrations as low as single-figure ppb for some species can seriously compromise the life span and efficiency of PEM fuel cells.
ASTM WK D7892-15	Test method for determination of total organic halides, total non-methane hydrocarbon and formaldehyde in H ₂ fuel by gas chromatography (GC) and mass spectrometry (MS)	International	<ul style="list-style-type: none"> Hydrogen fuel quality specifications for polymer electrolyte fuel cells in road vehicles.
NPL Report AS64	Methods for analysis of trace-level impurities in H ₂ for fuel cell applications	United Kingdom	<ul style="list-style-type: none"> Presents the results of work carried out by the Analytical Science Division, National Physical Laboratory, UK between February 2010 and March 2011 to develop traceable methods for the measurement of trace-levels impurities in hydrogen for fuel cell applications.
EIGA Doc 183/11	Best Available Techniques for the Co-Production of Hydrogen, Carbon Monoxide & their Mixtures by steam reforming (AHG-I.17)	European Union	<ul style="list-style-type: none"> Addresses the co-production of hydrogen, carbon monoxide, and their mixtures by steam reforming. This document is a sister to EIGA Doc. 155 and focuses primarily on the best available techniques of steam reforming where hydrogen (beside the co-produced steam) is the only product. Appears that it should be labelled Doc 183/13, not 11.²¹⁸ - eiga.eu/publications/eiga-documents/doc-18313-best-available-techniques-for-the-co-production-of-hydrogen-carbon-monoxide-their-mixtures-by-steam-reforming. Contributes to the European IPPC Bureau's reference documents that are due for revision and that are associated with hydrogen, carbon monoxide and syngas production technologies.

²¹⁸ See <<https://eiga.eu/publications/eiga-documents/doc-18313-best-available-techniques-for-the-co-production-of-hydrogen-carbon-monoxide-their-mixtures-by-steam-reforming/>>.

Number/ID	Name	Jurisdiction	General description
EIGA Doc 220/19	Environmental guidelines for permitting hydrogen plants producing less than 2 tonnes per day	European Union	<ul style="list-style-type: none"> • Environmental impacts and operational controls for these packaged hydrogen plants and is intended to be used as guidance.
EIGA Doc 15/06	Gaseous hydrogen stations (WG2)	European Union	<ul style="list-style-type: none"> • Prepared for the guidance / best practices of designers and operators of gaseous hydrogen stations. • Its application will achieve the primary objective of improving the safety of gaseous hydrogen station operation.
IEC 62282-3-100	Stationary fuel cell systems - safety	International	<ul style="list-style-type: none"> • Applies to stationary packaged, self-contained fuel cell power systems or fuel cell power systems comprised of factory matched packages of integrated systems which generate electricity through electrochemical reactions. • Applicable to stationary fuel cell power systems intended for indoor and outdoor commercial, industrial and residential use in non-hazardous areas.
IEC 62282-3-200	Test method for the performance of stationary fuel cell power plants	International	<ul style="list-style-type: none"> • Covers operational and environmental aspects of the stationary fuel cell power systems performance. • Applies as follows: <ul style="list-style-type: none"> – power output under specified operating and transient conditions; – electrical and heat recovery efficiency under specified operating conditions; – environmental characteristics. • For example, exhaust gas emissions, noise, etc. under specified operating and transient conditions.
IEC 62282-3-201	Small stationary polymer electrolyte fuel cell power systems - performance test method	International	<ul style="list-style-type: none"> • Provides test methods for the electrical, thermal and environmental performance of small stationary fuel cell power systems that meet the following criteria: <ul style="list-style-type: none"> – rated electric power output of less than 10 kW; – grid-connected/independent operation or stand-alone operation with single-phase AC output or 3-phase AC output not exceeding 1 000 V, or DC output not exceeding 1 500 V; – maximum allowable working pressure of less than 0,1 MPa (gauge) for the fuel and oxidant passages; – gaseous fuel (natural gas, liquefied petroleum gas, propane, butane, hydrogen, etc.) or liquid fuel (kerosene, methanol, etc.); – air as oxidant.
IEC 62932-2-2	Flow battery systems for stationary applicants - safety requirements	International	<ul style="list-style-type: none"> • Applies to flow battery systems for stationary applications and their installations with a maximum voltage not exceeding 1 500 V DC in compliance with IEC 62932-1. • Defines the requirements and test methods for risk reduction and protection measures against significant hazards relevant to flow battery systems, to persons, property and the environment, or to a combination of them. • Applicable to stationary flow battery systems intended for indoor and outdoor commercial and industrial use in non-hazardous (unclassified) areas.
EIGA Doc 120/04	Carbon monoxide and syngas pipeline system (grey hydrogen)	European Union	<ul style="list-style-type: none"> • Guidance on the design and operation of carbon monoxide and syngas pipeline systems. • Summary of current industrial practices. • Not intended to be a mandatory standard or code. • Based upon the experience and practices of members companies from Regional Gas Associations.
ISO/TS 18569:2009	Gaseous hydrogen and hydrogen blends -- Land vehicle fuel tanks	International	<ul style="list-style-type: none"> • Specifies the requirements for lightweight refillable fuel tanks intended for the on-board storage of high-pressure compressed gaseous hydrogen or hydrogen blends on land vehicles.
ISO 60079.10.1	Hazardous Areas	International	<ul style="list-style-type: none"> • Explosive gas atmospheres to determine the extent and degree of the hazard particularly for electronic and electrical equipment flame proof enclosures.

Number/ID	Name	Jurisdiction	General description
ISO 11114-1	Gas cylinders - compatibility of cylinder and valve materials with gas content Part 1: metallic materials	International	<ul style="list-style-type: none"> Provides requirements for the selection of safe combinations of metallic cylinder and valve materials and cylinder gas content. In this, "cylinder" refers to transportable pressure receptacles, which also include tubes and pressure drums.
ISO 11114-2	Gas cylinders - compatibility of cylinder and valve materials with gas content Part 2: non-metallic materials	International	<ul style="list-style-type: none"> Provides guidance in the selection and evaluation of compatibility between non-metallic materials for gas cylinders and valves and the gas contents. Also covers bundles, tubes and pressure drums.
ISO 11114-4	Gas cylinders - compatibility of cylinder and valve materials with gas content Part 4: test methods for selecting metallic material resistant to hydrogen embrittlement	International	<ul style="list-style-type: none"> Specifies test methods and the evaluation of results from these tests in order to qualify steels suitable for use in the manufacture of gas cylinders (up to 3 000 l) for hydrogen and hydrogen bearing embrittling gases.
SAE J2600	Compressed H ₂ vehicle fuelling connection devices	International	<ul style="list-style-type: none"> Applies to the design and testing of compressed hydrogen surface vehicle ("CHSV") fuelling connectors, nozzles, and receptacles. Connectors, nozzles, and receptacles must meet all SAE J2600 requirements and pass all SAE J2600 testing to be considered as SAE J2600 compliant.
EIHP package 2	European integrated H ₂ project Package 2 Refuelling station	European Union	<ul style="list-style-type: none"> Procedures for periodic vehicle inspections will be developed. Requirements for new draft standards, refuelling procedures and periodic inspections for hydrogen refuelling infrastructure components and systems will be developed and inputs forwarded to regulatory bodies.
EIHP package 3	Refuelling interface	European Union	<ul style="list-style-type: none"> WP3 consortium will develop requirements for new draft standards of the refuelling interface "vehicle refuelling station". This directly applies to the receptacle (vehicle based) and the nozzle (refuelling station based) and will have to take into consideration also items such as optimum storage pressure for CGH₂ storage and prerequisites of CGH₂ and LH₂ refuelling procedures. Validation of the interfaces shall ensure compliance with the elaborated standard and functional operability. Standardised on-board storage pressure(s) will be vital to the safe and commercially viable introduction of CGH₂.
GB 50177-2005	Design code for H ₂ station	China	<ul style="list-style-type: none"> Formulated with a view to correctly implementing the principles and policies of the national capital construction in the design of hydrogen station and hydrogen supply station, ensuring safety production, energy conservation, environmental protection, meeting production requirements, and achieving advanced technology and economy and rationality.²¹⁹
OIML R81	Dynamic measuring devices Ans system for cryogenic liquids	International	<ul style="list-style-type: none"> Prescribes the metrological and technical requirements and test procedures for measuring devices and systems used for the dynamic measurement of cryogenic liquids.
OIML R139	Compressed gaseous fuel measuring system for vehicles	International	<ul style="list-style-type: none"> Intended for the refuelling of motor vehicles, small boats, and aircraft with compressed natural gas, hydrogen, biogas, gas blends or other compressed gaseous fuels. May also be applicable to other vehicles, for instance trains.
EIGA Doc 100/20	Hydrogen Cylinders and Transport Vessels (WG2)	European Union	<ul style="list-style-type: none"> Describes industry experiences with hydrogen cylinders and transport vessels and provides a number of recommendations for the specification, manufacture, testing, maintenance and mounting of the cylinders and vessels.
EIGA Doc 79/19	Cylinder re-test stations	European Union	<ul style="list-style-type: none"> Intended for those who are specifying the periodic inspection and testing of gas cylinders; selecting inspection and testing facilities; and carrying out the periodic inspection and testing process.

²¹⁹ Code of China. 2005. *Design code for hydrogen station*. [online] Available at: <<https://www.codeofchina.com/standard/GB50177-2005.html>>.

Number/ID	Name	Jurisdiction	General description
EIGA Doc 171/12	Storage of Hydrogen in Systems Located Underground (WG11)	European Union	<ul style="list-style-type: none"> Addresses the safety issues that are specific to the storage of hydrogen in systems located underground. Although it is preferable that hydrogen storage and related equipment is located above ground in a well-ventilated area, this form of installation may be needed when it is beneficial to keep above ground areas free of equipment, such as may be the case for hydrogen vehicle refuelling stations.
EIGA 121/11	Environmental Impacts of Hydrogen Plants (WG5)	European Union	<ul style="list-style-type: none"> Details the environmental impacts of the production of hydrogen and gives guidelines on how to reduce this environmental impact.
ANSI/UL 2075	Gas and vapour detectors and sensors	International	<ul style="list-style-type: none"> Addresses toxic and combustible gas and vapour detectors and sensors intended to be portable or employed in indoor or outdoor locations in accordance with the National Electrical Code, NFPA 70. A gas detector and/or sensor and/or vapour detector, as covered by these requirements, consists of an assembly of electrical components coupled with a sensing means inside a chamber, or by separate components to detect toxic and/or combustible gases or vapours. The detector includes provision for the connection to a source of power and signalling circuits.
BS EN 50073	Guide for selection, installation, use and maintenance for the detection and measurement of combustible gases or oxygen	British Standard	<ul style="list-style-type: none"> Provides guidance on the selection, installation, use and maintenance of electrically operated Group (1) apparatus intended for use in industrial and commercial safety applications for the detection and measurement of: <ul style="list-style-type: none"> combustible gases, as described in EN 50054, EN 50057, EN 50058; or oxygen as described in EN 50104
IEC 60079-29-1	Explosive atmospheres - Part 29-1: gas detectors- performance requirements of detector for flammable gases	International	<ul style="list-style-type: none"> Explosive gas atmospheres to determine the extent and degree of the hazard, particularly for electronic and electrical equipment flame proof enclosures (performance requirements). A relevant Australian standard is <i>AS/NZS60079.10 Explosive gas atmospheres</i>.
IEC 60079-29-2	Explosive atmospheres - Part 29-1: gas detectors- selection, installation, use and maintenance of detectors for flammable gases	International	<ul style="list-style-type: none"> Explosive gas atmospheres to determine the extent and degree of the hazard particularly for electronic and electrical equipment flame proof enclosures (selection and use).
CGA G5.4	H ₂ pipping system at consumer locations	USA, Canada	<ul style="list-style-type: none"> Describes the specifications and general principles recommended for piping systems for gaseous (Type I) or liquid (Type II) hydrogen. Intended for designers, fabricators, installers, users, and maintainers of hydrogen piping systems as well as for safety personnel, fire departments, building inspectors, and emergency personnel.
CGA G5.6	H ₂ pipeline system	USA, Canada	<ul style="list-style-type: none"> Joint European Industrial Gases Association (EIGA)/CGA international harmonized standard on metallic transmission and distribution piping systems carrying pure hydrogen and hydrogen mixtures. Limited to gaseous products with a temperature range between -40 °C and 175 °C (-40 °F and 347 °F); total pressures from 1 MPa to 21 MPa (150 psig to 3000 psig); and defined concentration criteria.
CGA H5	Installation standard for bulk H ₂ supply systems	USA, Canada	<ul style="list-style-type: none"> Minimum requirements for locating/siting, selecting equipment, installing, starting up, maintaining, and removing bulk hydrogen supply systems. Two types of bulk hydrogen supply systems are covered in this standard: liquid and gaseous.
EN 13445 (series)	Unfired pressure vessels	European Union	<ul style="list-style-type: none"> Provides rules for the design, fabrication, and inspection of pressure vessels. Provides one means of conforming to essential safety requirements of the Pressure Equipment Directive 2014/68/CE.
ISO 17268:2012	Gaseous hydrogen land vehicle refuelling connection devices	International	<ul style="list-style-type: none"> Defines the design, safety and operation characteristics of gaseous hydrogen land vehicle (GHLV) refuelling connectors consisting of, as applicable, a receptacle and a protective cap (mounted on vehicle), and a nozzle.

Number/ID	Name	Jurisdiction	General description
IEC 62282-3-100	Stationary fuel cell systems - safety	International	<ul style="list-style-type: none"> IEC 62282 is a series of IEC codes for fuel cell technologies. Starts from 62282-1 to 62282-9. Applicable to stationary fuel cell power systems intended for indoor and outdoor commercial, industrial and residential use in non-hazardous (unclassified) areas. Contemplates all significant hazards, hazardous situations and events, with the exception of those associated with environmental compatibility (installation conditions), relevant to fuel cell power systems, when they are used as intended and under the conditions foreseen by the manufacturer.
IEC 62282-3-200	Test method for the performance of stationary fuel cell power plants	International	<ul style="list-style-type: none"> Addresses operational and environmental aspects of the stationary fuel cell power systems performance. The test methods apply as follows: <ul style="list-style-type: none"> power output under specified operating and transient conditions; electrical and heat recovery efficiency under specified operating conditions; environmental characteristics. For example, exhaust gas emissions, noise, etc. under specified operating and transient conditions.
IEC 62282-3-201	Small stationary polymer electrolyte fuel cell power systems - performance test method	International	<ul style="list-style-type: none"> Provides test methods for the electrical, thermal and environmental performance of small stationary fuel cell power systems that meet the following criteria: <ul style="list-style-type: none"> rated electric power output of less than 10 kW; grid-connected/independent operation or stand-alone operation with single-phase AC output or 3-phase AC output not exceeding 1 000 V, or DC output not exceeding 1 500 V; maximum allowable working pressure of less than 0,1 MPa (gauge) for the fuel and oxidant passages; gaseous fuel (natural gas, liquefied petroleum gas, propane, butane, hydrogen, etc.) or liquid fuel (kerosene, methanol, etc.); air as oxidant.
IEC 62282-2-100	Fuel cell technologies – Part 2-100: Fuel cell modules – Safety	International	<ul style="list-style-type: none"> Prescribes the minimum requirements for safety and performance of fuel cell modules and applies to fuel cell modules with the following electrolyte chemistry: <ul style="list-style-type: none"> alkaline; polymer electrolyte (including direct methanol fuel cells); phosphoric acid; molten carbonate; solid oxide; aqueous solution of salts.
IEC 62282-2-201	Fuel cell technologies - Part 2-201: Fuel cell modules - Performance (PEFC)	International	<ul style="list-style-type: none"> Defines the evaluation methods of typical performances for electric energy storage systems using hydrogen. Applicable to systems that use electrochemical reaction devices for both power charge and discharge. Applies to systems that are designed and used for service and operation in stationary locations (indoor and outdoor).
IEC 62282-3-100	Fuel cell technologies - Part 3-100: Stationary fuel cell power systems - Safety	International	<ul style="list-style-type: none"> Applies to stationary packaged, self-contained fuel cell power systems or fuel cell power systems comprised of factory matched packages of integrated systems which generate electricity through electrochemical reactions.
IEC 62282-5-100	Fuel cell technologies - Part 5-100: Portable fuel cell power systems - Safety	International	<ul style="list-style-type: none"> Addresses construction, marking and test requirements for portable fuel cell power systems, being fuel cell systems that are movable and not fastened or otherwise secured to a specific location with the purpose of the portable fuel cell power system being to produce electrical power. Applies to AC and DC type portable fuel cell power systems, with a rated output voltage not exceeding 600 V AC, or 850 V DC for indoor and outdoor use.
IEC 62282-6-400	Fuel cell technologies - Part 6-400: Micro fuel cell power systems - Power and data interchangeability	International	<ul style="list-style-type: none"> Addresses the interchangeability of power and data between micro fuel cell power systems and electronic devices to provide the micro fuel cell power system compatibility for a variety of electronic devices while maintaining the safety and performance of the micro fuel cell system. For that purpose, covers power interfaces and their connector configuration. Power management circuitry and power sharing methodology are also provided.

Number/ID	Name	Jurisdiction	General description
IEC 62282-8-101	Fuel cell technologies - Part 8-101: Energy storage systems using fuel cell modules in reverse mode - Test procedures for solid oxide single cell and stack performance including reversing operation	International	<ul style="list-style-type: none"> Addresses solid oxide cell (SOC) and stack assembly unit(s). Provides for testing systems, instruments and measuring methods to test the performance of SOC cell/stack assembly units for energy storage purposes.
IEC 62282-8-102	Fuel cell technologies - Part 8-102: Energy storage systems using fuel cell modules in reverse mode - Test procedures for proton exchange membrane single cell and stack performance including reversing operation	International	<ul style="list-style-type: none"> Deals with PEM cell/stack assembly units, testing systems, instruments and measuring methods, and test methods to test the performance of PEM cells and stacks in fuel cell mode, electrolysis and/or reversible mode²²⁰.
IEC 62282-8-201	Fuel cell technologies - Part 8-201: Energy storage systems using fuel cell modules in reverse mode - Power-to-power systems- Performance	International	<ul style="list-style-type: none"> IEC 62282-8-201:2020 defines the evaluation methods of typical performances for electric energy storage systems using hydrogen. Applicable to the systems that use electrochemical reaction devices for both power charge and discharge. This document applies to systems that are designed and used for service and operation in stationary locations (indoor and outdoor).
IEC 62932-2-2	Flow battery systems for stationary applicants - safety requirements	International	<ul style="list-style-type: none"> Defines the requirements and test methods for risk reduction and protection measures against significant hazards relevant to flow battery systems, to persons, property and the environment, or to a combination of them.

9 List of Abbreviations

AS/NZS	Australian/New Zealand Standard
ISO	International Organization for Standardization
AE	Alkaline Electrolyser
PEM	Polymer-electrolyte membrane (kind of electrolyser)
DIS (ISO)	Draft International Standard
TR (ISO)	Approved Technical Report
TC (ISO)	Technical Committee (Standards)
IEC (ISO)	International Electrotechnical Commission
FDIS (ISO)	Final Draft International Standard.
EIGA	European Industrial Gases Association
US DoE	Department of Energy, USA
CGA	Compressed Gas Association
OIML	International Organisation of Legal Metrology

²²⁰ International Electrotechnical Commission. *Fuel cell technologies – Part 8-102*. [online] Available at: <<https://webstore.iec.ch/publication/30534#:~:text=IEC%2062282%2D8%2D102%3A2019%20deals%20with%20PEM%20cell,electrolysis%20and%20For%20reversible%20mode>>.

NFPA	National Fire Protection Association
ASME	The American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
SAE	Society of Automotive Engineers, USA
ANSI	American National Standards Institute
BS	British standards
EN	European Norms
UL	Underwriter Laboratories

Appendix F – Results of ACT gas laws and ACT legal frameworks review

1 Notes

- (a) Acts are grouped in order of the importance of amendments to be made/considered and then within those groupings they are arranged alphabetically. The groupings are as follows:
- within scope, important amendment required;
 - within scope, minor amendment required;
 - within scope, no amendment seen to be required; and
 - out of scope, no amendment required
- (b) The words “within scope” means that the legislative instrument is a law or part of a legal framework relevant to RFQs EP2200511 and EP2200498, ie the law is an energy law or part of a legal framework that needs to support the adoption of hydrogen gas in the ACT.
- (c) The words “out of scope” means that the legislative instrument is not considered to be a law or part of a legal framework that is relevant to the subject matter.
- (d) Some Acts in this table are Commonwealth statutes, and are marked with “(Cth)” after the title of the Act accordingly.
- (e) Some Acts in this table point to other Acts that have since replaced them. They are included here for completeness, because they are listed on the ACT's official register of legislation.

2 Within scope, important amendment required

Title	Long title/ description	Observations / summary	Market / investment	Production	Infrastructure access	Planning and development	Infrastructure development	Transport	Safety / appliances
<i>Australian Capital Territory (Planning and Land Management) Act 1988</i> (Cth)	An Act to provide for the planning of the Australian Capital Territory and the management of land in that Territory, to repeal the National Capital Development Commission Act 1957, and for related purposes	Part III National Capital Plan							
<i>Construction Occupations (Licensing) Act 2004</i>	An Act to regulate construction occupations, and for other purposes	The Act identifies construction occupations that require licensing and details the management and administration of licensing. The Regs detail the particular classifications for works and the grounds on which demerit points may be issued for insufficient compliance with licences (per Pt 8 of the Act). Given the specificity of compliance identified in the Regs, changes for hydrogen industry will need to be incorporated and any additional standards included.		S7 "construction occupation" includes a gasfitter. Ss12 and 13 define "gasfitter" and "gas appliance worker", with both types of work defined with reference to the <i>Gas Safety Act 2000</i> . Regs Sch 1 Pt 1.7 details classifications of different types of gasfitters. Pt 1.7A details the same for gas appliance workers.					Reg 21 gives authority to prescribe licence conditions. S47A licensees must comply with registrar determinations about training. Reg Sch 2 details demerit grounds for different occupational disciplines, with Pt 2.5 covering gasfitters, and details which standards must be complied with under the relevant legislation.
<i>National Gas (ACT) Act 2008</i>	An Act to establish a framework to enable third parties to gain access to certain natural gas pipeline services, and for other purposes	This Act applies the model law ("NGL") enacted in SA as the <i>National Gas (South Australia) Act 2008</i> in the ACT. It relies on the definition of "natural gas" in the SA law, which requires amendment to include hydrogen. It sets up the gas market, regulators, the National Gas Rules and the Gas Code, defines the Minister's role, and makes provision for reviewable decisions. The same definition of natural gas is signposted for the purposes of the <i>Gas Safety Act 2000</i> .	NGL Ch 2 Pt 1 Functions and powers of the Australian Energy Regulator. NGL S26 National Gas Rules ("NGR") have the force of law. NGL Ch 2 Pt 2 Functions and powers of the Australian Energy Market Commission. NGL S69 AEMC publishes the National Gas Rules. NGL Ch 2 Pt 6 Role of AEMO under National Gas Law. NGL Ch 2 Pt 6 Div 2 Subdiv 3 AEMO's relationship with transmission system service providers and facility owners. NGL S91BJ Registration required for market participation.	NGL Ch 4 Pt 2 Div 2 Minimum ring fencing requirements. NGLS139 Carrying on related businesses prohibited.	S18 Actions taken by a Minister or Court with respect to a cross boundary pipeline in one jurisdiction deemed to be action taken in the other jurisdiction. NGR defines "gas connection", "connection", "gas meter" and "meter". NGL Ch 3 Access arrangements for covered pipelines and dispute resolution.		S18(4) Cross boundary pipeline means (a) a cross boundary transmission pipeline; or a cross boundary distribution pipeline.		

Title	Long title/ description	Observations / summary	Market / investment	Production	Infrastructure access	Planning and development	Infrastructure development	Transport	Safety / appliances
<i>Planning and Development Act 2007 / Territory Plan 2008</i>	An Act about planning and development in the ACT	The Territory Plan is the plan required to be prepared, administered, reviewed and amended by the "Territory planning authority" under S25 of the <i>Australian Capital Territory (Planning and Land Management) Act 1988</i> (Cth). The Planning and Development Act 2007 provides the mechanisms by which that takes place.				Territory Plan definitions for "service station", "liquid fuel depot", "power generation station" of relevance. Zoning in and around locations of step down from transmission to distribution and distribution to reticulation.		Regs relax full scale development approval requirements for electric vehicle charging points, consider same for hydrogen fuel cell vehicle refuelling points subject to policy.	
<i>Utilities Act 2000</i>	An Act to regulate the provision of services by certain utilities, and for other matters.	This Act is relevant to the hydrogen legislation review as it governs the operations of utilities in the ACT. "Gas" in this Act means natural gas and needs to be updated to cover hydrogen. Amended definition will flow through to definition of "gas services", "utility" and "utility service". Importantly, also need to include "generation" as a utility service (cf. s6(c) and s9). Pt 4 ICRC approves or determines industry codes. ICRC publishes the <i>Utilities (Consumer Protection Code) Determination 2020</i> . Customer contracts are made under this Act, while customer connection contracts are made under the National Energy Retail Law.	The definition of "market share" may need to be updated/reviewed depending on (a) comparative effectiveness of hydrogen, and (b) distribution mode of hydrogen. Current definition for a gas distributor "total number of megajoules of gas distributed in the ACT by the distributor in that year, divided by the total number of megajoules of gas distributed in the ACT in that year; for an NERL retailer "total number of megajoules of gas sold in the ACT by the retailer in that year, divided by the total number of megajoules of gas sold in the ACT in that year."	Note recommendation re inclusion of hydrogen gas <i>generation</i> as a utility service. Reliance on s15 regulation-making power for this purpose not recommended as an alternative.	S10 - "gas network" does not include infrastructure that is outside the network boundary. Electrolysers could be a "thing ancillary to any other part of the infrastructure". However, it not clear and thus specific amendment provisions recommended.		S10 "gas networks" definition determines where "utility infrastructure work" will be carried out under the <i>Utilities (Technical Regulation) Act</i> . <i>AS/NZS 5601-2004 Gas Installations</i> defines "consumer piping". See <i>Utilities (Gas Service and Installation Rules Code) Determination 2013</i> , Dictionary.		

3 Within scope, minor amendment required or to be considered

Title	Long title/ description	Observations / summary	Market / investment	Production	Infrastructure access	Planning and development	Infrastructure development	Transport	Safety / appliances
<i>Building Act 2004</i>	An Act to regulate buildings and building work, and for other purposes	Covers administrative processes and requirements for certification of building developments and associated works. Hydrogen related matters likely to be picked up by Pt8 which defines building codes and standards. <i>Building (General) Regulation 2008</i> states that National Construction Code ("NCC") series includes Building Code of Australia. Relevant standards for gas will be provided for within the <i>Gas Safety Act 2000</i> .				NCC is modified by <i>Building (ACT Appendix to the Building Code) Determination 2019 (No 3)</i> regarding "annual modelled energy use" versus "greenhouse gas emissions". This is a carve out for ACT use of renewable energy because NCC GHG emissions factors (kgCO ₂ –e/GJ) only refer to electricity and natural gas. Consider need for further carve out re green hydrogen gas.			NCC defines reticulated gas to include "reticulated compressed gas of some other type (including LPG, SNG or TLP gas)". in our opinion this definition would include hydrogen gas. NCC Vol 2 references AS 4552 (2005) gas fired water heaters for hot water supply and/or central heating.
<i>Gas Safety Act 2000</i>	An Act about safety in relation to the use of gas, and for other purposes	Need to amend definition of gas in dictionary to include hydrogen gas. Standards are named in the Act and referred to in the Regulations. The Act lists offences, some of which would be difficult to meet because of a lack of approved materials to make the consumer piping system safe. Eg testing is to ensure that there are "no leaks"; unsafe CPS; the action necessary to make it safe.	Does not apply to the connection of a gas appliance to a CPS or its use, with the construction occupations registrar's approval, for product testing, product development, or experimental purposes.			Pt3 responsibilities of owners and users - owner's duty to take reasonable steps to ensure that the CPS and gas appliances are in good condition and repair and safe to use. Owner can rely on advice from the gasfitter.	Reg20 serious gas accident prescribed amount is \$5k. Should this amount be changed. Obligations on occupier and gas fitter to report serious gas accident. S22(2) register of approvals, cancelled approvals. Safety warnings must be available for public inspection during office hours. Consider whether this should be a register published online.		This Act deals with compliance of all consumer piping after the outlet of the gas meter. Reg17C Type A appliance relevant standard. AS/NZS 5601 covers gas fitting and gas fitting work as well as Type A appliances. Type B appliance in accordance with AS/NZS 3814. Reg18 application for approval of Type B gas lists AS/NZS 1375 (industrial fuel-fired appliances) and 3814 (Industrial and commercial gas-fired appliances) and AS/NZS 5601 as in force from time to time. But Legislation Act does not apply to update those standards, make sure up to date. S29(2)(ii) - Construction Occupations Registrar can make directions incl recalling sold appliances (if unsafe) and refund price: Gasfitting work standards do not apply to portable gas appliance. S18 - approved Type A gas appliance if it consumes gas at a rate of less than 10MJ/h, consider whether too low for hydrogen gas.

Title	Long title/ description	Observations / summary	Market / investment	Production	Infrastructure access	Planning and development	Infrastructure development	Transport	Safety / appliances
<i>Utilities (Technical Regulation) Act 2014</i>	An Act relating to the safe, reliable and efficient delivery of regulated utility services, and for other purposes.	Covers utility services regulated under <i>Utilities Act 2000</i> . Pt3 introduces technical codes. The ICRC is involved at the consultation stage of draft technical codes. The Consumer Protection Code is one such industry Code.	AS or AS/NZS standards in technical codes do not need to be notified under Legislation Act. Gas General Metering Code applies. Gas distributor must supply metering equipment to customers. Metering equipment subject to technical requirements, check standards re hydrogen gas suitability.		Concept of "discrete district network" is introduced to handle examples of installations providing energy in a locality. Eg, solar power on one building being cabled to other buildings. Amend s9 so that hydrogen generated by electrolysis then piped to other places can be discrete district network.	<i>Utilities (Gas Service and Installation Rules Code) Determination 2013</i> applies to gas distributors (licensed utility). GS&I Rules are drafted by gas distributors (Evoenergy) and published. GS&I rules will need amendment re gas supply pressure, meter installation, construction/ maintenance of gas connection services/ equipment, liability of gas distributor for works and competencies for any persons engaged to perform works. Gas distributor must rectify at no cost to the customer/third party if there is a breach of the GS&I Rules.	"Infrastructure" re gas network is defined widely to include any other thing ancillary to any other part of the infrastructure. Could include hydrogen production but suggest clear amendment. Utility infrastructure work involves the "gas distribution network" as defined by the <i>Utilities Act 2000</i> . <i>Gas Network Boundary Code 2018</i> defines boundaries of networks (eg transmission to distribution; distribution to consumer). No amendment required to definition of network, but definition of infrastructure may require amendment.	<i>Utilities (Gas Service and Installation Rules Code) Determination 2013</i> applies. GS&I rules allow gas distributor to refuse gas supply if customer fails to comply with GS&I Rules. Rules must be achievable for customers in hydrogen context.	Dangerous/ notifiable incidents broadly defined, using ordinary meaning of words, will apply to hydrogen gas leaks/ explosions etc. <i>Utilities (Technical Codes) Determination 2000</i> provides requirements of the <i>Gas Safety and Operating Plan Code</i> , which is submitted by the operator of a gas network.
<i>Work Health and Safety Act 2011</i>	An Act about work health and safety, and for other purposes	Part of national scheme to secure health and safety of workers and workplaces (" <i>the highest level of protection against harm</i> "). Ch7 of the regs deals with hazardous chemicals which incorporates flammable gases. Provision made for labelling, data sheets and access to safety data sheets to people who need them.		Major hazard facility with reference to hydrogen storage under <i>Work Health and Safety Regulation 2011</i> Table 15.6.2 Item 24 applies where threshold quantity (t) is 50.					RegPt 7.1 deals with use, handling and storage of hazardous gases so far as that is not otherwise regulated under other enactments.

4 Within scope, no amendment seen to be required

Title	Long title/ description	Observations / summary	Market / investment	Production	Infrastructure access	Planning and development	Infrastructure development	Transport	Safety / appliances
<i>ACT Civil and Administrative Tribunal Act 2008</i>	An Act to establish the ACT Civil and Administrative Tribunal to resolve issues arising under certain legislation, and for other purposes	S22P – ACAT can review certain decisions, including under the <i>Planning and Development Act 2007</i> . No specific hydrogen gas relevance identified, tribunal available if policy dictates that a hydrogen gas should be made justiciable.							
<i>ACTEW/AGL Partnership Facilitation Act 2000</i>	An Act to facilitate the formation by ACTEW and AGL of a joint venture by way of partnerships between their subsidiaries	Generally covers the rights and responsibilities of Actew and AGL and manner in which they can form/ operate partnerships. “Network facility” and “utility service” unlikely to require amendment and not tied to other definitions.					S8 - “network facility” defined as “any part of the infrastructure of an electricity, gas, water or sewerage network ... used by ACTEW or AGL”; “utility service” means “operation of, or connection to, an electricity or a gas, water or sewerage network”.		
<i>Annual Reports (Government Agencies) Act 2004</i>	An Act relating to annual reports for certain government agencies, and for other purposes	Requires certain public sector bodies to prepare annual report. For noting only.				Architects Board, City Renewal Authority, and Suburban Land Agency must report.			Work Health and Safety Commissioner and Construction Occupations Registrar must report.
<i>Auditor-General Act 1996</i>	An Act to provide for an auditor-general, and for related purposes	S12 - auditor-general may conduct performance audits having regard to the principles of ecologically sustainable development. For noting only.							
<i>Australian National Registry of Emissions Units Act 2011 (Cth)</i>	An Act about the Australian National Registry of Emissions Units, and for other purposes	Defined as a “climate change law” by s4 of <i>Clean Energy Regulator Act 2011</i> (Cth). For noting only.							
<i>Australian Renewable Energy Agency Act 2011 (Cth)</i>	An Act to establish the Australian Renewable Energy Agency, and for related purposes	Objects are to improve competitiveness of renewable energy technologies and increase supply of renewable energy in Australia. For noting only.	S8 - ARENA has broad functions to provide financial assistance, collect information about renewable energy technologies, and provide advice to Minister.	Funding from ARENA helped to establish the Fyshwick hydrogen refuelling station.					

Title	Long title/ description	Observations / summary	Market / investment	Production	Infrastructure access	Planning and development	Infrastructure development	Transport	Safety / appliances
<i>Building and Construction Industry Training Levy Act 1999</i>	An Act to impose a levy for improving training in the building and construction industry, and for other purposes	Deals with obtaining levy for training workers on construction projects. Levy is calculated on value of work.					Sch1 defines "work". Unless a hydrogen production facility involves a "building", or is "mechanical" work, the work involved in erecting and commissioning same would largely not be work for the purposes of calculating the levy payable. Definition incl operations re "conveyance, collection, storage, treatment or distribution... of gas". Consideration of amendment to cover any work re production of hydrogen gas is policy matter.		
<i>Building and Construction Industry (Security of Payment) Act 2009</i>	An Act to facilitate recovery of payments under construction contracts in the building and construction industry, and for other purposes	Establishes the procedure for recovering payments under construction contracts. Not seen to require amendment for introduction of hydrogen gas.					S7 - work related to construction of hydrogen gas facilities would be covered by broad definition of "construction work".		
<i>Canberra Institute of Technology Act 1987</i>	An Act to establish the Canberra Institute of Technology	CiT will be instrumental in delivering the training required to upskill gasfitters for hydrogen gas work. Not seen to require amendment for introduction of hydrogen gas.							
<i>Carbon Credits (Carbon Farming Initiative) Act 2011 (Cth)</i>	An Act about projects to remove carbon dioxide from the atmosphere and projects to avoid emissions of GHG, and for other purposes	Defined as a "climate change law" by s4 of <i>Clean Energy Regulator Act 2011</i> (Cth). For noting only.							
<i>City Renewal Authority and Suburban Land Agency Act 2017</i>	An Act to establish the city renewal authority and the suburban land agency, and for other purposes	The Authority has a role in cohesive urban renewal. It has an environmental performance target. Minister makes annual statement of expectations (notifiable instrument). Authority must respond in three months with statement of operational intent. The Agency is established as a territory authority. For noting only.			With Minister/ Treasurer approval the Agency may hold shares in corporations to exercise a function, incl support of statutory GHG emissions targets, delivery of environmentally sustainable development, follow and support whole-of-government strategies; and any other function given to Agency.	S35 - Minister may declare an area of land to be an urban renewal precinct if consistent with National Capital Plan and Territory Plan.			

Title	Long title/ description	Observations / summary	Market / investment	Production	Infrastructure access	Planning and development	Infrastructure development	Transport	Safety / appliances
<i>Civil Law (Sale of Residential Property) Act 2003</i>	An Act to make provision in relation to the sale of residential property, and for other purposes	S9 - energy efficiency rating statement ("EER") statement is a document annexed to contract for sale of residential land. Ultimately not relevant to hydrogen gas uptake because EER system as it stands is independent of GHG implications of energy sources, rather it relates to fabric (insulation quality) of building only. Not seen to require amendment for introduction of hydrogen gas.							
<i>Clean Energy Regulator Act 2011 (Cth)</i>	An Act to establish the Clean Energy Regulator, and for other purposes	Umbrella legislation to establish a framework for clean energy regulation. For noting only.	Clean Energy Regulator is likely to become a lead player in certification of green hydrogen.	Certification of origin systems for green hydrogen production needed to allow green gas trading.					
<i>Climate Change and Greenhouse Gas Reduction Act 2010</i>	An Act to promote the development of policies and practices to address climate change, to set targets to reduce GHG emissions and to provide for monitoring and reporting in relation to the targets	Generally covers the administration of the ACT's GHG emissions targets, including detailing what those targets are. Use of hydrogen would inherently fall under the legislated renewable energy targets.	Consider whether green gas (including green hydrogen) consumption levels could be mandated through targets. The <i>Renewable electricity target measurement method</i> was made by a determination under this Act.	Certification of origin systems for green hydrogen production needed to allow green gas trading and determination of ACT performance against targets.					
<i>Commissioner for Sustainability and the Environment Act 1993</i>	An Act to establish the office of commissioner for sustainability and the environment, and for related matters	Commissioner has reporting, advisory and investigatory powers with respect to condition/ management of ACT environment; progress towards ecologically sustainable development; enhancement of knowledge/ understanding of ecologically sustainable development and environment; and sound environmental practices by Territory and territory for ecologically sustainable development.							
<i>Competition and Consumer Act 2010 (Cth)</i>	An Act relating to competition, fair trading and consumer protection, and for other purposes	Important from consumer rights perspective. Establishes the Australian Energy Regulator. The Australian Consumer Law ("ACL") is separately incorporated into ACT law by <i>Fair Trading (Australian Consumer Law) Act 1992</i> . For noting only.	S44AE - Australian Energy Regulator is established. S44AI(3) – AER's functions must align with the <i>Australian Energy Market Agreement</i> .						

Title	Long title/ description	Observations / summary	Market / investment	Production	Infrastructure access	Planning and development	Infrastructure development	Transport	Safety / appliances
<i>Crimes Act 1900</i>	An Act to consolidate the statutes relating to criminal law.	Offences within this Act typically require intention to do harm. Hydrogen gas leak causing explosion would fall under S27 (acts endangering life etc.) and S28 (acts endangering health). S27 notes that a "public utility service" means, <i>inter alia</i> , supply of electricity, gas or water; or supply of fuel. Wording sufficiently captures hydrogen gas. Pt2A (industrial manslaughter) relevant if a worker dies or is injured and employer was reckless or negligent. Not seen to require amendment for introduction of hydrogen gas.							S27(3) – penalty of imprisonment up to 10 years for person who intentionally and unlawfully causes explosion or uses any explosive device or any explosive, corrosive or inflammable substance which endangers human life or causes GBH or interferes with any transport facility/ public utility service in circo likely to endanger human life or cause GBH.
<i>Dangerous Goods (Road Transport) Act 2009</i>	Makes provision for safety in transport of dangerous goods by road as part of nationally consistent road transport system of laws, and for other purposes	Covers a variety of requirements for dangerous goods transport as described in the Australian Dangerous Goods Code ("ADG Code"). Will fall within scope of future hydrogen industry where hydrogen is being transported for future or other use (not the vehicle propulsion itself). Substantial references to ADG Code throughout the Regs. ADG Code already contemplates hydrogen as a flammable gas.							
<i>Dangerous Substances Act 2004</i>	An Act about dangerous substances, and for other purposes.	Purpose is to protect health and safety of people, and property and the environment, from hazards associated with dangerous substances. Not seen to require amendment for introduction of hydrogen gas.							Concept of "dangerous substance" (explosives, asbestos, etc) is different to "dangerous goods". Hydrogen is within latter category. Act does not apply to transmission, distribution and use of natural gas to which the <i>Gas Safety Act 2000</i> or <i>Utilities Act 2000</i> applies. Amendments to former for hydrogen will regulate hydrogen usage.

Title	Long title/ description	Observations / summary	Market / investment	Production	Infrastructure access	Planning and development	Infrastructure development	Transport	Safety / appliances
<i>Electricity Feed-in (Large-scale Renewable Energy Generation) Act 2011</i>	An Act about the large-scale generation of electricity from renewable energy sources, and for other purposes.	Objective is to promote establishment of large-scale facilities for generation of electricity from renewable energy sources in ACT and elsewhere; promote renewable energy generation industry development consistent with national electricity market; and reduce ACT contribution to GHG emissions/ meet ACT targets; urgently reduce reliance on non-renewable energy sources while minimising cost to electricity consumers.	Consider any future interdependency with <i>Renewable Energy (Electricity) Act 2000</i> (Cth) and Regs. "Eligible electricity" is electricity generated by large renewable energy generator connected to national electricity system. Thus, would depend on use of fuel cells to produce electricity on industrial scale. Large scale generation certificates are registered under the <i>Renewable Energy (Electricity) Act 2000</i> .	Hydrogen not specifically addressed. S6(1)(c) allows Minister to declare energy source to be a renewable energy source. Given this ability, Act itself not seen to require amendment in context of introducing hydrogen into ACT.					
<i>Electricity Feed-in (Renewable Energy Premium) Act 2008</i>	An Act about the supply of electricity from solar and other renewable energy sources to electricity distributors, and for other purposes	Generally covers definitions and administrative requirements for interactions between renewable energy sources and electricity distributors. Will fall within scope where electricity produced using hydrogen which was itself produced by renewable energy. Ministerial Determination would then be required to identify source as a renewable energy source under s5B. Act not seen to require amendment for introduction of hydrogen gas.		S5B(1) - "renewable energy source" means solar, wind, and any other source determined by the Minister.					
<i>Electricity (National Scheme) Act 1997</i>	An Act to make provision for the operation of a national electricity market, and for related purposes	Applies <i>National Electricity (South Australia) Act 1996</i> schedule, referred to as the National Electricity (ACT) Law. Regs under Pt4 of <i>National Electricity (South Australia) Act 1996</i> are in force, referred to as the National Electricity (ACT) Regulation. Similar to gas, NEL relies on AER (Pt3); AEMC (Pt 4); and AEMO (Pt5). Not seen to require amendment for introduction of hydrogen gas.	Changes to energy consumption and modes of producing/ providing energy will impact in a policy sense.		S32 - AEMC must have regard to the national electricity objective when exercising its powers and functions.				

Title	Long title/ description	Observations / summary	Market / investment	Production	Infrastructure access	Planning and development	Infrastructure development	Transport	Safety / appliances
<i>Electricity Safety Act 1971</i>	An Act relating to the safe use of electricity, and for other purposes	Incorporates various Australian electricity standards, thus if standards are updated to incorporate hydrogen not only as a gas but also in the manner in which it can produce electricity it will not require amendment.	The <i>Greenhouse and Energy Minimum Standards Act 2012</i> (Cth) applies greenhouse and energy minimum standards in association with supply and commercial use of products that use energy. Consider possible interdependency between this Act and the standards at a future date.	Definition of “ <i>electrical installation</i> ” incorporates the word “ <i>generator</i> ” which includes a generator that generates electricity from any energy source. Gas is used as an example of an energy source and is not otherwise defined Thus hydrogen already covered in this context.					
<i>Emergencies Act 2004</i>	An Act about emergencies and fire and ambulance incidents, and for other purposes	Establishes mechanisms such as fire, rescue and ambulance service to manage emergencies with an “ <i>all-hazard</i> ” approach. Minister may make hazard specific sub-plan for ACT, declare state of emergency or alert. “ <i>Hazardous material</i> ” means anything that may cause injury or death, or damage to property or the environment, if it is produced, stored, moved, used, or in any other way dealt with, without adequate safeguards. Not seen to require amendment for introduction of hydrogen gas.				S86 - relevant chief officer may issue improvement notice, occupancy notice or closure notice for premises where risk to public safety. .			Hydrogen gas would be hazardous material and within scope of Act. Offence to store flammable material, may be triggered if portable hydrogen gas for BBQ explodes. Adequate safeguards must be in place. Systemic issue with management of hydrogen gas may cause state of emergency to be declared. Proper maintenance standard for fire protection systems might need to be modified for fires caused by hydrogen gas. S94(7) calls up AS 1851 and AS/NZA 2293.2.
<i>Energy Efficiency (Cost of Living) Improvement Act 2012</i>	An Act to encourage the efficient use of energy, and for other purposes.	Object is to encourage efficient use of energy; reduce GHG emissions in ACT; reduce household and business energy use and cost. Incorporates opportunities for priority households to reduce energy use and cost. Definition of “ <i>energy</i> ” includes electricity and gas without being confined to any type, thus not seen to require amendment.							
<i>Environment Protection Act 1997</i>	An Act to provide for the protection of the environment, and for related purposes.	Not seen to require any amendments in relation to introduction of hydrogen into the ACT energy sector.				Act is general enough in its nature such that it applies to all relevant activities, thus as it presently stands it covers hydrogen sufficiently.			

Title	Long title/ description	Observations / summary	Market / investment	Production	Infrastructure access	Planning and development	Infrastructure development	Transport	Safety / appliances
<i>Fair Trading (Australian Consumer Law) Act 1992</i>	An Act about fair trading and consumer protection, and for other purposes	Adopts the Australian Consumer Law into the ACT. Provides general protections and specific protections. Sch 2 Ch 3 Pt 3 Div 1 addresses specific safety standards. Not seen to require amendment for introduction of hydrogen gas, standards system is key.							Safety standards need to be in place before hydrogen gas compatible appliances are supplied
<i>Fair Trading (Fuel Prices) Act 1993</i>	An Act to make provision for the regulation of prices of certain fuels, and for related purposes	Minister has power to make a determination as to fuel pricing upon recommendation of Commissioner. Not seen to require amendment for introduction of hydrogen gas.	S3 - Commissioner has power to recommend maximum base wholesale price, retail price and retail margin for specified fuels. S4 then gives Minister power to make a determination as to relevant fuel pricing.					Fuel is widely defined and includes both hydrogen and electricity.	
<i>Fuels Rationing Act 2019</i>	An Act for the rationing and restriction of fuels, and for other purposes	Broadly covers rationing of fuel if there is a shortage. Definitions explicitly state the potential for hydrogen gas to be used.						Fuel is defined as including hydrogen.	
<i>Fuel Tax Act 2006 (Cth)</i>	An Act about fuel tax and fuel tax credits, and for related purposes	Fuel tax and fuel tax credits dependent on the fuel tax being payable under excise and customs duty laws. For noting only.	S42-5 - fuel tax credit available for fuel used for domestic heating or generating electricity for domestic use.						
<i>Fair Trading (Motor Vehicle Repair Industry) Act 2010</i>	An Act to provide for the licensing and regulation of people in the motor vehicle repair industry, and for other purposes	Establishes a motor vehicle repair industry advisory committee (Pt6) and contains provisions about false or misleading representations. Not seen to require amendment for introduction of hydrogen gas.						Definition of motor vehicle signposts to Sale of Motor Vehicles Act 1977, which includes any vehicle used on land propelled wholly or partly by gas.	S7A Minister may incorporate documents that set out standards.
<i>Heavy Vehicle National Law (ACT) Act 2013</i> <i>Heavy Vehicle National Law (ACT)</i>	An Act to apply a national law relating to the regulation of the use of heavy vehicles, and for other purposes	Covers definitions, administration and management of heavy road vehicles and drivers vehicles within national framework. Most authority lies with the National Heavy Vehicle Regulator established under the Act. Regs prescribe standards, maximum mass and dimensions as well as safety duties. Non-compliance with heavy vehicle standards is subject to fines. No amendment is seen to be necessary.						S6 – “heavy vehicle” is defined by weight not form of energy used.	

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<i>Independent Competition and Regulatory Commission Act 1997</i>	An Act to establish an independent commission to regulate pricing, access and other matters in relation to industries involving the provision of water, electricity and sewerage services, and other industries, and to investigate competitive neutrality complaints and government-regulated activities	S4B - ACT gas transmission service pricing is not referenced by this Act. For the distribution and transmission pipeline see <i>National Gas (ACT) Law</i> .	ICRC will be enabled to issue licences to hydrogen gas utilities, via adoption of Recommendations 6 or 7. Adoption of latter could suggest pricing role for ICRC re ACT pipeline carriage of hydrogen gas.		ICRC is a licencing entity and regulator for gas utilities. See <i>Utilities Act 2020</i> .				
<i>Lakes Act 1976</i>	An Act to provide for the administration, control and use of certain lakes	Covers activities on surface of lakes and associated safety requirements. Some provisions address commercial activities and restricting areas. No amendment is seen to be necessary to accommodate hydrogen uptake.				S8 - Act to be construed and administered consistently with ACT environment and health laws.			
<i>Lands Acquisition Act 1994</i>	An Act relating to the acquisition of interests in land by the Executive and certain authorities and dealings with land so acquired, and for other purposes	Not seen to require amendment for introduction of hydrogen gas.			S96A - allows acquisition of land by a utility under <i>Utilities Act 2000 Pt7</i> (network operations).				
<i>Long Service Leave (Portable Schemes) Act 2009</i>	An Act to provide for the portability of long service entitlements in certain industries, and for other purposes	Covers long service leave in the building and construction industry, among others. No amendment is seen to be necessary to accommodate hydrogen uptake, however employees engaged in building/construction of energy generation may not be specifically covered presently.					Sch1.1 - building and construction industry is not defined to include energy generation facilities, unless seen to be a "building".		
<i>Machinery Act 1949</i>	An Act relating to the installation, use, inspection and operation of machinery	Provides the framework for an administrative body to regulate machinery use. Regs details penalties for failure to prevent prescribed accidents. Not seen to require amendment for introduction of hydrogen gas.							"Engine" defined as piece of mechanism powered by source of energy such as gas, amongst other things, and "machinery" includes an engine.
<i>Motor Vehicle Standards Act 1989 (Cth)</i>	An Act to provide for national motor vehicle standards, and for related purposes	Not seen to require amendment. See references in report.							

Title	Long title/ description	Observations / summary	Market / investment	Production	Infrastructure access	Planning and development	Infrastructure development	Transport	Safety / appliances
<i>National Greenhouse and Energy Reporting Act 2007 (Cth)</i>	An Act to provide for the reporting and dissemination of information related to GHG emissions, GHG projects, energy production and energy consumption, and for other purposes	Defined as a "climate change law" by s4 of <i>Clean Energy Regulator Act 2011 (Cth)</i> . For noting only.							
<i>National Vocational Education and Training Regulator Act 2011 (Cth)</i>	An Act to establish the National Vocational Education and Training Regulator, and for related purposes	An object of the Act is to have standards based vocational education and training. For noting only.							A person can apply to the National VET Regulator for registration. Courses can be accredited by the National VET Regulator.
<i>National Energy Retail Law (ACT) Act 2012</i>	An Act to establish a national energy customer framework for the regulation of the retail supply of energy to customers, to make provision for the relationship between the distributors of energy and the consumers of energy, and for other purposes	Applies the law set out in the equivalent SA Act and in limited circumstances, the equivalent NSW laws. Gas is defined as per NGL as "natural gas". If SA/NSW laws fail to adequately acknowledge and accommodate future hydrogen industry, then this Act may need to be amended accordingly in its application to the ACT.							
<i>National Environment Protection Council Act 1994</i>	An Act to provide for the establishment of a national environment protection council, and for related purposes	NEPC's functions are to make national environment protection measures (Div3.2) and assess and report on the implementation and effectiveness of same in participating jurisdictions (S12). Sch1 is Intergovernmental Agreement on the Environment. Sch3 describes the EIA process, Sch5 refers to the National Greenhouse Response Strategy. Not seen to require amendment for introduction of hydrogen gas.	Sch5 National Greenhouse Response Strategy - parties agree that strategy should include measures for auditing and reporting on national GHG emissions.						

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<i>Nature Conservation Act 2014</i>	An Act to make provision for the protection, conservation, enhancement and management of nature in the ACT, for the management of reserves, and for other purposes	Allows a Conservator to develop policies and regulate biodiversity and use of natural resources. Impacts of hydrogen gas would not require Conservator to act any differently, to have any different responsibilities or to carry out different functions. Conservator has a role in development approvals handled under the <i>Planning and Development Act 2007</i> . Refer to the summary for that Act for any requirements/relevance for hydrogen gas.				See "Infrastructure development".	S308, etc - Conservator has power with respect to entity/activities of entity as supplier of "gas [ordinary meaning], <i>electricity, water or sewerage services</i> " or (relevantly) is responsible for a development on land. Conservator may require management agreement to be entered into by entity.		
<i>Ombudsman Act 1989</i>	An Act to provide for the appointment of an ombudsman and to define the functions and powers of that office	Broadly details the administration and functions of the ACT Ombudsman. Notably, the Act does not apply to any agency exercising functions under the National Electricity (ACT) Law and National Electricity Rules, however, this would not appear to affect the position of energy or gas industry <i>vis-à-vis</i> the ombudsman.	Ombudsman would have jurisdiction over those having carriage of public duties re hydrogen gas industry. Note overlap of functions in this regard with Commissioner under <i>Commissioner for Sustainability and the Environment Act 1993</i> .						
<i>Planning and Development Act 2007</i>	An Act about planning and development in the ACT.	The Act itself is not seen to require any amendments in relation to the introduction of hydrogen in to the Australian Capital Territory energy sector.				However there is need for amendments to Territory Plan as it plays key role in relation to this Act. See other references in this report.			
<i>Prohibited Weapons Act 1996</i>	An Act to prohibit the possession of certain dangerous weapons and other articles, and for related purposes.	Definition of "prohibited weapon" potentially of relevance in particular fact situation, no amendment required however.							Prohibited weapon includes a device or apparatus made or modified for use with a gas or liquid, if the device or apparatus is capable of killing or incapacitating someone; or made or modified to kill or incapacitate someone.
<i>Renewable Energy (Electricity) Act 2000 (Cth)</i>	An Act for the establishment and administration of a scheme to encourage additional electricity generation from renewable energy sources, and for related purposes	Defined as a "climate change law" by s4 of <i>Clean Energy Regulator Act 2011</i> (Cth). For noting only.							

Title	Long title/ description	Observations / summary	Market / investment	Production	Infrastructure access	Planning and development	Infrastructure development	Transport	Safety / appliances
<i>Renewable Energy (Electricity) (Large-scale Generation Shortfall Charge) Act 2000 (Cth)</i>	An Act to impose large-scale generation shortfall charge, and for related purposes	Defined as a "climate change law" by s4 of <i>Clean Energy Regulator Act 2011</i> (Cth). For noting only.							
<i>Renewable Energy (Electricity) (Small-scale Technology Shortfall Charge) Act 2010 (Cth)</i>	An Act to impose small-scale technology shortfall charge, and for related purposes	Defined as a "climate change law" by s4 of <i>Clean Energy Regulator Act 2011</i> (Cth). For noting only.							
<i>Road Transport (General) Act 1999</i>	An Act to provide for the administration and enforcement of road transport legislation, to provide for the review of decisions made under road transport legislation, to make further provision about the use of vehicles on roads and road related areas, and for other purposes	The Act makes provision for offences, many of which relate to traffic infringements. The Road Transport Authority administers the Act. No special issues seen with registration of hydrogen vehicles in ACT. However note comments in report re ADR coverage as dealt with nationally.						S6 - road transport legislation is this Act; <i>Motor Accident Injuries Act 2019</i> ; <i>Road Transport (Alcohol and Drugs) Act 1977</i> ; <i>Road Transport (Driver Licensing) Act 1999</i> ; <i>Road Transport (Public Passenger Services) Act 2001</i> ; <i>Road Transport (Safety and Traffic Management) Act 1999</i> ; <i>Road Transport (Vehicle Registration) Act 1999</i> .	
<i>Road Transport (Safety and Traffic Management) Act 1999</i>	An Act to facilitate the adoption of nationally consistent road rules in the ACT, to make provision about other matters relating to safety and traffic management on roads and road related areas, and for other purposes	Covers general road offences, such as speeding, dangerous driving and other traffic offences. No explicit mention of gas under the definition of "prohibited substance", although the catch all provision Part 3(b) definition would arguably cover this. "Unsafe loads" are defined in very broad terms and any vessel to transport hydrogen gas will likely be covered by language already used.						Reg156 – allows zero emissions vehicles to use transit lanes.	Prohibited substance defined as "petrol, oil, diesel fuel or any other flammable liquid; or any other substance that increases the risk of death, injury or damage to property". Pt3 covers unsafe loads in broad terms
<i>Road Transport (Vehicle Registration) Act 1999</i>	An Act to provide for the registration of vehicles and for related matters as part of the system for nationally consistent road transport law, and for other purposes	This Act will be relevant for hydrogen vehicles in private use. Function of relevant authority is to administer vehicle standards and inspections established under Act. Not seen to require amendment as a result of the introduction of hydrogen in the ACT energy sector.						"Motor vehicle" broadly defined as vehicle built to be propelled by a motor that forms part of the vehicle. Reg1.152A - hydrogen-powered vehicles already considered.	Pt6.2 - evidence from manufacturer sufficient evidence that vehicle complies with applicable vehicle standards.

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<i>Road Transport (Public Passenger Services) Act 2001</i>	An Act to regulate public transport services, and for other purposes	Unlikely that vehicle drivers would need to be accredited to drive a hydrogen gas vehicle. In any case, this Act does not regulate the accreditation process.							
<i>Scaffolding and Lifts Act 1912</i>	An Act about scaffolding, lifts, cranes, building, excavation and compressed air work	The regulations contain safety measures in the presence of gas. Gas is not defined so assume that it takes its natural meaning, which would include hydrogen gas.							Reg84 - all practicable steps to be taken to prevent danger from fire or explosion through leakage or accumulation of gas or vapour. Reg118E(6) – no explosive powered tool to be used in the presence of an explosive or inflammable gas, dust or vapour, or in compressed air, or in any place where explosive charge might be exploded or rendered dangerous by heat. Consider whether Reg133(61) should be amended – electrified conductors and apparatus to be at least six feet clear of vessels containing gas under pressure".
<i>Territory-owned Corporations Act 1990</i>	An Act to provide for the establishment of government enterprises as territory-owned corporations	Schedule 1 lists Icon Water. For noting only.							
<i>Training and Tertiary Education Act 2003</i>	An Act about vocational education and training, and for other purposes	Part 3 outlines work-related training and training contracts. For noting only.							
<i>Trans-Tasman Mutual Recognition Act 1997 (Cth)</i>	An Act relating to the recognition of regulatory standards adopted in New Zealand regarding goods and occupations	Sch3 of the Act lists special exemptions with reference to s48. Item 2 lists laws dealing with hazardous substances, industrial chemicals and dangerous goods. Item 4 lists laws relating to road vehicles. Item 5 lists laws relating to gas appliances.							

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<i>Tree Protection Act 2005</i>	An Act for the protection of trees, and for other purposes	Covers procedures for the protected trees and consequences of damage. Not directly related to the use of hydrogen gas. Development projects to be aware of effects on surrounding land and potential for damage to protected trees. Not seen to require amendment as a result of the introduction of hydrogen in the ACT energy sector.							Division 3.2 covers offences if protected trees are damaged.
<i>Unit Titles Act 2001</i>	An Act to provide for the subdivision of land by units plans, and for other purposes	Gas is mentioned within the definition of utility service. Ss34 and 36 provide for unit title easement rights to inspect and maintain facilities for any utility service on the estate. Not seen to require amendment as a result of the introduction of hydrogen in the ACT energy sector.	S17(4) and Reg8 - development statements must state that the development must pay the reasonable expenses incurred by the owners corporation for any water, sewerage, drainage, gas, electricity, oil garbage, conditioned air or telephone service used in carrying out the development.				S34 - right to utility services and to their provision by any reasonable form of utility conduit and all ancillary rights necessary to make the rights effective, including right of entry by owner of benefited estate onto burdened estate for inspection and maintenance of any utility service facilities. S36 easements declared by owners corporations.		
<i>Water Resources Act 2007</i>	An Act to provide for sustainable management of the water resources of the Territory, and for other purposes	Objects are to ensure management/ use of Territory water resources sustain the physical, economic and social wellbeing of ACT people while protecting ecosystems; protect aquatic ecosystems and aquifers from damage and reverse damage if possible; and ensure that the water resources are able to meet reasonably foreseeable needs of future generations.	Reg5 conditions of water access entitlements.	Reg6 exemption may be given for licence to take water from a water body on land if to be used for generating electricity for domestic use on land and then returned to the water body. Exemption only if authority satisfied that will result in improved environmental outcomes or other public benefit. Does not cover hydrogen gas production simpliciter.			Pt4 deals with water access entitlements. Water management areas are Gudgenby, Naas, Paddy's, Upper Murrumbidgee, Lower Murrumbidgee, Upper Molonglo catchment. Icon Water is of opinion that water for hydrogen possible under existing commercial arrangements. Supply/demand balance could shift to small degree.	Minister determines amount of water available with consideration of environmental flow guidelines, total water resources of Territory and sustainable yields for water management area. Unlikely that this needs to be amended for water taken for the purpose of producing hydrogen gas for grid injection.	
<i>Workers Compensation Act 1951</i>	An Act relating to compensation to workers for injuries arising out of or in the course of their employment, and for other purposes	Drafted using broad terms, no changes seen to be necessary to capture injuries caused by hydrogen gas.							
<i>Trans-Tasman Mutual Recognition Act 1997</i>	An Act relating to the recognition of regulatory standards adopted in New Zealand regarding goods and occupations.	Recognises regulatory standards that are adopted in NZ and implements them in Australian law to make the sale and trade of goods more efficient. Not seen to require any amendments as a result of the introduction of hydrogen in the ACT energy sector.							Sch3 - laws that are excluded from operation of the Act include hazardous substances, dangerous goods, road vehicles, work health and safety, and gas appliances.

Title	Long title/ description	Observations / summary	Market / investment	Production	Infrastructure access	Planning and development	Infrastructure development	Transport	Safety / appliances
<i>Utilities (Network Facilities Tax) Act 2006</i>	An Act to impose a tax on owners of utility network facilities, and for other purposes	Covers utility networks as defined under the <i>Utilities Act 2000</i> , which explicitly includes both gas transmission and distribution networks. Recommended changes to <i>Utilities Act 2000</i> would carry over to this Act.	Consider whether s8(1) tax rate (determined rate/route length) is suitable from policy perspective with respect to hydrogen gas/generation.				S7 – a utility network includes a gas transmission network and a gas distribution network under the <i>Utilities Act 2000</i> .		
<i>Utilities (Telecommunications Installations) Act 2001</i>	An Act about the installation of telecommunications facilities on utility network facilities	Facilitates the installation of telecommunications facilities on utility network services in certain circumstances.				S8 - carrier has no right to install telecommunications facility on utility network facility without consent of responsible utility or owner of the utility network facility.			
<i>Water and Sewerage Act 2000</i>	An Act to make provision in relation to the supply of plumbing or sanitary drainage services.	Sets out the legal and licensing requirements in relation to water supply and sanitary plumbing work.		As a general comment, water purification systems associated with electrolysis systems can produce some waste water but should be no different to other sources of waste water and handled by existing rules.					

5 Out of scope, no amendment required

Title	Long title/ description	Observations / summary
<i>A.C.T. Institute of Technical and Further Education Act 1987</i>	N/A	See <i>Canberra Institute of Technology Act 1987</i> .
<i>Aboriginal and Torres Strait Islander Elected Body Act 2008</i>	An Act to establish an Aboriginal and Torres Strait Islander Elected Body, and for other purposes	Search term present but no relevant context or could apply with no relevant amendment.
<i>Act of Settlement 1700 12 and 13 Will 3 c 2</i>	N/A	Search term present but no relevant context or could apply with no relevant amendment.
<i>ACT Teacher Quality Institute Act 2010</i>	An Act to establish the ACT Teacher Quality Institute, and for other purposes	Search term present but no relevant context or could apply with no relevant amendment.
<i>Administration and Probate Act 1929</i>	An Act relating to the administration of the estates of deceased persons	Search term present but no relevant context or could apply with no relevant amendment.
<i>Administrative Decisions (Judicial Review) Act 1989</i>	An Act relating to the review on questions of law of certain administrative decisions	Search term present but no relevant context or could apply with no relevant amendment.
<i>Adoption Act 1993</i>	An Act relating to the adoption of children and young people	Search term present but no relevant context or could apply with no relevant amendment.
<i>Age of Majority Act 1974</i>	An Act relating to the age of majority	No hits and either no relevant context or could apply with no relevant amendment.
<i>Agents Act 2003</i>	This Act regulates agents such as real estate agents.	Search term present but no relevant context or could apply with no relevant amendment.
<i>Anglican Church of Australia Constitution Act 1961</i>	N/A	Search term present but no relevant context or could apply with no relevant amendment.
<i>Anglican Church of Australia Constitutions Act 1902</i>	An Act to give legal force and effect to the constitution for the management and good government of the Anglican Church of Australia	No hits and either no relevant context or could apply with no relevant amendment.
<i>Anglican Church of Australia Trust Property Act 1917</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Anglican Church of Australia Trust Property Act 1928</i>	An Act relating to Church of England trust property	Search term present but no relevant context or could apply with no relevant amendment.
<i>Animal Diseases Act 2005</i>	An Act to provide for the control of endemic and exotic diseases of animals, and for other purposes	Search term present but no relevant context or could apply with no relevant amendment.
<i>Animal Welfare Act 1992</i>	N/A	Search term present but no relevant context or could apply with no relevant amendment.
<i>Appropriation (Office of the Legislative Assembly) Act 2019-2020</i>	An Act to appropriate money for expenditure in relation to the Office of the Legislative Assembly and officers of the Assembly for the financial year beginning on 1 July 2019, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Appropriation Act 2019-2020</i>	An Act to appropriate money for the purposes of the Territory for the financial year beginning on 1 July 2019, and for other purposes	Search term present but no relevant context or could apply with no relevant amendment.
<i>Appropriation Act 2019-2020 (No 2)</i>	An Act to appropriate additional money for the purposes of the Territory for the financial year that began on 1 July 2019	Search term present but no relevant context or could apply with no relevant amendment.
<i>Architects Act 2004</i>	An Act about the provision of architectural services, and for other purposes	Search term present but no relevant context or could apply with no relevant amendment.
<i>Associations Incorporation Act 1991</i>	An Act to provide for the incorporation of certain associations, and for related purposes	Search term present but no relevant context or could apply with no relevant amendment.
<i>Australian Capital Territory (Legislative Assembly) Act 2014</i>	An Act to provide for the number of members of the Legislative Assembly	No hits and either no relevant context or could apply with no relevant amendment.
<i>Australian Capital Territory (Ministers) Act 2013</i>	An Act to provide for the number of Ministers for the Territory	No hits and either no relevant context or could apply with no relevant amendment.
<i>Australian Capital Territory (Self-Government) Act 1988 (Cth)</i>	An Act to provide for the Government of the Australian Capital Territory, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Australian Crime Commission (ACT) Act 2003</i>	An Act to make provision for the operation of the Australian Crime Commission in the ACT, to repeal the National Crime Authority (Territory Provisions) Act 1991, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Australian-American Educational Foundation Act 1966</i>	An Act relating to the Australian-American Educational Foundation	Search term present but no relevant context or could apply with no relevant amendment.
<i>Bail Act 1992</i>	An Act relating to bail for accused people in connection with criminal proceedings	No hits and either no relevant context or could apply with no relevant amendment.
<i>Betting Operations Tax Act 2018</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Bill of Rights 1688 1 Will and Mary sess 2 c 2</i>	An Act declaring the rights and liberties of the subject and settling the succession of the Crown	Search term present but no relevant context or could apply with no relevant amendment.
<i>Births, Deaths and Marriages Registration Act 1997</i>	An Act relating to the registration of births, deaths, marriages, civil unions, civil partnerships and changes of name and sex, and for related purposes	Search term present but no relevant context or could apply with no relevant amendment.
<i>Blood Donation (Acquired Immune Deficiency Syndrome) Act 1985</i>		See <i>Blood Donation (Transmittable Diseases) Act 1985</i> .
<i>Blood Donation (Transmittable Diseases) Act 1985</i>	An Act to limit liability in respect of the transmission of acquired immune deficiency syndrome and other diseases through the transfusion of blood	Search term present but no relevant context or could apply with no relevant amendment.

Title	Long title/ description	Observations / summary
<i>Board of Senior Secondary Studies Act 1997</i>	An Act to establish a board of senior secondary studies	Search term present but no relevant context or could apply with no relevant amendment.
<i>Casino (Electronic Gaming) Act 2017</i>	An Act to regulate electronic gaming in the casino, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Casino Control Act 2006</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Cemeteries and Crematoria Act 2003</i>	An Act about cemeteries and crematoria, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Cemeteries and Crematoria Act 2020</i>	An Act about cemeteries and crematoria, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Charitable Collections Act 2003[6]</i>	An Act to regulate collections for charities, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Children and Young People Act 2008[7]</i>	An Act about the welfare of children and young people, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Church of England Constitutions Act Amendment Act 1902</i>		See <i>Anglican Church of Australia Constitutions Act 1902[8]</i> .
<i>Church of England in Australia Constitution Act 1961</i>		See <i>Anglican Church of Australia Constitution Act 1961</i> .
<i>Church of England Property Trust Act 1928</i>		See <i>Anglican Church of Australia Trust Property Act 1928</i> .
<i>Church of England Trust Property Act 1917</i>		See <i>Anglican Church of Australia Trust Property Act 1917</i> .
<i>City of Canberra Arms Act 1932[12]</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Civil Law (Property) Act 2006</i>	An Act to amend, simplify and consolidate provisions about the law of property, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Civil Law (Wrongs) Act 2002</i>	An Act to consolidate and reform the statute law relating to wrongs, and for other purposes.	Search term present but no relevant context or could apply with no relevant amendment.
<i>Civil Unions Act 2012</i>	An Act to provide for civil unions, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Classification (Publications, Films and Computer Games) (Enforcement) Act 1995</i>	An Act to provide for the enforcement of a scheme of classification of publications, films and computer games, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Clinical Waste Act 1990</i>	An Act relating to the treatment, storage, transportation and disposal of clinical waste	No hits and either no relevant context or could apply with no relevant amendment.
<i>Commercial Arbitration Act 2017</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Common Boundaries Act 1981</i>	An Act relating to dividing fences and party walls	No hits and either no relevant context or could apply with no relevant amendment.
<i>Community Housing Providers National Law (ACT) Act 2013</i>	An Act to apply a national law about the registration and regulation of community housing providers, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Community Title Act 2001</i>	An Act to provide for the establishment and administration of community title schemes, and for other purposes	Search term present but no relevant context or could apply with no relevant amendment.
<i>Companies (Unclaimed Assets and Moneys) Act 1950</i>		See <i>Unclaimed Money Act 1950</i> .
<i>Competition Policy Reform Act 1996</i>	An Act to apply certain laws of the Commonwealth relating to competition policy as laws of the Australian Capital Territory, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Confiscation of Criminal Assets Act 2003</i>	An Act to deprive people of the proceeds of crime and of property used for criminal activity, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Controlled Sports Act 2019</i>	An Act to regulate controlled sports, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Co-operatives National Law (ACT) Act 2017</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Coroners Act 1997[32]</i>	An Act to provide for the holding of inquests into deaths and inquiries into fires and disasters, and for related purposes	Search term present but no relevant context or could apply with no relevant amendment.
<i>Corporations Act 2001 (Cth)</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Corrections Management Act 2007[34]</i>	An Act relating to correctional services, and for other purposes	Search term present but no relevant context or could apply with no relevant amendment.
<i>Court of Petty Sessions Act 1930</i>		See <i>Magistrates Court Act 1930</i> .
<i>Court Procedures Act 2004</i>	An Act to provide for certain matters relating to courts and tribunals, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>COVID-19 Emergency Response Act 2020</i>	An Act to provide for emergency measures in response to the COVID-19 emergency, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Crimes (Assumed Identities) Act 2009</i>	An Act to provide for the lawful acquisition and use of assumed identities for law enforcement purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Crimes (Child Sex Offenders) Act 2005</i>	An Act about registration and reporting requirements for certain offenders who commit sexual offences against children, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.

Title	Long title/ description	Observations / summary
<i>Crimes (Controlled Operations) Act 2008</i>	An Act to provide for the authorisation, conduct and monitoring of controlled operations	No hits and either no relevant context or could apply with no relevant amendment.
<i>Crimes (Forensic Procedures) Act 2000</i>	An Act about forensic procedures and other matters	No hits and either no relevant context or could apply with no relevant amendment.
<i>Crimes (Protection of Witness Identity) Act 2011</i>	An Act to provide for the protection of the identity of operative witnesses	No hits and either no relevant context or could apply with no relevant amendment.
<i>Crimes (Restorative Justice) Act 2004</i>	An Act to provide a process of restorative justice for victims, offenders and the community, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Crimes (Sentence Administration) Act 2005</i>	An Act to consolidate and reform the law about the administration of sentences, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Crimes (Sentencing) Act 2005</i>	An Act to consolidate and reform the law about sentencing offenders, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Crimes (Surveillance Devices) Act 2010</i>	An Act to provide for the authorisation of the installation, use, maintenance and retrieval of surveillance devices for law enforcement purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Criminal and Civil Justice Act 1351 25 Edw 3 St 5 c 4</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Criminal Code 2002</i>	An Act relating to the criminal law, and for other purposes	Search term present (in Regs) but not used in the relevant context
<i>Cultural Facilities Corporation Act 1997</i>	An Act to establish the Cultural Facilities Corporation, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Director of Public Prosecutions Act 1990</i>	An Act to establish an Office of the Director of Prosecutions, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Disability Services Act 1991</i>	An Act relating to persons with disabilities	No hits and either no relevant context or could apply with no relevant amendment.
<i>Discrimination Act 1991</i>	An Act to make certain kinds of discrimination unlawful and to provide for related matters	No hits and either no relevant context or could apply with no relevant amendment.
<i>Districts Act 2002</i>	An Act to provide for the division and description of land, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Dividing Fences Act 1981</i>		See <i>Common Boundaries Act 1981</i> .
<i>Domestic Animals Act 2000</i>	An Act to provide for the identification and registration of certain animals and the duties of owners, carers and keepers, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Domestic Relationships Act 1994</i>	An Act to make provision with respect to certain domestic relationships	No hits and either no relevant context or could apply with no relevant amendment.
<i>Domestic Violence Act 1986</i>		See <i>Domestic Violence Agencies Act 1986</i> .
<i>Domestic Violence Agencies Act 1986</i>	An Act relating to family violence, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Drugs in Sport Act 1999</i>	An Act to give functions to the Australian Sports Anti-Doping Authority in relation to the use of drugs and doping methods in sport and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Drugs of Dependence Act 1989</i>	An Act to prohibit the sale, supply and possession of drugs of dependence and prohibited substances, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Due Process of Law Act 1354 28 Edw 3 c 3</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Due Process of Law Act 1368 42 Edw 3 c 3</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Duties Act 1999</i>	An Act to create and charge various duties	Search term present but no relevant context or could apply with no relevant amendment.
<i>Education Act 2004</i>	An Act about the education of children in the ACT, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Education and Care Services National Law (ACT) Act 2011</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Eggs (Labelling and Sale) Act 2001</i>	An Act about the labelling and sale of hen eggs, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Election Commitments Costing Act 2012</i>	An Act to enable costing of election commitments	No hits and either no relevant context or could apply with no relevant amendment.
<i>Electoral Act 1992</i>	An Act to provide for elections of members of the Legislative Assembly and related matters	No hits and either no relevant context or could apply with no relevant amendment.
<i>Electricity Act 1971</i>		See <i>Electricity Safety Act 1971</i> .
<i>Electronic Conveyancing National Law (ACT)</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Electronic Conveyancing National Law (ACT) Act 2020</i>	An Act to apply a national law relating to electronic conveyancing, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Electronic Transactions Act 2001</i>	An Act to facilitate the use of electronic methods in transactions and record keeping	No hits and either no relevant context or could apply with no relevant amendment.
<i>Enclosed Lands Protection Act 1943</i>	An Act relating to protection of enclosed lands from intrusion and trespass	No hits and either no relevant context or could apply with no relevant amendment.

Title	Long title/ description	Observations / summary
<i>Enforcement of Public Interests Act 1973</i>	An Act relating to the conduct of certain proceedings in courts	No hits and either no relevant context or could apply with no relevant amendment.
<i>Epidemiological Studies (Confidentiality) Act 1992</i>	An Act to provide for confidentiality in relation to certain epidemiological studies	No hits and either no relevant context or could apply with no relevant amendment.
<i>Evidence (Closed-Circuit Television) Act 1991</i>		See <i>Evidence (Miscellaneous Provisions) Act 1991</i> .
<i>Evidence (Miscellaneous Provisions) Act 1991</i>	An Act about evidence	No hits and either no relevant context or could apply with no relevant amendment.
<i>Evidence Act 2011</i>	An Act about the law of evidence	No hits and either no relevant context or could apply with no relevant amendment.
<i>Fair Trading Act 1992</i>		See <i>Fair Trading (Australian Consumer Law) Act 1992</i> .
<i>Family Provision Act 1969</i>	An Act to ensure that the family of a deceased person receives adequate provision out of his or her estate	No hits and either no relevant context or could apply with no relevant amendment.
<i>Family Violence Act 2016</i>	An Act to protect people from family violence, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Fertilisers Act 1904</i>		See <i>Fertilisers (Labelling and Sale) Act 1904</i> .
<i>Fertilisers (Labelling and Sale) Act 1904</i>	An Act to regulate the sale and prevent the adulteration of fertilisers	No hits and either no relevant context or could apply with no relevant amendment.
<i>Financial Agreement Act 1994</i>	An Act to approve an agreement between the Commonwealth, States and Territories, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Financial Management Act 1996</i>	An Act to provide for the financial management of the government of the Territory, to provide for the scrutiny of that management by the Legislative Assembly, to specify financial reporting requirements for the government of the Territory, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Financial Sector Reform (ACT) Act 1999</i>	An Act to make provision for the reform of the financial sector, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Firearms Act 1996</i>	An Act to provide for the regulation, control and registration of firearms	Search term present but no relevant context or could apply with no relevant amendment.
<i>First Home Owner Grant Act 2000</i>	An Act to encourage and assist home ownership, and to offset the effect of the GST on the acquisition of a first home, by establishing a scheme for the payment of grants to first home owners	No hits and either no relevant context or could apply with no relevant amendment.
<i>Fisheries Act 2000</i>	An Act about the management of fisheries	No hits and either no relevant context or could apply with no relevant amendment.
<i>Food Act 2001</i>	An Act to regulate the sale of food for human consumption, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Forfeiture Act 1991</i>	An Act to provide for the relief of persons guilty of unlawful killing from the forfeiture of inheritance and other rights, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Free Access to Courts Act 1400 2 Hen 4 c 1</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Freedom of Information Act 2016</i>	An Act to give public access to government information, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Gambling and Racing Control Act 1999</i>	An Act to provide for the administration of certain Acts relating to gambling and racing and to create the gambling and racing commission	No hits and either no relevant context or could apply with no relevant amendment.
<i>Gaming Machine Act 2004</i>	An Act in relation to gaming machines, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Gene Technology (GM Crop Moratorium) Act 2004</i>	An Act to enable a moratorium to be imposed on the cultivation of certain genetically modified plants, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Gene Technology Act 2003</i>	An Act to regulate activities involving gene technology, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Government Agencies (Campaign Advertising) Act 2009</i>	An Act about campaign advertising by government agencies	No hits and either no relevant context or could apply with no relevant amendment.
<i>Government Agencies (Land Acquisition Reporting) Act 2018</i>	An Act about reports about land acquired by government agencies, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Government Procurement Act 2001</i>	An Act about procurement by the Territory and territory entities, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Guardianship and Management of Property Act 1991</i>	An Act to provide for guardianship, and management of the property, of certain people, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Health (National Health Funding Pool and Administration) Act 2013</i>	An Act to apply a national law relating to the reform of health funding arrangements and administration, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Health Act 1993</i>	An Act relating to the provision of health services	No hits and either no relevant context or could apply with no relevant amendment.
<i>Health Practitioner Regulation National Law (ACT)</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Health Practitioner Regulation National Law (ACT) Act 2010</i>	An Act about health practitioner regulation, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.

Title	Long title/ description	Observations / summary
<i>Health Professionals (Special Events Exemptions) Act 2000</i>	An Act to allow visiting health professionals to provide health services in connection with certain special events without being registered under Territory laws	No hits and either no relevant context or could apply with no relevant amendment.
<i>Health Records (Privacy and Access) Act 1997</i>	An Act to provide for the privacy and integrity of, and access to, personal health information, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Hemp Fibre Industry Facilitation Act 2004</i>	An Act about the cultivation of hemp for certain commercial uses, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Heritage Act 2004</i>	An Act to provide for the recognition, registration and conservation of places and objects of natural and cultural significance, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Holidays Act 1958</i>	An Act to make provision with respect to public holidays and bank holidays	No hits and either no relevant context or could apply with no relevant amendment.
<i>Housing Assistance Act 2007</i>	An Act to provide for housing assistance, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Human Cloning and Embryo Research Act 2004</i>	An Act to prohibit human cloning for reproduction and other unacceptable practices associated with reproductive technology and to regulate certain activities involving the use of human embryos	No hits and either no relevant context or could apply with no relevant amendment.
<i>Human Embryo (Research) Act 2004</i>		See <i>Human Cloning and Embryo Research Act 2004</i> .
<i>Human Rights Act 2004</i>	An Act to respect, protect and promote human rights	No hits and either no relevant context or could apply with no relevant amendment.
<i>Human Rights Commission Act 2005</i>	An Act to establish the Human Rights Commission, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Independent Pricing and Regulatory Commission Act 1997</i>		See <i>Independent Competition and Regulatory Commission Act 1997</i> .
<i>Information Privacy Act 2014</i>	An Act to regulate the handling of personal information by public sector agencies and contracted service providers, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Inquiries Act 1991</i>	An Act relating to inquiries	No hits and either no relevant context or could apply with no relevant amendment.
<i>Inspector of Correctional Services Act 2017</i>	An Act to provide for an inspector of correctional services, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Insurance Authority Act 2005</i>	An Act to make provision about the Australian Capital Territory Insurance Authority, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Integrity Commission Act 2018</i>	The Act broadly covers the powers, rights, functions and operations of the Integrity Commission where there are concerns of corruption.	No hits and either no relevant context or could apply with no relevant amendment.
<i>Interactive Gambling Act 1998</i>	An Act to make provision about the Australian Capital Territory Insurance Authority, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Intoxicated People (Care and Protection) Act 1994</i>	An Act to provide for the care and protection of intoxicated people, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Intoxicated Persons (Care and Protection) Act 1994</i>		See <i>Intoxicated People (Care and Protection) Act 1994</i> .
<i>Judicial Commissions Act 1994</i>	An Act to provide for the examination of complaints in relation to judicial officers, to provide for their removal from office in certain circumstances, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Juries Act 1967</i>	An Act relating to juries	No hits and either no relevant context or could apply with no relevant amendment.
<i>Jurisdiction of Courts (Cross-vesting) Act 1993</i>	An Act to make provision for the cross-vesting of certain jurisdiction	No hits and either no relevant context or could apply with no relevant amendment.
<i>Justices of the Peace Act 1989</i>	An Act about justices of the peace	No hits and either no relevant context or could apply with no relevant amendment.
<i>Land Rent Act 2008</i>	An Act about the rental of certain residential leases, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Land Tax Act 2004</i>	An Act about land tax	No hits and either no relevant context or could apply with no relevant amendment.
<i>Land Titles (Unit Titles) Act 1970</i>	An Act to provide for the registration of unit titles, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Land Titles Act 1925</i>	An Act to provide for the registration of title to land, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Law Officers Act 2011</i>	An Act about the functions of the Attorney-General, solicitor-general and government solicitor, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Leases (Commercial and Retail) Act 2001</i>	An Act to regulate commercial and retail leases and tenancies, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Legal Aid Act 1977</i>	An Act relating to the provision of legal aid	No hits and either no relevant context or could apply with no relevant amendment.
<i>Legal Profession Act 2006</i>	An Act about the legal profession and legal services	No hits and either no relevant context or could apply with no relevant amendment.
<i>Legislation Act 2001</i>	An Act about legislation	No hits and either no relevant context or could apply with no relevant amendment.

Title	Long title/ description	Observations / summary
<i>Legislative Assembly (Broadcasting) Act 2001</i>	An Act about broadcasting of proceedings of the Legislative Assembly and its committees	No hits and either no relevant context or could apply with no relevant amendment.
<i>Legislative Assembly (Members' Staff) Act 1989</i>	An Act to provide for the employment of staff and the engagement of consultants and contractors by office-holders and members of the Legislative Assembly	No hits and either no relevant context or could apply with no relevant amendment.
<i>Legislative Assembly (Members' Superannuation) Act 1991</i>	An Act to provide superannuation benefits for members of the Legislative Assembly, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Legislative Assembly (Office of the Legislative Assembly) Act 2012</i>	An Act to establish the Office of the Legislative Assembly, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Legislative Assembly Precincts Act 2001</i>	An Act about the precincts of the Legislative Assembly	No hits and either no relevant context or could apply with no relevant amendment.
<i>Lifetime Care and Support (Catastrophic Injuries) Act 2014</i>	An Act to provide a scheme for the lifetime care and support of people who have been catastrophically injured, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Limitation Act 1985</i>	An Act to provide for the limitation of actions, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Liquor Act 2010</i>	An Act relating to the supply of liquor	No hits and either no relevant context or could apply with no relevant amendment.
<i>Listening Devices Act 1992</i>	An Act to regulate the use of listening devices for the purpose of listening to or recording private conversations, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Litter Act 2004</i>	An Act relating to litter, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Long Service Leave Act 1976</i>	An Act relating to long service leave	No hits and either no relevant context or could apply with no relevant amendment.
<i>Lotteries Act 1964</i>	An Act relating to lotteries	No hits and either no relevant context or could apply with no relevant amendment.
<i>Magistrates Court Act 1930</i>	An Act to establish a Magistrates Court, to provide for the appointment of magistrates, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Magna Carta (1297) 25 Edw 1 c 29</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Major Events Act 2014</i>	An Act relating to the management of major events	No hits and either no relevant context or could apply with no relevant amendment.
<i>Married Persons Property Act 1986</i>	An Act relating to the rights and liabilities of people who are married, in a civil union or civil partnership in relation to property	No hits and either no relevant context or could apply with no relevant amendment.
<i>Medical Treatment (Health Directions) Act 2006</i>	An Act to provide for directions about the withholding or withdrawal of medical treatment, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Medicines, Poisons and Therapeutic Goods Act 2008</i>	An Act to consolidate and reform the law relating to regulated substances and regulated therapeutic goods, to give effect to the medicines and poisons standard, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Mental Health Act 2015</i>	An Act to provide for the treatment, care or support, rehabilitation and protection of people with a mental disorder or mental illness and the promotion of mental health and wellbeing, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Mental Health (Secure Facilities) Act 2016</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Mercantile Law Act 1962</i>	An Act relating to mercantile agents, guarantors and sureties, usury, written memoranda and warehouse persons' liens	No hits and either no relevant context or could apply with no relevant amendment.
<i>Monitoring of Places of Detention (Optional Protocol to the Convention Against Torture) Act 2018</i>	An Act to enable the Optional Protocol to the Convention against Torture and other Cruel, Inhuman or Degrading Treatment or Punishment to be given effect within the ACT	No hits and either no relevant context or could apply with no relevant amendment.
<i>Motor Accident Injuries Act 2019</i>	An Act about motor accident injuries, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Motor Sport (Public Safety) Act 2006</i>	An Act to regulate motor sport activities	No hits and either no relevant context or could apply with no relevant amendment.
<i>Motor Traffic (Alcohol and Drugs) Act 1977</i>		See <i>Road Transport (Alcohol and Drugs) Act 1977</i> .
<i>Mutual Recognition Act 1992 (Cth)</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Mutual Recognition (Australian Capital Territory) Act 1992</i>	An Act relating to the recognition of regulatory standards adopted in Australia regarding goods and occupations	No hits and either no relevant context or could apply with no relevant amendment.
<i>Native Title Act 1994</i>	An Act to establish a framework to enable third parties to gain access to certain natural gas pipeline services, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Notaries Public Act 1984</i>	An Act to establish a framework to enable third parties to gain access to certain natural gas pipeline services, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Nudity Act 1976</i>	An Act to permit nudity in certain public places	No hits and either no relevant context or could apply with no relevant amendment.
<i>Oaths and Affirmations Act 1984</i>	An Act relating to oaths and affirmations	No hits and either no relevant context or could apply with no relevant amendment.

Title	Long title/ description	Observations / summary
<i>Official Visitor Act 2012</i>	An Act to provide for the appointment of official visitors, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Parentage Act 2004</i>	An Act relating to parentage, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Partnership Act 1963</i>	An Act relating to partnership	No hits and either no relevant context or could apply with no relevant amendment.
<i>Pawnbrokers Act 1902</i>	An Act to provide for the licensing and regulation of pawnbrokers, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Payroll Tax Act 2011</i>	An Act to impose payroll tax, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Perpetuities and Accumulations Act 1985</i>	An Act to effect reforms in the rules of law relating to perpetuities and accumulations	No hits and either no relevant context or could apply with no relevant amendment.
<i>Personal Violence Act 2016</i>	An Act to protect people from personal violence (other than family violence) including personal violence in the workplace, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Pest Plants and Animals Act 2005</i>	An Act about pest plants and animals, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Petition of Right 1627 3 Chas 1 c 1</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Plant Diseases Act 2002</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Plastic Shopping Bags Ban Act 2010</i>	An Act to restrict the supply of plastic shopping bags, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Pool Betting Act 1964</i>	An Act relating to pool betting	No hits and either no relevant context or could apply with no relevant amendment.
<i>Powers of Attorney Act 2006</i>	An Act about powers of attorney, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Presbyterian Church (Proposals for Union with other Churches) Act 1972</i>	An Act to make provision in relation to the trusts on which property of the Presbyterian Church of Australia is to be held	No hits and either no relevant context or could apply with no relevant amendment.
<i>Presbyterian Church Trust Property Act 1971</i>	An Act relating to the property of the Presbyterian Church of Australia in the Australian Capital Territory	No hits and either no relevant context or could apply with no relevant amendment.
<i>Proportional Representation (Hare-Clark) Entrenchment Act 1994</i>	An Act to entrench the principles of the proportional representation (Hare-Clark) electoral system	No hits and either no relevant context or could apply with no relevant amendment.
<i>Prostitution Act 1992</i>		See <i>Sex Work Act 1992</i> .
<i>Protection of Public Participation Act 2008</i>	An Act about protection for participation in public debate and matters of public interest	No hits and either no relevant context or could apply with no relevant amendment.
<i>Public Health Act 1997</i>	An Act relating to public health, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Public Interest Disclosure Act 2012</i>	An Act to facilitate public interest disclosures and protect people making those disclosures, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Public Place Names Act 1989</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Public Pools Act 2015</i>	An Act relating to public pools, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Public Roads Act 1902</i>	An Act to consolidate the Acts relating to the opening, closing, survey, altering and improving of roads and the alignment and alteration of the alignment of streets in municipalities	No hits and either no relevant context or could apply with no relevant amendment.
<i>Public Sector Management Act 1994</i>	An Act to regulate the administration of the public sector of the Territory, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Public Sector Workers Compensation Fund Act 2018</i>	An Act to provide for the management of funds dedicated to meeting the workers compensation liabilities of the Territory, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Public Trustee Act 1985</i>		See <i>Public Trustee and Guardian Act 1985</i> .
<i>Public Trustee and Guardian Act 1985</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Public Unleased Land Act 2013</i>	An Act about public unleased land, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Race and Sports Bookmaking Act 2001</i>	An Act to regulate betting on races and other sports events, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Racing Act 1999</i>	An Act to regulate thoroughbred racing and harness racing conducted for the purpose of betting, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Radiation Protection Act 2006</i>	An Act to provide for the protection of the health and safety of people, and for the protection of property and the environment, from the harmful effects of radiation, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Rail Safety National Law (ACT) Act 2014</i>	An Act to provide for a national system of rail safety, and for other purposes. Regs may deal with prohibition of the carriage of goods on railways	Search term present but no relevant context or could apply with no relevant amendment.
<i>Rates Act 2004</i>	An Act about rates, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.

Title	Long title/ description	Observations / summary
<i>Real Property Act 1925</i>		See <i>Land Titles Act 1925</i> .
<i>Real Property (Unit Titles) Act 1970</i>		See <i>Land Titles (Unit Titles) Act 1970</i> .
<i>Recovery of Lands Act 1929</i>	An Act to provide for the recovery of possession of lands on the determination of leases	No hits and either no relevant context or could apply with no relevant amendment.
<i>Referendum (Machinery Provisions) Act 1994</i>	An Act relating to referendums	No hits and either no relevant context or could apply with no relevant amendment.
<i>Registrar-General Act 1993</i>	An Act to establish an office of registrar-general	No hits and either no relevant context or could apply with no relevant amendment.
<i>Registration of Deeds Act 1957</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Remuneration Tribunal Act 1995</i>	An Act to establish a tribunal to determine the remuneration and allowances to be paid, and the entitlements to be granted, to the holders of certain offices, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Residential Tenancies Act 1997</i>	An Act relating to residential tenancies and occupancy agreements	No hits and either no relevant context or could apply with no relevant amendment.
<i>Retirement Villages Act 2012</i>	An Act to regulate retirement villages, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Road Transport (Alcohol and Drugs) Act 1977</i>	An Act to provide for the detection of people who drive motor vehicles after consuming alcohol or drugs, for offences by those people, and to provide measures for the treatment and rehabilitation of those people	No hits and either no relevant context or could apply with no relevant amendment.
<i>Road Transport (Driver Licensing) Act 1999</i>	An Act to provide for the licensing of drivers and for related matters as part of the system for nationally consistent road transport law, to provide for additional matters about learner, probationary, provisional, public vehicle and restricted licences, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Roman Catholic Church Property Trust Act 1937</i>	An Act relating to property held upon any trust for or for the use, benefit or purposes of the Roman Catholic Church in the Australian Capital Territory	No hits and either no relevant context or could apply with no relevant amendment.
<i>Royal Commissions Act 1991</i>	An Act relating to royal commissions	No hits and either no relevant context or could apply with no relevant amendment.
<i>Sale of Goods (Vienna Convention) Act 1987</i>	An Act to give effect within the ACT to the United Nations Convention on Contracts for the international sale of goods, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Sale of Goods Act 1954</i>	An Act relating to the sale of goods	No hits and either no relevant context or could apply with no relevant amendment.
<i>Sale of Motor Vehicles Act 1977</i>	An Act relating to the sale of motor vehicles and the licensing of motor vehicle dealers	No hits and either no relevant context or could apply with no relevant amendment.
<i>Salvation Army Property Trust Act 1934</i>	An Act to provide for the temporal affairs of The Salvation Army in the Australian Capital Territory	No hits and either no relevant context or could apply with no relevant amendment.
<i>Seat of Government (Administration) Act 1910 (Cth)</i>	N/A	No hits and either no relevant context or could apply with no relevant amendment.
<i>Seat of Government Acceptance Act 1909 (Cth)</i>	An Act relating to the Acceptance of the Territory surrendered by the State of New South Wales for the Seat of Government of the Commonwealth	No hits and either no relevant context or could apply with no relevant amendment.
<i>Seat of Government Acceptance Act 1922 (Cth)</i>	An Act to ratify an Agreement for the variation of the Agreement for the Surrender and Acceptance of territory for the purposes of the Seat of Government of the Commonwealth	No hits and either no relevant context or could apply with no relevant amendment.
<i>Seat of Government Act 1908 (Cth)</i>	An Act to Determine the Seat of Government of the Commonwealth	No hits and either no relevant context or could apply with no relevant amendment.
<i>Seat of Government Supreme Court Act 1933</i>		See <i>Supreme Court Act 1933</i> .
<i>Second-hand Dealers Act 1906</i>	An Act to provide for the licensing and regulation of dealers in certain second-hand goods, to regulate the sale of certain second-hand goods, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Second-hand Dealers and Collectors Act 1906</i>		See <i>Second-hand Dealers Act 1906</i> .
<i>Security Industry Act 2003</i>	An Act to provide for the licensing and regulation of people in the security industry, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Senior Practitioner Act 2018</i>	An Act to provide for the appointment of a senior practitioner and the regulation of restrictive practices to minimise their use	No hits and either no relevant context or could apply with no relevant amendment.
<i>Sex Work Act 1992</i>	An Act to regulate certain aspects of sex work	No hits and either no relevant context or could apply with no relevant amendment.
<i>Smoke-Free Public Places Act 2003</i>	An Act to prohibit smoking in certain public places, and for other purposes	Search term present but no relevant context or could apply with no relevant amendment.
<i>Smoking (Prohibition in Enclosed Public Places) Act 2003</i>		See <i>Smoke-Free Public Places Act 2003</i> .
<i>Smoking in Cars with Children (Prohibition) Act 2011</i>	An Act to prohibit smoking in cars when children are present	No hits and either no relevant context or could apply with no relevant amendment.

Title	Long title/ description	Observations / summary
<i>Spent Convictions Act 2000</i>	An Act to limit the effect of a person's conviction for certain offences if the person completes a period of crime-free behaviour, to make provision about extinguished convictions, quashed convictions and pardons, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Standard Time and Summer Time Act 1972</i>	An Act relating to standard time and summer time	No hits and either no relevant context or could apply with no relevant amendment.
<i>Statutory Declarations Act 1959 (Cth)</i>	An Act relating to Statutory Declarations	No hits and either no relevant context or could apply with no relevant amendment.
<i>Stock Act 2005</i>	An Act about stock, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Superannuation (Legislative Assembly Members) Act 1991</i>		See <i>Legislative Assembly (Members' Superannuation) Act 1991</i> .
<i>Supervised Injecting Place Trial Act 1999</i>	An Act to allow for a trial of a supervised injecting place for drug-dependent people	No hits and either no relevant context or could apply with no relevant amendment.
<i>Supreme Court Act 1933</i>	An Act to establish a Supreme Court of the Australian Capital Territory, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Surveyors Act 2007</i>	An Act to regulate the practice of land surveying, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Taxation (Government Business Enterprises) Act 2003</i>	An Act about the payment of tax, and amounts equivalent to tax, by government business enterprises, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Taxation Administration Act 1999</i>	An Act to provide for the administration of certain Acts relating to the imposition and collection of taxes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Territory Records Act 2002</i>	An Act about Territory records, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Territory Superannuation Provision Protection Act 2000</i>	An Act to provide for the protection of funds dedicated to meeting the superannuation liabilities of the Territory, territory authorities and territory-owned corporations, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Terrorism (Extraordinary Temporary Powers) Act 2006</i>	An Act to provide extraordinary temporary powers to prevent and respond to terrorist acts, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Tertiary Accreditation and Registration Act 2003</i>		See <i>Training and Tertiary Education Act 2003</i> .
<i>Testamentary Guardianship Act 1984</i>	An Act to provide for the appointment of testamentary guardians, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Tobacco Act 1927</i>		See <i>Tobacco and Other Smoking Products Act 1927</i> .
<i>Tobacco and Other Smoking Products Act 1927</i>	An Act about tobacco and smoking products	No hits and either no relevant context or could apply with no relevant amendment.
<i>Totalisator Act 2014</i>	An Act to provide for the conduct of totalisators and the regulation of totalisator betting, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Traders (Licensing) Act 2016</i>	An Act to regulate the licensing of traders, and for other purposes	Search term present but no relevant context or could apply with no relevant amendment.
<i>Transplantation and Anatomy Act 1978</i>	An Act to make provision for and in relation to the removal of human tissues for transplantation, for post-mortem examinations, for the definition of death, for the regulation of schools of anatomy, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Trespass on Commonwealth Lands Act 1932 See Trespass on Territory Land Act 1932</i>	An Act to provide for the disposal of uncollected, lost or abandoned goods, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Trespass on Territory Land Act 1932</i>	An Act relating to trespass on Territory land	No hits and either no relevant context or could apply with no relevant amendment.
<i>Trustee Act 1925</i>	An Act relating to trustees and trust property, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Trustee Companies Act 1947</i>	An Act relating to trustee companies	No hits and either no relevant context or could apply with no relevant amendment.
<i>Unclaimed Money Act 1950</i>	An Act relating to unclaimed assets in the hands of liquidators of companies, unclaimed amounts held by companies, unclaimed superannuation benefits and unclaimed amounts held in retirement savings accounts	No hits and either no relevant context or could apply with no relevant amendment.
<i>Uncollected Goods Act 1996</i>	An Act to provide for the disposal of uncollected, lost or abandoned goods, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Unit Titles (Management) Act 2011</i>	An Act to provide for the management of units plants, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Uniting Church in Australia Act 1977</i>	An Act to establish The Uniting Church in Australia (Australian Capital Territory) Property Trust, and for related purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>University of Canberra Act 1989</i>	An Act about the University of Canberra	No hits and either no relevant context or could apply with no relevant amendment.
<i>Unlawful Gambling Act 2009</i>	An Act relating to unlawful gambling, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Veterinary Practice Act 2018</i>	An Act to regulate veterinary practitioners, veterinary premises, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Victims of Crime (Financial Assistance) Act 2016</i>	An Act to provide financial assistance for people affected by acts of violence, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Victims of Crime Act 1994</i>	An Act relating to victims of crime	No hits and either no relevant context or could apply with no relevant amendment.

Title	Long title/ description	Observations / summary
<i>Waste Management and Resource Recovery Act 2016</i>	An Act to provide for the minimisation of waste, the recovery, recycling and re-use of resources, and for other purposes	Search term present but no relevant context or could apply with no relevant amendment.
<i>Water Efficiency Labelling and Standards (ACT) Act 2015</i>	An Act to apply as a law of the Territory a national law relating to water efficiency labelling and standards, and for other purposes	Search term present but no relevant context or could apply with no relevant amendment.
<i>Wills Act 1968</i>	An Act to make provisions in relation to the execution and interpretation of wills, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Witness Protection Act 1996</i>	An Act to make provision to protect the safety and welfare of witnesses	No hits and either no relevant context or could apply with no relevant amendment.
<i>Workers' Compensation Act 1951</i>		See <i>Workers Compensation Act 1951</i> .
<i>Working with Vulnerable People (Background Checking) Act 2011</i>	An Act to provide for background checking and registration of people who work with vulnerable people, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.
<i>Workmens' Compensation Act 1951</i>		See <i>Workers Compensation Act 1951</i> .
<i>Workplace Privacy Act 2011</i>	An Act to regulate surveillance of workers in workplaces, and for other purposes	No hits and either no relevant context or could apply with no relevant amendment.