Gas Injection Review

April 2022

BIOENERGY AUSTRALIA
FUEL | GAS | HEAT | POWER

HELMONT energy

Acknowledgement of Country

We acknowledge the Traditional Custodians of the lands on which we live and work and recognise their continuing connection with the land, sea and waterways.
We pay our respects to Elders past, present and emerging.

Acknowledgement and Disclaimer

Helmont Energy Pty Ltd (Helmont) acknowledge the work undertaken by the Future Fuels Cooperative Research Centre (FF CRC), including specific studies pertaining to biomethane injection within the domestic and international markets. This report summarises material and references content from a suite of FF CRC studies relating to biomethane. The findings and recommendations would not have been possible without the groundwork laid down by the FF CRC.

Executive Summary

Executive Summary

- Bioenergy Australia (BA) has engaged Helmont Energy (Helmont) to provide a high level review (the 'Review') of the gas injection studies that have been completed by the Future Fuels Cooperative Research Centre (FFCRC). The purpose of this Review is to identify the opportunity available to the biomethane industry that could lead to an amendment of the current gas injection standard that applies to natural gas in Australia (known as AS4564).
- At the outset, it is noted that biomethane can be injected safely into gas infrastructure and comply with AS4564. In fact, Jemena is currently developing Australia's first biomethane injection project at Malaba, NSW, using wastewater biogas as feedstock. Notwithstanding this, it is becoming increasingly evident, from the work being conducted by BA's members, that the cost of complying with AS4564 exceeds the cost experienced within international jurisdictions where biomethane markets are more mature.
- In this Review, it is highlighted that:
  - International standards have been amended to support biomethane injection.
  - The technology to upgrade biogas into biomethane is mature. More than half of the technology applications in Europe will not comply to Australian requirements (specifically projects that use the mature water wash and chemical scrubbing processes).
  - A biogas upgrade cost target allows policy markers and technical committees to set goals and objectives to support the biomethane industry.
  - Practical measures to amend AS4564 could include:
    - A reduction in Wobbe Index (a measure of natural gas heating value)
    - An increase in the level of inert gases (including O_2)
    - Inclusion of specific biomethane contaminant levels
    - Approval of a process known as in pipe blending
    - A risk based approach to design, measurement and implementation of biomethane injection projects

Executive Summary

- The Bioenergy Roadmap has identified an enormous opportunity for bioenergy in Australia; and includes the prioritisation of three categories of bioenergy, including biomethane.
- The Bioenergy Roadmap identified that up to 23% of the total gas used in Australia could be derived from biomethane. This implies that the market opportunity is significant and that barriers will need to be reduced to encourage producers, transporters and users of biomethane. The gas injection standards are specifically called out as an area that will need to be refined as the market develops.
- A review of the international incentives and the emerging incentives in Australia (i.e. biomethane ERF method) demonstrates that Australian biomethane projects will create less revenue than international projects. The implication is that costs will need to reduce to attract investment. The starting point (as defined by AS4564) sets a standard which is more stringent than international biomethane projects. This leads to a higher production cost (relative) which presents a material risk to the emerging biomethane industry in Australia.

Overview

Scene Setting

- The Renewable Gas Alliance (RGA) is a subgroup of BA and is a not-for-profit industry group advocating for policy changes to support the emerging biomethane industry in Australia.
- Biomethane injected into an Australian regulated gas network must meet minimum gas injection specifications. Broadly, this is covered under legislation and regulation covering state and territory natural gas production/transport/usage, environmental land use, and workplace health and safety requirements.
- The required gas injection specification is set out in AS4564 and is referenced in the majority of the legislation and regulations of natural gas. It was created for conventional natural gas injection and does not specifically address the nuances associated with biomethane, including its impurities (or constituents-of-concern) and the practicalities associated with complying with the requirements.
- Research conducted by the FFCRC suggests that international biomethane projects are operating to a different gas specification to that of AS4564. The specification is generally of a lower quality than AS4564 and has been refined to support biomethane. This has a number of implications:
  - Mature gas clean-up technologies that are used in international jurisdictions may not be suitable to meet the requirements of AS4564
  - Additional costs will be imposed on Australian biomethane producers to meet the higher Australian standards (as compared to international producers)
  - Project implementation could stall, delaying investment and supply chain participation
- The RGA is seeking to understand whether there is an opportunity to amend the gas injection specification to support the Australian biomethane industry. It is seeking to identify key stakeholders to be consulted and the process required to make an amendment. Ultimately, the RGA is seeking to develop an action plan that will support it (and its members) to develop an injection standard that supports the biomethane industry.

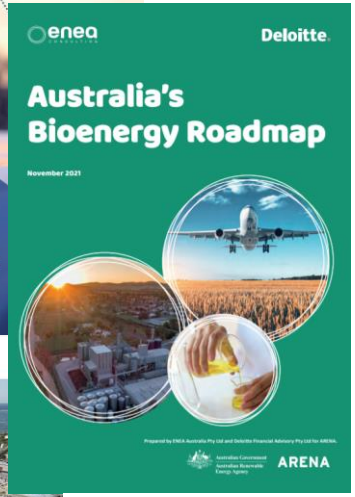
Biomethane Injection Projects by Country (no projects in Australia) [1]

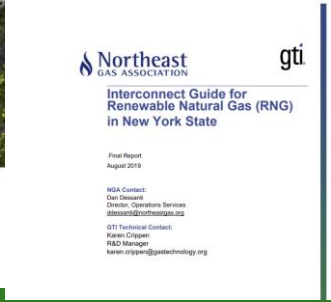
Country	Number of Upgrading Plants [2, 3]	Most Recent Data (Year) [2, 3]	Percentage of Upgrading Facilities Injecting into the Gas Grid [3, 4]
EU Members			
Germany	232	2019	> 90
France	131	2020	> 90
United Kingdom	80	2018	> 90
Sweden	70	2018	< 25
Netherlands	53	2020	> 90
Denmark	46	2019	> 90
Switzerland	38	2019	> 90
Italy	18	2020	0
Finland	17	2019	58
Norway	16	2020	50
Austria	15	2020	100
Non-EU Countries			
U.S.A.	77	2018	-
China	73	2017	-
South Korea	10	2017	-
Canada	9	2018	-
Japan	6	2014	-
Brazil	5	2017	-

1. Department of Industry Science Energy and Resources 2021, *Project number: RPP3.2-09. Biomethane Impurities,* Future Fuels CRC, Canberra

Reference Information

- The FFCRC is a not-for-profit organisation that is co-funded by industry members and the Federal Government. It has completed technical and economic assessments of the biomethane injection requirements in Australia. A total of ten documents were reviewed and relevant information is referenced in this Review. The FFCRC is not an advocacy group and undertakes the technical studies required to support future fuels in Australia.
- In November 2021, ARENA released its Bioenergy Roadmap which outlines the future market opportunity for bioenergy across Australia. Biomethane has been identified as one of three priority areas for the Federal Government in promoting bioenergy.
- Throughout 2021, the RGA facilitated two working groups to progress incentives and certification for biomethane and a new injection guideline for biomethane. Information generated from within these working groups has been referenced in this Review.
- Other information was secured from international guidelines that have been developed to support the biomethane industry. Specifically, the approach adopted within the Northeast Gas Association - The Interconnect Guide for Renewable Gas in New York State and SCalGas RNG Tool Kit are considered for this Review.





The Natural Gas Injection Standard

Existing Gas Injection Standard

- AS4564 (the 'Standard') is designed to create a uniform product that can be safely transported in natural gas pipelines and used within a wide range of consumer devices. It was designed with reference to the inherent characteristic of natural gas within the available natural gas reservoirs across Australia.
- AS4564 was originally drafted from AG864 in 2003. It was revised in 2005, 2011 and again in 2020. The Standard is overseen by the AG-010 committee, which is comprised of industry bodies from the natural gas sector.
- The Standard has limitations:
  - It does not adequately quantify the requirements of the injected gas with respect to 'constituents-of-concern' that can be produced from some sources of biogas.
  - Limits such as Wobbe (a measure of heating value), oxygen and inerts (gases that have no heating value) are more stringent than international standards

Australian Natural Gas Specification – AS4564

Characteristics and Components	Units	Limit Value
Wobbe Index[3]	MJ/m^3	46.0 – 52.0
Higher Heating Value	MJ/m^3	42.3
Oxygen	mol %	0.2
Hydrogen Sulfide (H_2S)	mg/m^3	5.7
Odour Intensity	-	Where required, detectable at a level not exceeding 20 % LEL
Total Sulfur	mg/m^3	50
Water Content	-	Dewpoint of 0 °C at the highest MAOP in the relevant transmission system (in any case, < 112.0 mg/m^3)
Hydrocarbon Dew Point	-	2 °C at 3500 kPag
Total Inert Gases	mol %	7.0
Oil	mL/TJ	20

- The implications of the Standard limitations is that:
  - Definitionally, biogas constituents-of-concern need to be reduced to "absolute zero" for biomethane injection projects to be compliant with the Standard. Note, seven contaminants typically found in biomethane are not contained in AS4564.
  - Projects are required to install additional equipment, deal with measurement complexity and inefficiently process gas. Uncertainty in how to deal with biomethane impurities adds inherent risks to biomethane projects in Australia.
- In contrast, international standards have been refined to quantify the contaminants of biomethane. In some cases, the standards relax key variables such as Wobbe and oxygen. The international standards establish clear guidelines for biogas upgrade engineers to develop the technical designs and processes that are required to meet the relevant standard.

1. Department of Industry Science Energy and Resources 2021, *Project number: RPP3.2-09. Biomethane Impurities,* Future Fuels CRC, Canberra

Assessment of FF CRC Information

- The FF CRC (RP3.2-09) researched 13 international standards and found that contaminants within biomethane were not uniformly addressed across the standards. For example, the limits on bacteria (found in biogas) was only addressed in one of the thirteen standards.
- This demonstrates some of the inconsistency found across the industry, however, international biomethane injection studies can be used to inform the development of Australian biomethane injection standards.
- One of the common international approaches is to test the feedstock before imposing measurement and testing requirements on the biomethane. This is due to the intrinsic relationship between certain feedstocks and the presence of constituents-of-concern. For example, siloxanes are only evident in municipal wastes and therefore testing regimes should not be required for siloxanes for biomethane derived from agricultural waste. This engineering approach saves costs and reduces complexity for biomethane projects.
- Interestingly, some feedstocks are forbidden from participating in the biomethane industry. Namely:
  - Landfill (Germany, Switzerland, Austria, Brazil)
  - Sewage (France)

Table 1 Biomethane Parameters / Contaminants without AS 4564 Limits

Parameters / Contaminants	Biogas Range	Biomethane Range	Regulatory Coverage[1]	Limit Value Range[2]
Hydrogen	BDL[3]	BDL – 0.9 mol. %	9/13	0.1 – 5.0 mol %
Siloxanes	BDL – 14.4 mgSi/m^3 (8000 mg/m^3)[4]	BDL – 0.4 mgSi/m^3	9/13	0.01 – 10 mg Si/m^3
Ammonia	0.2 – 63 mg/m^3	0.15 – 0.25 mg/m^3	8/13	3 – 20 mg/m^3
Halocarbons	BDL – 735 mgCl/m^3	BDL	7/13	1 – 10 mg (Cl/F)/m^3
Semi-Volatile and Volatile Organic Compounds (SVOCs and VOCs)	10 – 700 mg/m^3	<1 – 100 mg/m^3	3/13	< 100 mg/m^3 Xylene (UK) < 904 mg/m^3 Toluene (California, USA) < 3.7 ppm General VOC contents (Quebec, Canada)
Heavy Metals	**Mercury:** BDL – 0.02 µg/m^3 **Arsenic:** BDL - 8.5 µg/m^3	**Mercury:** BDL – 0.05 µg/m^3 **Arsenic:** BDL – 0.32 µg/m^3	2/13	< 1 µg/m^3 Mercury limit recommendation in AS 4564 is sufficient. 19 – 30 µg/m^3 Arsenic 30 – 60 µg/m^3 Copper 600 µg/m^3 Antimony (California, USA) 75 µg/m^3 Lead (California, USA)
Bacteria[6]	**APB[6]:** 1.23 x 10^3 – 6.03 x 10^4 **IOB[6]:** 1.02 x 10^3 – 5.09 x 10^3 **SRB[6]:** 1.1 x 10^2	**APB:** 9.69 x 10^1 – 2.02 x 10^5 **IOB:** 6.9 x 10^2 – 7.67 x 10^4 **SRB:** 1.65 x 10^2 – 2.52 x 10^4	1/13	4 x 10^4 CFU/scf (qPCR per APB, SRB, IOB group) and commercially free of bacteria of >0.2 microns (California, USA)

[1] Number of jurisdictions with gas quality regulations for each parameter / contaminant. Only 13 out of 18 jurisdictions were found to have unique biomethane quality regulations.
[2] Range of maximum contaminant limits found via the regulatory review.
[3] BDL = Below Detection Limits.
[4] Total siloxane concentrations of up to 8,000 mg/m^3 have been reported for raw landfill gas.
[5] Concentrations presented in Colony Forming Units (CFU)/100 scf.
[6] APB, IOB, SRB = Acid Producing Bacteria, Iron Oxidising Bacteria, Sulphate Reducing Bacteria.

1. Department of Industry Science Energy and Resources 2021, *Project number: RPP3.2-09. Biomethane Impurities,* Future Fuels CRC, Canberra

Assessment of FF CRC Information

- In some jurisdictions, projects are allowed to blend "offspec" gas within the natural gas pipeline. Residual risk is addressed by ensuring the first gas off-taker has a 'blended' gas spec that is equivalent to the required gas standard. This initiative supports smaller biomethane projects due to the relatively low volume of injected biomethane compared to the total pipeline flow.
- The FFCRC has identified studies that will quantify the safe tolerance of compliant gas appliances (e.g. home gas heaters) to potential changes in the gas composition. The results of the proposed studies could be used to establish a proposal to amend AS4564. An amendment could include an appendix in the next revision of AS4564 – precedent has been set for this.
- An alternative approach is to directly emulate the work conducted by the Standards Australia ME-093 Hydrogen Technologies committee in the adoption of ISO hydrogen standards for Australian utilisation. This could be achieved utilising the existing European biomethane quality standard (EN 16723-1:2016).[1]
- The intent of these studies will ensure a safe transition for biomethane injection into the Australian market.

From FFCRC RP3.2-09

Several studies were identified to accelerate the adoption of Australian biomethane standards. The following promising studies were identified for deliberation by the RP3.2-09 project team for the next RP3.2-09 project milestone (Industry Workshop Event):

- *Assessment of minimum allowable Wobbe Index specifications for biomethane injection in Australian networks.*
- *Assessing the work conducted in other jurisdictions for increasing allowable oxygen content and its applicability for Australian Assets (e.g., increase from 0.2 – 1.0 mol %).*
- *Detailed assessment of the effects of relaxing the AS 4564 7 mol % total inert gas limits for Australian end-users.*
- *Analysis of the effects of terpene odorant masking for Australian odorant compositions and concentrations.*
- *Assessment of the effects of propane blending on hydrocarbon dew point for likely biomethane product compositions.*
- *Determination of appropriate limit values for siloxane content for end-users.*

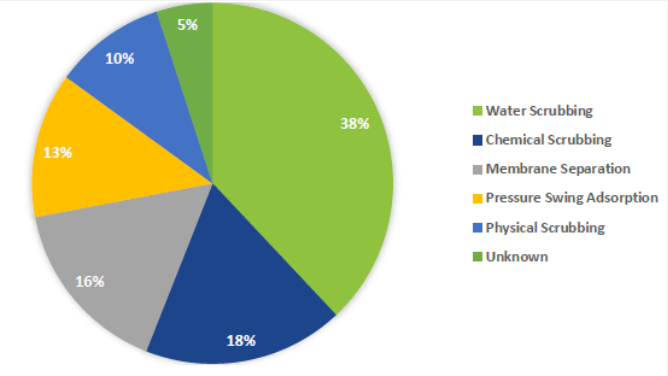
1. Department of Industry Science Energy and Resources 2021, *Project number: RP3.2-09. Biomethane Impurities,* Future Fuels CRC, Canberra

Available Technologies to Upgrade Biogas

- Broadly, the upgrading of biogas from all feedstocks consists of the removal of five key elements, including carbon dioxide (CO_2), air (N_2 & O_2), sulphur compounds and water vapor.
- Some sources of biogas, namely landfill and municipal/industrial wastewater treatment, require the removal of other constituents-of-concern (i.e. siloxanes).
- The removal of nitrogen and oxygen are generally the most expensive component gases to remove. Generally, these are more prevalent in landfill and animal effluent (due to air ingress).
- The scale and location of the plant, as well as the feedstock that produces the biogas, are the dominant factors for technology choice.
- The current AS4564 limits on Wobbe and Inerts require that a relatively large proportion of the inert gases be removed. This requirements means that technologies such as water wash and chemical scrubbing are unsuitable for the Australian market (without further treatment).
- Water wash and chemical scrubbing account for 56% of the projects in Europe. The technology is a low-cost method of upgrading biogas (contingent on plant size and location). This technology is unlikely to meet the requirements of AS4564.

The FFCRC identified five broad methods for gas upgrading across Europe

1. *Water wash*
2. *Chemical Scrubber*
3. *Pressure Swing Absorption*
4. *Membrane*
5. *Cryogenic*



Biogas upgrading includes many options. The cost and complexity relates to the required gas injection standard, biogas feedstock and location of plant

Bioenergy Roadmap and Biomethane Incentives

Bioenergy Roadmap

Australia's Bioenergy Roadmap (referred to as the Bioenergy Roadmap or this Roadmap) has been developed following extensive consultation to enhance the growth of Australia's bioenergy sector and identify bioenergy's role in Australia's future energy mix. It is designed to help inform future policy and investment decisions. It sets out a vision for a sustainable bioenergy industry that delivers lower emissions, regional growth, energy resilience and waste management benefits for Australia.[1]

> **The Bioenergy Roadmap has been developed following extensive consultation to enhance the growth of Australia's bioenergy sector and identify bioenergy's role in Australia's future energy mix. It is designed to help inform future policy and investment decisions.**

1. ARENA 2021, *Australia's Bioenergy Roadmap*, ENEA Consulting and Deloitte, Canberra

Bioenergy Roadmap

The Bioenergy Roadmap highlighted relevant points for biomethane injection:

- Three priorities bioenergy areas are identified, including renewable industrial heat, sustainable aviation fuel and renewable gas (biomethane).
- 20% of Australia's total energy consumption could be provided by bioenergy by the 2050's.
- There is scope for the expansion of the current industry if production costs can be reduced – including biomethane production costs.
- 23% of the total pipeline gas demand could be met by incorporating biomethane (105 PJ p.a.).
- ARENA modelling assumes an increase in the cost efficiency of the production of biomethane. Costs are assumed to be $9.80/GJ in 2030.
- "Continue to assess the appropriateness of the natural gas specifications for biomethane grid injection and implement amendments to the National Gas Law so it extends to renewable gas blending to provide more legal certainty for industry"[1]
- Facilitate the commercialisation of mature technologies that are new to Australia.

→ Future policy support for biomethane

→ Market is large and bioenergy has an important role to play in decarbonising hard-to-abate sectors

→ Biogas clean-up costs need to be reduced to facilitate market development

→ Current biomethane production costs are much higher than the target assumed for modelling

→ Specific call-out of the need to assess natural gas specifications to support the biomethane industry

→ No need to re-invent the wheel given that it is being done successfully overseas

1. ARENA 2021, *Australia's Bioenergy Roadmap*, ENEA Consulting and Deloitte, Canberra

Emissions Reduction Fund

Biomethane ERF Method:

- In December 2020, Minister Taylor announced the prioritisation of five new biomethane ERF methods covering:
  - Landfill Gas
  - Animal Effluent
  - Wastewater
  - Source Separated Organics
  - Alternative Waste Treatment
- Under the methods, eligible projects earn ACCUs. This reduces the cost of biomethane to consumers.
- Agricultural and forestry wastes have been excluded from the method – further work is being done during 2022 to assess their eligibility for an ERF method.
- The available credit (or incentive) is materially less valuable than financial incentives available within mature international biomethane markets.

New incentives are being implemented to support an emerging biomethane industry

The raw biogas from these feedstocks contain impurities difficult (and expensive) to process, including siloxane removal and high levels of nitrogen

The last Government auction for ACCUs resulted in an average price of $16/tonne – significantly lower than international carbon prices or secondary market ACCU prices

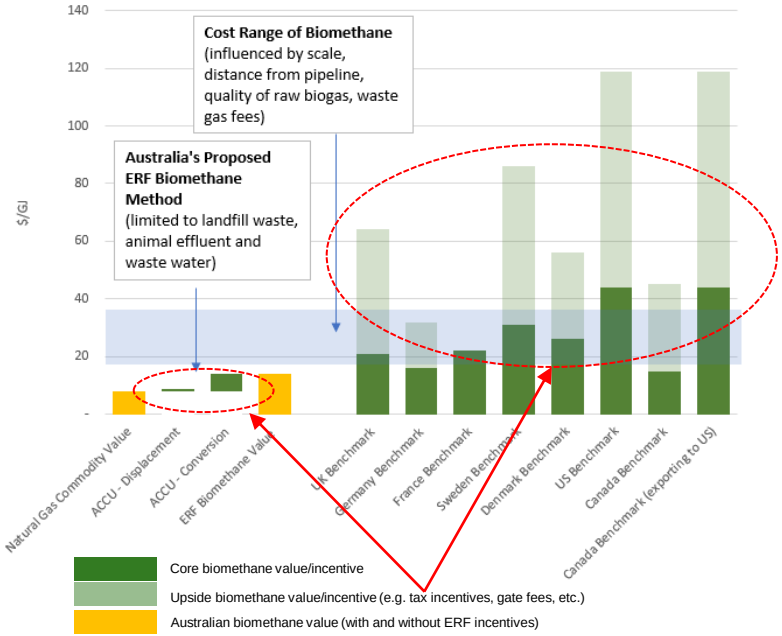
Excluded waste streams make up 73% of international biomethane industry – these waste streams are generally cheaper to process than landfill or wastewater derived waste streams

Under the ERF method, projects (on average) will cost more and earn less than international biomethane projects.

1. ARENA 2021, *Australia's Bioenergy Roadmap*, ENEA Consulting and Deloitte, Canberra

ERF Method

Underlying Biomethane Value

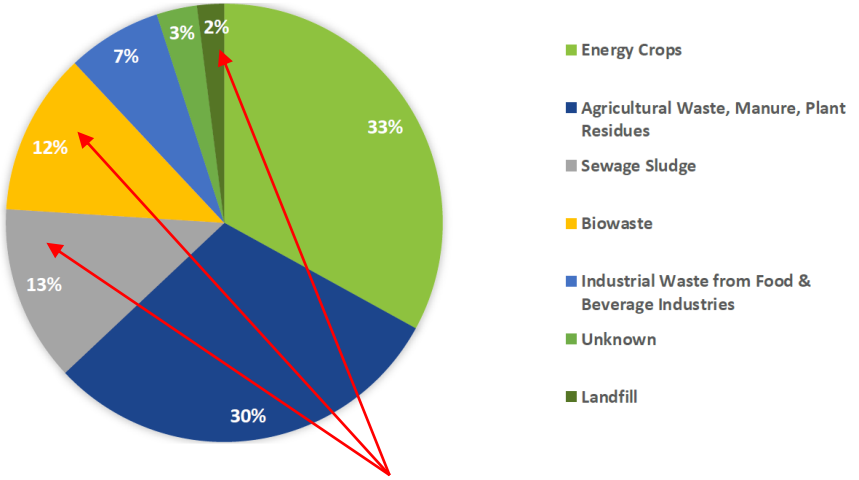


The incentives available within international biomethane projects are much greater than the incentives proposed under the biomethane ERF method. ACCU prices reflect

Commonwealth ERF auction price of $16 assumed for analysis.

Dark green bars represent the low end of the price range. Light green represent upside available with stacking of benefits (i.e. waste gate fees, LCFS credits, etc.)

European Biogas Production by Region and Feedstock Type (2018)



These feedstocks (supported by the ERF Biomethane Method) are relatively expensive feedstocks to convert to biomethane

Concluding Remarks – Bioenergy Roadmap and Biomethane Incentives

- ARENA's Bioenergy Roadmap demonstrates there is enormous potential for biomethane in Australia – 23% of gas usage could come from biomethane.
- Biomethane will allow hard-to-abate manufacturing sectors immediate access to carbon neutral gas that will provide rapid transition using existing infrastructure and commonly used commercial instruments.
- ARENA's modelling shows that the cost of biomethane must reach $9.80/GJ for it to be competitive with alternative fuels and carbon abatement technologies. This can only occur if mature technologies can be brought to Australia, the cost of upgrading biogas reduces, and the incentives (carbon abatement value) increases.
- The ERF method creates the first regulated financial incentive for biomethane. The value created under the method will attract investment if costs can be brought down from current projections.
- The method supports a subset of the available bioenergy resources. Unfortunately, the eligible feedstocks are relatively expensive to upgrade to biomethane due to high impurities in landfill wastes and wastewater and the sub-scale nature of animal effluent projects (typically <100TJ p.a.).
- International biomethane policies have encouraged a broad range of feedstocks to participate in the biomethane industry – mature technologies now exist across those feedstocks.
- International policies create a much larger financial incentive than the proposed biomethane ERF method – Australian biomethane projects will need to significantly reduce in cost to encourage investment (and supply chain participation).
- Reducing the cost of upgrading biogas by adapting key parameters in AS4564 (using international precedent) will be one of the levers available to the industry to encourage a competitive biomethane market in Australia.

Biomethane Regulatory Framework

Regulatory Overview

Background

- The manufacturing of future fuels and processing of natural gas is regulated by workplace health and safety legislation in most states and territories.
- The injection of biomethane into existing infrastructure may, in some circumstances, be precluded under existing legislation and amendment to legislation will be required to support the injection of biomethane into existing gas infrastructure.[1]
- Amendments to legislation to inject biomethane into the gas infrastructure is briefly addressed in this Review (page 24). These legislative amendments must be addressed to overcome the legal (non-compliance) risk attached to current and future biomethane projects.

1. Department of Industry Science Energy and Resources 2020, *Project number: RP2.2-04. Regulatory mapping of future fuels,* Future Fuels CRC, Canberra

Regulatory Framework

Gas Specification

- The legislation relies on (and/or specifies) compliance with standards and codes of practice to ensure that gas quality standards and other key requirements of the legislation are met for safety or security reasons. Compliance with AS4564 is generally accepted by all pipeline operators for the natural gas composition in the pipeline. This has historically set the standard for injection and offtake.
- AS4564 could be amended to support biomethane. An alternative approach is to directly emulate the work conducted by the Standards Australia ME-093 Hydrogen Technologies committee in the adoption of ISO hydrogen standards for Australian utilisation. This could be achieved utilising the existing European biomethane quality standard (EN 16723-1:2016).
- Alternatively, the relevant legislation covering natural gas production, transport and usage across state and territories could be amended.
- The FFCRC has reviewed over 200 Acts, Regulations and Standards. Natural gas is either considered or referenced in 112 legal instruments across States, Territories and the Commonwealth. These may require amending should biomethane not meet the definitional requirements of natural gas even if AS4564 is amended to support biomethane.

				Composition/fuel type considered						
Doc type	Title	Jurisdiction	Year	Electricity	Natural gas	Hydrocarbon	Hydrogen	Biogas	Ammonia	Other
Regulation	Building (General) Regulation 2008	ACT	2008		Y					
Act	Building Act 2004	ACT	2004		Y					
Act	Construction Occupations (Licensing) Act 2004	ACT	2004		Y					
Regulation	Construction Occupations (Licensing) Regulation 2004	ACT	2004		Y					
Act	Environment Protection Act 1997	ACT	1997							
Regulation	Environment Protection Regulation 2005	ACT	2005							
Act	Gas Safety Act 2000	ACT	2000		Y					
Regulation	Gas Safety Regulation 2001	ACT	2001		Y					
Act	Heritage Act 2004	ACT	2004							
Act	National Gas (ACT) Act 2008	ACT	2008		Y	Y				
Regulation	National Gas (ACT) Regulations	ACT	2012	Y	Y	Y				
Act	Nature Conservation Act 2014	ACT	2014							
Act	Planning and Development Act 2007	ACT	2007							
Regulation	Planning and Development Regulation 2008	ACT	2008							
Act	Tree Protection Act 2005	ACT	2005							
Regulation	Utilities (Gas Restrictions) Regulation 2005	ACT	2005		Y					
Act	Utilities (Technical Regulation) Act 2014	ACT	2014	Y	Y					
Act	Utilities Act 2000	ACT	2000	Y	Y					
Regulation	Utility Networks (Public Safety) Regulation 2001	ACT	2001	Y	Y					
Act	Water Resources Act 2007	ACT	2007							
Regulation	Water Resources Regulation 2007	ACT	2007							
Act	Work Health and Safety Act 2011	ACT	2011		Y	Y	Y	Y	Y	
Regulation	Work Health and Safety Regulation 2011	ACT	2011		Y	Y	Y	Y	Y	

Summary of regulatory review – ACT shown as example

1. Department of Industry Science Energy and Resources 2020, *Project number: RP2.2-04. Regulatory mapping of future fuels,* Future Fuels CRC, Canberra

Regulatory Framework

Economic Regulation

- The National Gas Law (NGL) and the National Gas Rules (NGR) determine if a gas transmission pipeline or distribution network is subject to economic regulation.
- 46.3% and 98.1% of transmission pipeline and distributions networks, respectively, are subject to economic regulation.
- The definition of natural gas contained in the NGL does not contemplate future fuels such as biogas and hydrogen.
- This presents an issue for pipeline operators who are compensated (under economic regulation) for transporting natural gas.
- Failure to recognise biomethane in the definition of natural gas means that there could be a potential cost impost for pipeline operators that support the injection and transport of biomethane within their pipelines. This creates a barrier for producers and consumers of biomethane.
- The AER is currently consulting with industry on potential changes to NGL and NGR – BA has made a submission seeking that biomethane be captured in the definition of natural gas.

Economic regulatory status of gas infrastructure[1]

Transmission pipelines				
Jurisdiction	**Length (km)**	**Full regulation**	**Light regulation**	**No regulation**
WA	6,039	54.3%	0.7%	45.0%
QLD	6,502	8.6%	14.5%	76.9%
NSW	3,379[20]	8.9%	38.0%	53.1%
VIC	2,614	77.9%	-	22.1%
SA	2,217	-	-	100.0%
TAS	734	-	-	100.0%
NT	3,074	53.9%	-	46.1%
Australia	**24,559**	**31.9%**	**14.8%**	**53.3%**
Distribution networks				
Jurisdiction	**Length (km)**	**Full regulation**	**Light regulation**	**No regulation**
WA	12,800	100.0%	-	-
QLD	6,199	-	97.5%	2.5%
NSW	26,668	97.4%	-	2.6%
VIC	31,190	99.7%	-	0.3%
SA	7,950	100.0%	-	-
TAS	712	-	-	100.0%
ACT	4,720	100.0%	-	-
NT	38	-	-	100.0%
Australia	**90,277**	**91.4%**	**6.7%**	**1.9%**

1. Department of Industry Science Energy and Resources 2020, *Project number: RP2.2-04. Regulatory mapping of future fuels,* Future Fuels CRC, Canberra

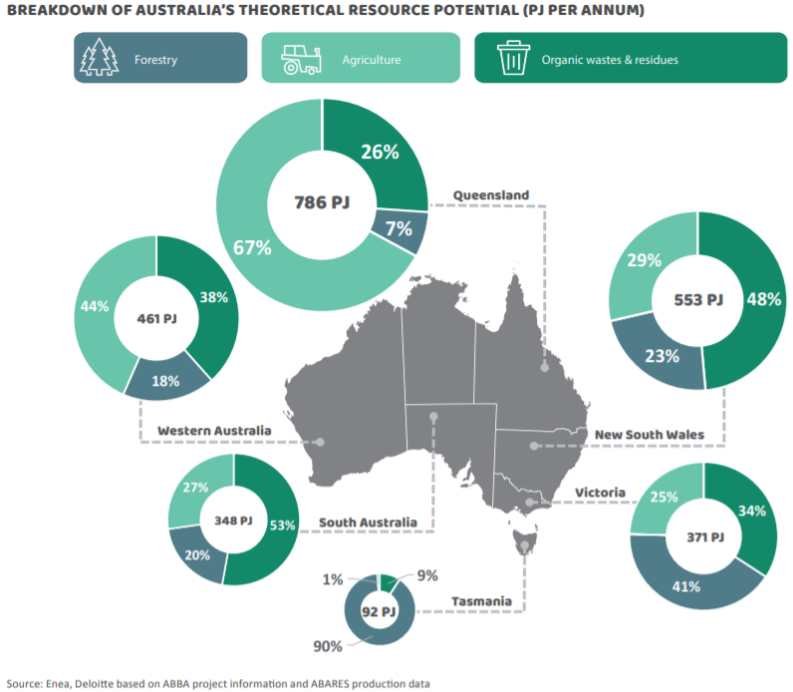
Concluding Remarks – Biomethane Regulatory Framework

- Under legislation, the biomethane industry is required to comply with AS4564 – the standard that sets out the specification for biomethane injected in the gas grid.
- Nothing in AS4564 precludes biomethane from meeting the specification, albeit, there is additional cost and complexity for biomethane producers to meet AS4564, compared with conventional natural gas producers (and international precedent).
- Producers who inject biomethane outside the specification contained in AS4564 will need to do so under special exemptions from the pipeline operator or via legislative amendments.
- AS4564 can be amended and there is a process stipulated by Standards Australia for seeking an amendment - refer to https://www.standards.org.au/standards-development/developing-standards/process
- The process includes six main stages of development, including a stakeholder consultation and public comment process. Amendment of a standard will take a considerable amount of time and resources to implement. It is expected that work undertaken by the FFCRC will be leveraged to support an application to amend the standard. Further studies will be required to address some of the risks that will need to be addressed during the amendment.
- In the absence of an amendment to AS4564, legislative amendments can be made to support biomethane injection that falls outside the specification outlined in AS4564. This may not be an efficient process to undertake given that twelve separate legislative instruments in various states and territories will need to be amended.
- ARENA and the FFCRC have identified that necessary amendments to legislation are required to support renewable gases (biomethane and hydrogen). The AER is currently engaging with industry to support a change to the definition of natural gas which will include renewable gases. The FFCRC is continuing its work to ensure that any deviation from the standard is done so prudently and safely, taking into consideration international precedent and domestic trials and studies.

The Opportunity

What does all this mean?

- There is an opportunity for industry to develop a biomethane standard that will reduce costs and safely increase the volume of biomethane injected into gas infrastructure. International experience demonstrates that this can be achieved.
- The FFCRC is undertaking biomethane injection studies and further funding will be required to complete the studies that are earmarked to support an amendment to AS4564.
- Industry (the RGA) could consider establishing a cost target for biogas upgrading, as measured on a $/GJ basis. A similar approach is being done with soil carbon measurement ($3 per hectare) and hydrogen ($2/kg).
- Based on ARENA's modelling for the Bioenergy Roadmap, a biomethane cost of $9.80/GJ broadly establishes a biogas upgrading target of $2-3/GJ based on conventional anaerobic digestion (organic diversion) and gas collection (landfill) costs. Using publicly available information, the current biomethane upgrading cost for demonstration projects in Australia is likely to be around $20-25/GJ[2].
- Industry may need to develop a technical plan that will set how the target can be achieved.



1. ARENA 2021, *Australia's Bioenergy Roadmap,* ENEA Consulting and Deloitte, Canberra
2. Estimates based on $14.2m capex for 100TJ p.a. of biomethane upgrading. Assumes long-run-marginal-cost analysis over a 20 years period and a 10% discount rate

Delivering the target

Using information gathered from the FFCRC literature and based on Helmont's biogas upgrading experience, the following practical measures are examples of how a biogas upgrading cost target of $2-3/GJ could be achieved. Measures should be peer reviewed by industry members and subject matter experts.

1. Reduction of the minimum Wobbe Index from 46.0 MJ/m^3 to 45.0 MJ/m^3 – ***avoids the need for expensive (and fossil based) LPG to be blended upstream of the injection point.***
2. Increase of the O_2 limits from 0.2mol% to 1% - ***reduces cost and improves upgrading conversion efficiency.***
3. Increase the total inerts limit from 7% to 8.5% - ***allows a greater proportion of nitrogen to be injected. Nitrogen is very expensive to remove as it has similar properties as methane.***
4. Increase the available feedstocks available for incentives (and net-zero certification) – ***adds scale and reduces costs.***
5. Add new limits for constituents-of-concern that are applicable to biomethane – ***provides certainty and avoids unnecessary clean-up costs.***
6. Support in-pipe blending of biomethane, taking into consideration the gas spec delivered to the first user downstream of the injection point – ***materially reduces gas clean-up costs for smaller projects and increases the participation rate***
7. Undertake a risk-based approach to upgrading and injection, consistent with a pipelines safety case – ***reduces the need to measure contaminants that are impossible to make their way into the biomethane stream***
8. Encourage an injection standard that supports mature technologies that could be applied in Australia, including cost-effective water wash or chemical scrubbing solutions that have been implemented throughout Europe ***– reduces complexity and encourages supply chain participation from international providers***