



INQUIRY INTO THE DEVELOPMENT OF A HYDROGEN INDUSTRY IN NEW SOUTH WALES SUBMISSION

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1. Introduction

Thank you for the opportunity to make a submission to the Legislative Council's *Inquiry into the Development of a Hydrogen Industry in New South Wales*. We commend the Standing Committee on State Development for their commitment to consider the opportunity presented by a hydrogen sector in the state and warmly welcome this timely inquiry.

Southern Green Gas is a renewable energy company pioneering world-first technology aimed at creating carbon-neutral fuels; **renewable methane and renewable methanol**.

Our technology has been recognised by ARENA who are supporting our first demonstration project at the Wallumbilla gas hub in Queensland. This project will be realised through our partnership with natural gas transmission company, APA Group, and will jointly allow us to showcase the role of renewable methane as an enabler of the hydrogen economy in a real-world setting.

The commitment of ARENA and APA Group provides an endorsement of Southern Green Gas' technology and our strategic approach to the role of renewable fuels in contributing to Australia's hydrogen future.

Specifically, through the production of renewable methane, we will create a scalable pathway to carbon neutral natural gas which has the potential to create **a major new export market for renewable LNG and a means to transport hydrogen globally**.

As the most effective hydrogen carrier, renewable methane presents an enormous opportunity for Australia to reach its objectives, namely to be a top three supplier of hydrogen into Asian markets by 2030, to realise the first technology stretch target - "H2 under 2" and the NSW target of up to 10% hydrogen in the gas networks by 2030 should this be extended to renewable methane.

To reiterate, to facilitate the opportunity presented by hydrogen whilst maximising the use of existing infrastructure, it can be converted to renewable methane.

Additionally, our technology delivers "firm" renewables with the potential to fuel existing gas fired power stations and despatch renewable electricity on demand thereby **creating a pathway to 100% renewables in the electricity sector**.

Our technology comprises process modules which will be aggregated in the thousands and will create major production projects in Australia utilising advanced manufacturing. It is anticipated the market opportunity for the technology would support world scale manufacturing.

NSW is a priority jurisdiction for Southern Green Gas where we are currently investigating both demonstration project and manufacturing opportunities. We are also partnering with two NSW universities on the development of our core technologies; University of Sydney and University of Newcastle.

We look forward to supporting the NSW Legislative Council in its inquiry to realise the state's transition to a low emissions future through hydrogen and its derivatives, including renewable methane.

2. About Southern Green Gas

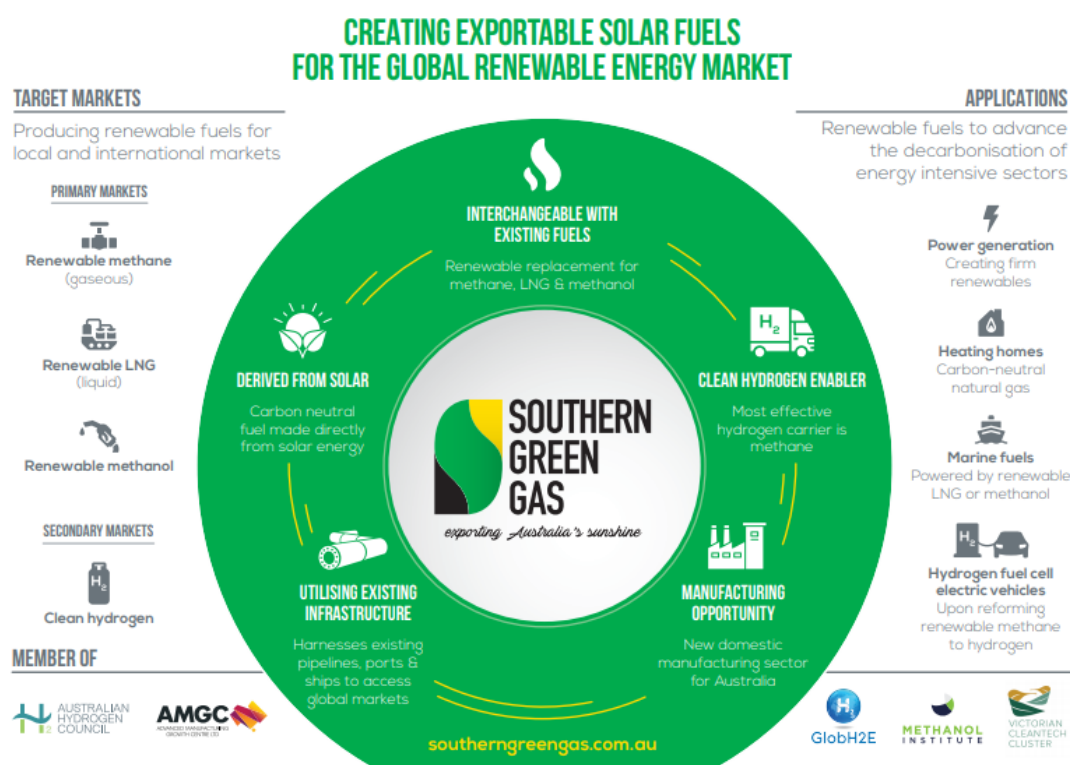
Founded in 2018, Southern Green Gas is a renewable energy company established to commercialise carbon neutral fuels.

Through Australian and international R&D, we have developed a package of proprietary processing technologies that extract water vapour and CO₂ from the atmosphere, use solar

energy to produce hydrogen, and combine hydrogen and CO₂ to form renewable methane gas or methanol liquid.

This technology creates an opportunity to produce carbon neutral fuels that utilise Australia’s existing pipeline infrastructure and play a role in a wide range of domestic and international sectors including power generation, residential and commercial heat, and transport (see figure 1 below)

Figure 1: Southern Green gas – Company overview



The key benefits of our technology are as follows:

- **Delivering carbon neutral fuels through existing infrastructure.** Renewable methane, being interchangeable with natural gas, can utilise existing infrastructure (gas pipelines, gas power stations, LNG export facilities) and therefore maximise the utilisation of these investments and avoid stranded assets.
- **Achieving cost parity with fossil fuels.** Our goal is to reach “8 by 28”, that is \$8/GJ by 2028. At this price, renewable methane would compete with natural gas in Eastern Australia. By 2028, significant shortfalls in gas supply to Eastern Australia are predicted – renewable methane could avert this decline. Further, meeting this cost target also supports achievement of “H2 under 2”.
- **Creating a major new export industry.** Renewable methane, via the LNG network, can supply into the existing mandated renewable electricity markets in Japan, Korea, Singapore, Germany and UK. As an ideal hydrogen carrier, renewable methane also presents a viable pathway for Australia to reach its objective to be a top three supplier of hydrogen into Asian markets by 2030.
- **Delivering firm renewables.** As hydrogen storage is included in our production process, the technology delivers “firm” renewables. That is, renewable methane can fuel existing gas

fired power stations and despatch renewable electricity as the demand requires, creating the pathway to 100% renewables in the electricity sector.

- **Creating new manufacturing capability based on smart jobs and advanced manufacturing processes.** Historically, Australian manufacture has been sub-world scale, however given the growing demand for carbon neutral fuels, it is anticipated the manufacture of our process modules to produce these fuels in Australia would be world scale (comparable to Tesla gigafactories).
- **Substantially increasing business investment and employment growth in regional areas.** Renewable fuels generation projects and associated manufacturing will be based in regional Australia with specific opportunities identified in regional NSW that are currently being pursued.

2.1 Technology overview

Through a modular, scalable approach we have developed a technology package capable of producing methane sustainably, solely from renewable sources.

Southern Green Gas has partnered with two NSW based universities - the University of Newcastle and the University of Sydney - to develop the technologies that underpin other renewable fuels production process.

The University of Newcastle has recently completed development of a water harvester technology which extracts water directly from the atmosphere to input into the hydrogen generation process – further details [here](#). The technology has also been supported by the Office of NSW Chief Scientist & Engineer.

The University of Sydney is developing our innovative CO₂ extraction technology which is currently in testing phase.

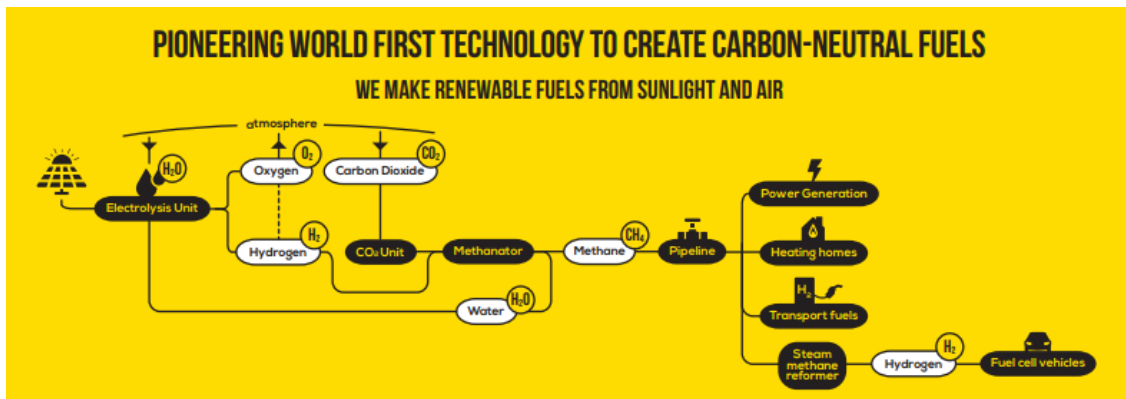
Commercialisation of this technology will occur through world scale projects in regional Australia taking advantage of the co-location of the following:

- World class solar resource
- Abundant low-cost flat land
- Major gas pipeline infrastructure

Each project will comprise thousands of process modules coupled to solar PV panels, with each module's methane production aggregated and injected into Australia's existing gas pipeline system.

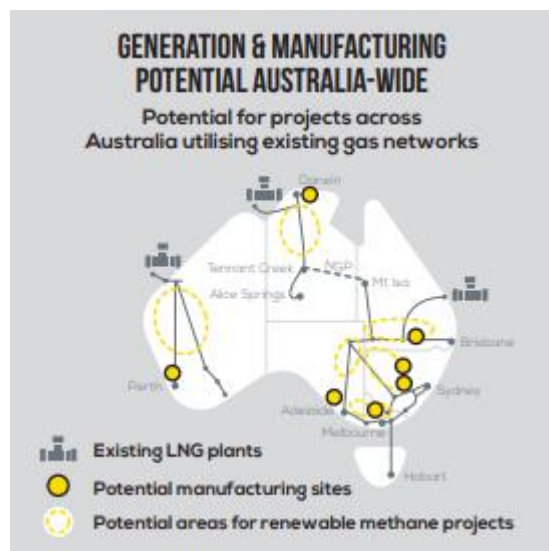
The CO₂ released at the point of use is completely offset by the CO₂ extracted from the air during production **ensuring carbon neutrality**. The process, outlined at Figure 2, is therefore completely sustainable.

Figure 2: Renewable methane creation process



Our technology is designed to be sited alongside existing gas transmission pipelines with potential areas for deployment shown at Figure 3. As Australia’s largest gas transmission operator, it is intended that our partnership with APA Group will enable this roll out nationally to a significant degree.

Figure 3: Potential areas for renewable methane generation projects and manufacturing facilities



2.2 The market for renewable methane

Hydrogen is the lightest gas and storage is considerably more costly than liquid fossil fuels. Methane is however a highly efficient hydrogen carrier with several benefits as enabler of the hydrogen economy, including:

- Interchangeable with natural gas, therefore uses existing infrastructure
- 33% hydrogen when reformed, versus 17% for ammonia and 6% for methylcyclohexane
- No new infrastructure to build
- Cost and speed-to-market advantage

Renewable methane therefore presents a carbon neutral pathway to grow the hydrogen economy without new pipeline investment and with a speed-to-market advantage. It is therefore an attractive option for the natural gas transition and .

Renewable methane can be used in a number of renewable fuel applications, including generation of electricity from existing gas-fired power stations, heating homes, fuelling

compressed natural gas (CNG) vehicles and fuel cell electric vehicles (upon reforming back into hydrogen).

Our initial target markets are those with government mandated renewable electricity goals, namely Japan and Korea, that have set renewable electricity targets of 22-24% and 20% by 2030 respectively. This is equivalent to twice the total electricity demand in Australia.

Both countries are lagging in their achievement of these targets (Japan – 5%; Korea – 18%), due mainly to the high cost of indigenous renewables. In Japan alone, to supply the unmet portion of the renewable electricity target would require investment of up to \$50 billion in renewable methane facilities.

Marine is another emerging market for carbon neutral fuels. With phasing out of high sulphur fuels as the IMO introduces emissions targets, LNG is actively being considered as a replacement bunker fuel which presents scope for the introduction of renewable methane.

2.4 Southern Green Gas business model

As a technology company we will be supported by partnerships with gas transmission operators, such as through our relationship with APA Group and international trading houses to facilitate renewable methane supply to Asia.

Local manufacture is central to our business model. We are actively pursuing relationships with major industrial companies to establish a new suite of manufacturing businesses in Australia that will directly contribute to the Australian national imperative to expand domestic engineering and manufacturing capability post COVID-19 and generate opportunities for smart jobs.

Cost reduction will be achieved by economies of manufacture, similar to photovoltaics with an initial production target of one million modules per annum. NSW has been identified as a priority state for our first manufacturing facility and we are currently in talks with the NSW Government regarding this opportunity.

2.5 Wallumbilla demonstration project

Through our partnership with the APA Group and financial support from ARENA, the Wallumbilla Renewable Methane Demonstration Project will demonstrate the technical and commercial viability of renewable methane production.

Commencing in 2021 and operating over a 12-month period, the project will be located at APA's Wallumbilla major gas hub in southern Queensland and see the deployment of a renewable methane module generating gases for use on site.

The validation of the technology will provide the foundation we require to scale, including securing additional investment, gas supply partnerships and manufacturing facilities, which are highly likely to be based in NSW given the growing conduciveness of the state to clean energy projects.

3. Southern Green Gas response to Inquiry terms of reference

a) The size of the economic and employment opportunity created by the development of a hydrogen industry in NSW, in particular those opportunities for regional NSW

According to the Hydrogen Council, the hydrogen sector is forecast to be a \$2.5 trillion global marketplace in the year 2050. NSW, with its competitive strengths in natural resources, infrastructure, skills and trading relationships, is well placed to benefit from this

emerging industry, however it must consider how to leverage its key advantages against potential competitors, both domestically and overseas.

A clear pathway to capitalise upon the opportunity presented by the global trade in hydrogen in advance of competitors is to pursue a strategy that leverages the state's existing infrastructure and supply chains, most notably via the gas pipeline and shipping networks. Hydrogen, with its high diffusivity, presents challenges in relation to transport and storage whereas a hydrogen derivative, such as renewable methane can be handled in the same way as natural gas and utilise existing value chains.

Renewable methane must also be produced in areas with flat land, abundant solar and within proximity to gas pipeline infrastructure for transport purposes and therefore is highly suited to production in regional locations. It therefore presents a pathway to guaranteed regional jobs, investment and manufacturing in in NSW.

b) The State's existing hydrogen capabilities

Southern Green Gas is proud to have partnered with two NSW universities for the development of our technology – University of Sydney and University of Newcastle. The innovative approach of both institutions as well as their appetite for industry collaboration has enabled us to co-develop leading edge technologies that will be critical to the development of the renewable methane sector in Australia.

We strongly urge the NSW Government to continue its support for the state's R&D sector, but also its investment in STEM, particularly in regional areas. Not only will this facilitate the development of the future skills the hydrogen industry will require to scale but will also bring about local community support for low carbon industrial investments in regions, such as those Southern Green Gas is currently investigating in NSW.

We foresee significant economic benefit derived by regional NSW communities in the shift towards global supply chains based on the movement of clean energy originating in their geography.

Our business footprint as an example is regionally focused with production projects and manufacturing facilities to be located in regional areas of the country yet connected to the world through existing land and sea-based infrastructure. This model will allow us to tap into local skill sets and build capability as needed as we meet our objective of deploying one million plus renewable methane production modules across Australia, with a significant number in NSW.

c) The capacity of and barriers to NSW becoming a major production, storage and export hub for hydrogen

NSW has a significant opportunity before it to participate in the accelerating global hydrogen sector, however the state's current hydrogen production and storage presence is minimal and would require sizeable public and private investment to build the infrastructure required for an export scale industry.

As noted above, to capitalise upon the hydrogen opportunity while minimising investment, NSW should be exploring hydrogen derivatives, like ammonia and renewable methane, which already have pre-existing supply chains in place and can be exported worldwide today without the need to develop new value chains, such as those required for liquid hydrogen.

Renewable methane in particular will also ensure the longevity of Australia's LNG trade, albeit in a sustainable way, and presents an opportunity to decarbonise the sector with minimal disruption.

d) The economics of hydrogen's use in different sectors of the economy, including emerging opportunities to use hydrogen in industrial processes and as a feedstock

According to the Hydrogen Council, long-distance and heavy-duty transportation, industrial heating and heavy industry feedstock present the most near-term attractive pathways for hydrogen's use from an economic perspective. Given the need for the sector to transition to a commercialisation pathway to reach scale, it is recommended NSW focus on these applications as a priority, to serve both domestic and international markets (through export).

In pursuing these opportunities, NSW should initially focus on building a sustainable production base of hydrogen and its derivatives throughout the state from renewable energy. Potential hydrogen trading partners are, to a significant degree, signalling their preference for renewable hydrogen which NSW must be cognisant of in developing any hydrogen strategy.

Secondly, NSW must identify the pathways to create or transition existing export supply chains to hydrogen or its derivatives. At present, NSW does not have a clear strategy in place for export sector development, however it is critical that a long-term roadmap be designed that has corresponding government support in place to enable these supply chains to come to fruition (further detail below).

Southern Green Gas also urges NSW to consider hydrogen derivatives as part of, including fully quantifying the benefit of renewable methane as a pathway to participating in the hydrogen economy as a more immediate opportunity than hydrogen in its pure form.

e) The infrastructure, technology, skills, workforce capabilities and other things needed to realise the economic opportunities of hydrogen as and when it becomes commercial in different sectors of the economy

As Southern Green Gas commences our first demonstration project, which will go into operation in 2021 and will see renewable methane injected into Australian gas transmission infrastructure for the first time, we are actively considering opportunities for our second demonstration project and first manufacturing facility. NSW is a priority state for both activities given its supportive government environment for clean energy projects.

However, to maintain the state's competitive advantage in attracting clean energy project investment it is critical NSW continues to build its skills and capabilities in this area, particularly in regional areas. Southern Green Gas' business model, for example, is dependent upon sourcing relevant technical skills in regional areas and therefore skills availability is critical to our success.

From an infrastructure perspective, renewable methane is unique, in that it is one of few clean gases that can be transported through existing gas pipelines. We therefore encourage NSW to not pursue the electrification pathway as the sole strategy for the state's decarbonisation objectives, but instead develop a strategy for an orderly transition away from natural gas by leveraging existing infrastructure through renewable methane.

f) The actions needed of the public and private sectors, to support the development of a hydrogen industry in NSW and to realise the associated economic opportunities, including actions to manage any safety risks in the hydrogen industry

To support the development of the NSW hydrogen industry, Southern Green Gas recommends governments, both current and future, pursue the following actions:

- Extend the current target of up to 10% hydrogen in gas pipelines by 2030 to include renewable methane (this will facilitate greater ease in meeting the target while achieving the same decarbonisation objective)
- Provide preferential land access for clean energy projects participating in the NSW hydrogen sector – both energy generation and manufacturing projects
- Provide co-investment for demonstration projects and manufacturing facilities to stimulate private investment in NSW
- Implement arrangements for the NSW Government to be a first offtaker of renewable gases, such as renewable methane, for supply to government infrastructure to enable market development
- Develop a dedicated hydrogen strategy for NSW that thoroughly considers and provides appropriate support for the pathway to grow the hydrogen derivative sector, notably renewable methane
- Provide dedicated support for hydrogen startups to connect with potential investors and offtakers both locally and overseas

From a private sector perspective, in our own experience as a startup in Australia, venture capital opportunities are limited relative to other markets. One significant investment avenue which should be unlocked for technology commercialisation is Australian superannuation funds. With a value of approximately A\$1.9 trillion, these funds could be an attractive vehicle directed towards scaling emerging clean technologies.¹

g) The potential for jobs in New South Wales, both directly in the hydrogen industry and in other industries powered by hydrogen

We believe an enormous opportunity exists for NSW to prioritise the establishment of a renewable methane sector in the state with the benefits of domestic fuel security and creating a new manufacturing sector based on clean technologies all while laying the foundation to establish a future export sector for renewable LNG.

In an environment with growing demand for cleaner energy sources, Australia's dependency on fossil fuel commodities presents a growing risk. Many of its traditional markets are already moving towards a requirement for Australian energy commodities and manufactured products to be based on carbon neutral energy inputs.

On this basis, Southern Green Gas encourages NSW to incorporate in any hydrogen focused strategy the need to transition existing workforces to jobs of the future in the clean energy sector and approaches that have been developed globally to do so effectively.

¹ Austrade, "Australia has the fourth largest pension fund assets in the world", *austrade.gov.au*, 22 February 2019, <https://www.austrade.gov.au/news/economic-analysis/australia-has-the-fourth-largest-pension-fund-assets-in-the-world> (accessed 16 June 2020)