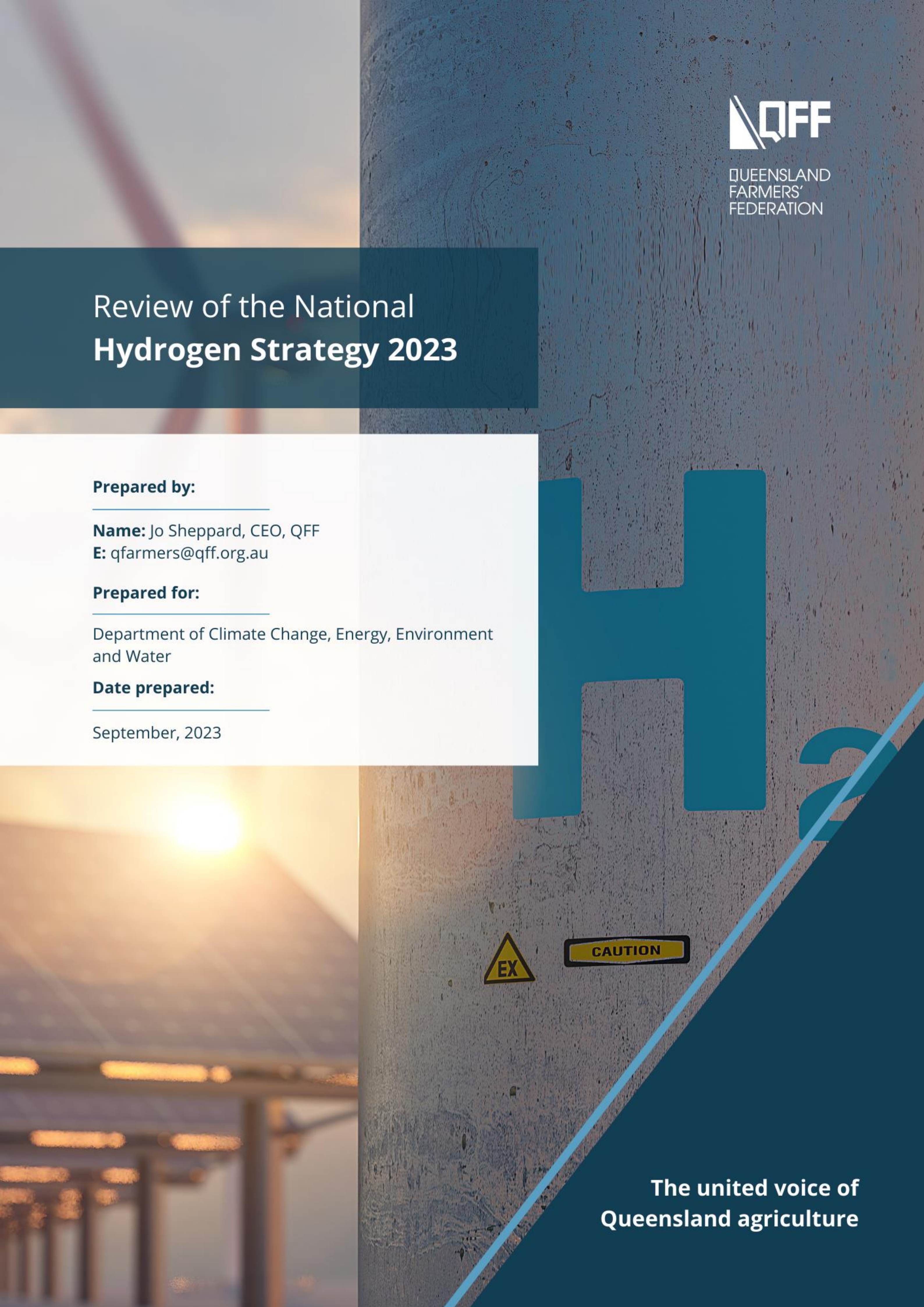

QUEENSLAND FARMERS' FEDERATION

Review of the National **Hydrogen Strategy 2023**

Prepared by:

Name: Jo Sheppard, CEO, QFF
E: qfarmers@qff.org.au

Prepared for:

Department of Climate Change, Energy, Environment and Water

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The united voice of Queensland agriculture

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This submission is provided to:

Department of Climate Change, Energy, the Environment and Water
Net Zero Industries Division, National Hydrogen Strategy Review
GPO Box 3090
CANBERRA ACT 2601

Submitted via email: hydrogen@dcceew.gov.au

Our members

- Canegrowers
- Cotton Australia
- Queensland Fruit & Vegetable Growers
- Nursery & Garden Industry Queensland
- eastAUSmilk
- Australian Cane Farmers Association
- Queensland United Egg Producers
- Turf Queensland
- Queensland Chicken Meat Council
- Pork Queensland
- Bundaberg Regional Irrigators Group
- Burdekin River Irrigation Area
- Central Downs Irrigators Ltd
- Fairburn Irrigation Network
- Mallawa Irrigation
- Pioneer Valley Water Co-operative Ltd
- Theodore Water Pty Ltd
- Eton Irrigation
- Queensland Oyster Growers Association
- Lockyer Water Users Forum

About the Queensland Farmers' Federation

The Queensland Farmers' Federation (QFF) is the united voice of agriculture in Queensland.

We are a member-based organisation representing the interests of peak agriculture industry organisations (both state and national). Through our members, QFF represents more than 13,000 primary producers across the cotton, cane, horticulture, dairy, nursery and garden, poultry, pork, and intensive animal industries.

We unite the sector to engage in a broad range of economic, social, environmental, and regional issues through advocacy, policy development, and project activity. We work with the government of the day on behalf of industry, farmers, and the community to provide powerful representation and contribution to the policy direction, sustainability, and future growth of Queensland's agriculture sector.

Our Council of member representatives and policy committees set the strategic priorities for policy development and advocacy, while our Executive Board ensures our corporate governance.

QFF draws on the expertise and industry knowledge of our members, and through our commitment to collaboration and considered policy development, we lead Queensland's agriculture sector towards a strong future, ensuring our members are ahead of the game and have a voice at the table on the issues that matter to their members.

Review of the National Hydrogen Strategy 2023

QFF welcomes the opportunity to provide comment on the National Hydrogen Strategy Review, Consultation Paper (July, 2023). We provide this submission without prejudice to any additional submission from our members or individual farmers.

Background

Australia's first National Strategy was endorsed by all Australian Governments and published in 2019. There were a series of actions that were identified, however will take a cohesive approach between all governments, as the actions identified will not be enough to be fulfilled, however are a step forward in creating a clear framework for implementing actions, and what is needed to help develop production and support required for the agricultural sector.

Australia is noted to be on the path to be a global hydrogen leader by 2030. Enabling domestic decarbonisation through the development of the hydrogen industry, and helping to ensure economic benefit for all Australians, but not adversely impacting the agricultural sector through the development of the hydrogen industry.[1]

[1] Commonwealth of Australia. Australian Government, Department of Climate Change, Energy, and Environment and Water. National Hydrogen Strategy Review, Consultation Paper. July 2023.

Overview Summary

QFF note the key areas that we wish to address in this submission are detailed below and can be summarised as:

- How can Australia enable decarbonisation through the development of a clean hydrogen industry?
- How could Australia further activate its hydrogen and related industries?
- How can we ensure our hydrogen industry attracts the necessary investments?
- How can we ensure our hydrogen industry develops in a way that benefits all Australians?
- How should we develop the necessary infrastructure needed to support the development of our hydrogen industry?
- How can we enable a hydrogen export industry (including the export of goods manufactured with hydrogen)?

Enabling decarbonisation of the agricultural sector through a clean hydrogen industry

Queensland agriculture's connection with the potential of renewable energy sources (RES) is emblematic of the evolving nexus between food security and sustainable energy. Agricultural production demands significant amounts of energy, primarily for machinery, irrigation, and fertiliser production. The increasing challenges of remaining profitable as a result of rising energy prices and reliability issues have resulted in agribusinesses increasingly implementing efficiency measures, and off-grid or alternative energy solutions in an attempt to gain control over energy price hikes. While on-farm energy sources have traditionally been sourced from fossil fuels, as the urgency to transition to cleaner and cheaper energy intensifies, hydrogen gas (H_2), when produced via methods like electrolysis for instance, emerges as another alternative.

H_2 as an energy carrier will become a critical component of the global decarbonisation trend. H_2 has the highest energy density of any fuels, two to three times more efficient than that of diesel or unleaded petrol.[2] H_2 is also easier to store and transport than electricity and can facilitate the decarbonisation of 'hard-to-abate' sectors. Currently, the most economically viable method to produce H_2 ("grey H_2") at scale involves the use of fossil-based fuels as a feedstock in a process called 'steam methane reforming'.[3] However, the grey H_2 production process leads to excess carbon dioxide that may be difficult to mitigate even by sequestering the greenhouse gas emissions ("blue H_2"); the environmental benefits of reduction in emissions for H_2 at this point of use are negated.[4] As a result,

[2] Mcwhorter, S., Read, C., Ordaz, G., Stetson, N. (2011) Materials-based hydrogen storage: attributes for near-term, early market PEM fuel cells. *Current Opinion in Solid State Materials Science* 15(2) 29–38.
[3] Álvarez-Murillo, A., Ledesma, B., Román, S., Sabio, E., Gañán, J. (2015) Biomass Pyrolysis Toward Hydrocarbonization: Influence on Subsequent Steam Gasification Processes. *Journal of Analytical and Applied Pyrolysis,* 113(May):380–389; Parkinson, B., Tabatabaei, M., Upham, D.C., Ballinger, B., Greig, C., Smart, S., & McFarland, E. (2018). Hydrogen production using methane: Techno-economics of decarbonizing fuels and chemicals. *International Journal of Hydrogen Energy*, 43(5), 2540–2555.
[4] Arreola-Vargas, J., González-Álvarez, V., Corona Gonzalez, R.I., MéndezAcosta, H.O. (2016) Mexican center for innovation in bioenergy view project succinic acid production by *Actinobacillus succinogenes* view project.

grey or blue H_2 should not be seen as the long-term answer for a decarbonised energy and industrial system.

For modern agriculture to fully embrace international sustainability trends, the future H_2 market has to be fully decarbonised, and coordination and investments in H_2 produced from electrolysis using RES ("green H_2") will be required to achieve that. Its renewable-nature, capability for energy storage, and potential for on-farm production, among other features, positions green H_2 as a viable energy source to augment or even replace traditional on-farm energy use.[5] Green H_2 is, in effect, carbon-free electricity stored in molecular form. For Queensland, a state dependant on its agricultural sector and with an abundance of RES potential, this transition could mean a myriad of changes. Integrating green H_2 production within modern agricultural practices would not only decrease the sector's carbon footprint but also bolster its resilience against fluctuating energy prices, making the food production chain more sustainable and economically viable. A paradigm shift of this magnitude requires an in-depth analysis of the substantial environmental, technical, social, and economic repercussions of green H_2 on Queensland's agricultural industry. While the appeal of green H_2 as a sustainable future fuel should be embraced, it cannot supersede the pivotal role of food production in Queensland. The Australian Government's support for H_2 industry projects needs to focus on making downstream application more affordable, not just incentivising upstream production. Therefore, it is imperative that the updated National Hydrogen Strategy establish the extent and cost of the feasibility and implications of switching capable agribusinesses and regional areas to a green H_2 energy economy.

What sectors are best placed to be early adopters of hydrogen?

The highest value uses of green H_2 are likely to be in sectors where processes are otherwise hard to electrify (and emissions therefore hard to abate). The potential for green H_2 as a sustainable on-farm energy source is rapidly gaining traction, and it may not be long before this becomes both an affordable and practical option for the agricultural sector. One avenue for H_2 integration in farming is through utilisation of on-farm solar systems. These systems could be designed to produce H_2 using an electrolyser, particularly during periods when they are not powering essential farm machinery or equipment and pumps. For instance, during downtime when irrigation systems are idle or when there is no option to export excess electricity back to the grid, the generated solar energy can be directed to produce H_2. This stored H_2 can then be used as a backup energy source, ensuring that agribusinesses have a consistent energy supply. Moreover, the agricultural sector has a vast fleet of vehicles and generators that have potential for H_2 conversion. By transitioning farm vehicles, machinery and generators to fuel cells that utilise on-farm H_2 production, agribusinesses could drastically reduce their carbon footprint and reliance on fossil fuels. This not only forms a more sustainable farming operation but also could result in significant cost savings in the long run, especially if the price of H_2 becomes cost competitive.

[5] International Renewable Energy Agency (IRENA) (2022). *Geopolitics of the Energy Transformation: The Hydrogen Factor*. January, Abu Dhabi, ISBN 978-92-9260-370-0.

What barriers may limit hydrogen uptake and what actions are required to overcome these barriers and realise opportunities?

H_2 compatible vehicles, machinery and equipment

The innovation and technologies that Queensland agribusinesses seek, will require some degree of coordination across a wide variety of industry participants to ensure the synchronised trial and delivery of new types of H_2 compatible vehicles and equipment. Any implementation trials should be at zero cost for agribusinesses willing to participate and post-trial support (i.e., operation maintenance) must be provided. The pilot programs should consider coverage of a broad range of agricultural activities and seek to attract the deployment of equipment, technologies, and H_2 supply chains to fit with established infrastructure and early merging of demand from producers, as well as workforce and skills availability. Agribusinesses will likely assess whether the affordability and utility of the new H_2 technology is acceptable with respect to established infrastructure in areas such as refuelling and maintenance.

It is important to note that the long asset life of farm machinery, especially mobile machinery, means any new technology that replaces old equipment, such as H_2 fuel cells, will take a long time to propagate through the national farm fleet in Australia. As most farm equipment is imported, predominately from major US or European manufacturers, government engagement is crucial to explore their development plans and timelines, as Australia does not dictate their technology advancements. Current participants and potential new entrants throughout the fuel and vehicle provision value chains will need to assess the potential impact on their existing activities and whether the risk and uncertainties and entry and exit costs for new activities are sufficiently manageable to warrant participation. The Australian government must examine macrolevel impacts, decide whether intervention is necessary to stimulate or regulate new market segments and attempt to steer the economies. Substantial funding needs to be integrated into this area for the agricultural sector, to be able to fulfill its requirements in reducing emissions.

H2 supply chain constraints

The successful adoption of H_2 technologies into farming hinges on the seamless functioning of the supply chain, from the base material in an electrolyser to end-user application. It is important that H_2 production and market priorities set by government also accommodate and value the supply chain issues and opportunities available. Current constraints, such as the limited availability of key materials like nickel or iridium, manufacturing bottlenecks, and challenges in H_2 transportation and storage, pose tangible hurdles. However, these challenges present opportunities for innovation and collaboration. Proactive stimulus of commercial participation in new value chains for support infrastructure (such as recharging/refuelling stations) is required, particularly in parts of those chains requiring substantive capital investment with long-term payback times. By investing in research to identify alternative materials, incentivising the expansion of manufacturing capacities, and fostering the development of specialised infrastructure for H_2 storage and conveyance, Australia can overcome these obstacles.

Other contingencies

Appropriate regulatory measures need to be put in place to protect producers and facilitate the establishment of a domestic market for H_2. It is also crucial to develop contingencies for situations of market failure to ensure the industry's resilience. Immediate issues, as well as short-term and long-term impacts, should be thoroughly assessed. For instance, how H_2 might affect vehicles or equipment, or whether it's more viable to replace machinery rather than convert existing ones for H_2 compatibility. Additionally, the availability of H_2 needs to be considered to avoid supply disruptions. The development of comprehensive disaster management plans could help minimise potential adverse effects of extreme weather events or other unexpected challenges on H_2 production and distribution. Bridging the workforce skill gap through targeted training programs and creating standardised equipment designs will simplify the adoption process for agribusinesses. Addressing regional disparities through localised distribution hubs and emphasising domestic production can further stabilise the H_2 supply chain, reducing dependence on volatile international markets. Above all, a commitment to rigorous safety and quality standards ensures the sustainability and reliability of the H_2 on-farm transition.

How can we ensure Australia's hydrogen industry develops in a way that benefits all Australians?

Regional water security must be prioritised

Electrolysis, the primary method for generating green H_2, involves the decomposition of high purity water – both demineralised and deionised – into its elemental constituents, gaseous H_2 and oxygen, when exposed to an electric current derived from RES.[6] While conceptually simple, the magnitude of water consumption in this process warrants scrutiny. Large-scale production already reveals that the generation of a single kilogram of green H_2 through electrolysis requires approximately 9 litres of water.[7] The National Hydrogen Strategy envisions its H_2 production at a daily production rate of 100,000 kilograms, meaning the water demand approximates are a staggering 900,000 litres each day. In this context, there will be a continuous demand for water in the near and long-term from green H_2 production. Because industrial H_2 production will depend on guaranteed water availability, a key consideration will be how to manage the available water supplies in a sustainable manner so that it does not exacerbate existing regional water stresses.[8] Amalgamating these concerns with the impacts of climate change on agriculture and water required for water security, these figures beg the question if they are in fact sustainable?

The agricultural sector in Queensland, underpinned by irrigators, the grazing industry, intensive agriculture, and regional town communities, is inextricably linked to water availability and reliability. Irrigation systems, livestock sustenance, and even metabolic processes of plants hinge on a stable

[6] Harvey, L. D. Danny. (2010) Energy and the New Reality 2. *Carbon-Free Energy Supply.* Taylor & Francis Group. pp. 430-35.
[7] See National Hydrogen Strategy.
[8] Bergman, N. and Johnstone, E. (2021). 'Water access for hydrogen projects: Don't let your options dry up', *Insights*, Allens Linklaters, 25 October. URL: allens.com.au/insights-news/insights/2021/10/Water-access-for-hydrogen-projects/.

and adequate water supply. As such, any disruption in prevailing conditions can lead to not only declines in crop yield and livestock health but also exacerbate economic inequalities for farming communities.[9] Given this context, it is imperative to critically evaluate the allocation of water entitlements, particularly in regions like Queensland where water resource scarcity is expected to intensify as the impacts of climate change intensify– characterised by longer and intense precipitation and longer and more intense drought conditions. When evaluating water sources for H_2 production, it is crucial to consider farmers and regional households in areas with limited rural water allocations.[10] Shifting this demand for water can generate a range of economic, social, and environmental impacts and can thus present equity and socio-economic concerns, especially when the water is used to provide H_2 for export to other countries. The potential for this displacement highlights the need for better economic modelling to help understand the socio-economic impacts of allocating water to a H_2 project.

Intentional siting of H2 production

Despite the potential of green H_2 as a sustainable energy source, its adaptation within an Australian context remains in its early phases. Policy considerations should incorporate a holistic environmental and economic evaluation of the availability of regional resources. Intentional siting of green H_2 projects in Queensland can be a way to prevent putting added pressure on our water systems. As part of the approval process, it is crucial to evaluate the water supply both locally and downstream in areas like the Fitzroy Basin and Burdekin River. Factors like competing water demands and rights should be considered to ensure that the projects are not set up in areas that cannot meet future water requirements. Adherence to Queensland's water policies is paramount. A strategic approach might involve establishing green H_2 facilities where coal mines have been retired, like those in the Bowen Basin, or where water-intensive industries once stood. This could mean maintaining water allocation continuity at the community level. Queensland might need to reconsider its water pricing strategies to reflect the true value of water given its scarcity. In all project planning within Queensland, the availability of water in that specific region, be it the Pioneer Valley or the Murray-Darling Basin, needs to be considered. The strategies discussed for project location, system configuration, and water sourcing can significantly reduce the potential water footprint of green H_2 at the community level.

Utilising alternative water sources

As extensively outlined above, the retention of water is a pressing issue for Queensland farmers; one that would seemingly trump the production of an *additional* clean energy technology, such as green H_2. As a result, requirements such as resource abundance and availability should be taken into consideration when choosing potential feedstocks for green H_2 production. Given volume of water required for H_2 production, it is vital to evaluate the possibilities of fresh, desalinated, and reclaimed

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[9] Feitz, A.J., Tenthorey, E., Coghlan, R. (2019) Prospective hydrogen production regions of Australia. Record 2019/15. Geoscience Australia, Canberra, pp. 34-35.
[10] Ashworth, P., Witt, K., Ferguson, M., & S. Sehic (2019) *Developing Community Trust in Hydrogen*. University of Queensland: Brisbane.

water as feedstocks for electrolysis.[11] The water quality and any necessary pretreatment for H_2 production or other purposes should also be assessed. For instance, water that is not fit for H_2 production without treatment might be apt for irrigation. Ensuring water availability is a significant concern for regional communities, especially in areas vulnerable to drought. The significance of diverting alternative water sources for green H_2 production cannot be understated and should be seen as an attractive solution in addressing existing stresses of regional water availability.[12] By channelling alternative water sources for green H_2 production, Australia can ensure that agricultural practices remain insulated from unpredictable weather patterns, thereby safeguarding food security.

Green ammonia and domestic fertiliser production

Ammonia-based fertilisers, such as urea and ammonium nitrate, are vital to the global food chain. Australia currently imports about 95 per cent of our urea, making Queensland farmers vulnerable to rising fertiliser prices due to geopolitical tensions and supply chain disruptions. Using domestic green H_2 for ammonia can reduce Australia's import dependency, improve food security, and lower emissions from fertiliser production. The Asian Renewable Energy Hub in Western Australia highlights Australia's recognition of the benefits of using green H_2 for ammonia production. This transition aligns with global sustainability standards and has potential to safeguard the agricultural sector from external market fluctuations.

By supporting green H_2 and ammonia infrastructure, governments can cultivate a stronger and more sustainable agricultural future. Queensland farmers can gain significantly by the production of green H_2 and ammonia fertilisers locally, reducing dependency on foreign exports and ensuring stability against global prices and energy issues. This shift would position Australia to control pricing, considering reduced shipping costs. The government needs to ensure domestic fertiliser production capacity meets the uptake requirements of Queensland's farmers as a priority. Collaboration among the fertiliser industry, farmers, and governments is vital for this transition and for the protection of food and water security for Australia.

Bioeconomy opportunities

With an increasing need to focus on waste management systems and the environmental effects of fossil fuels, anaerobic digestion for the production of green H_2 offers an alternative energy source that can both mitigate the release of greenhouse gasses and facilitate waste management. Anaerobic digestion is a series of biochemical reactions that involves the microbial breakdown of organic material in an oxygen-deprived environment, leading to the conversion of methane and carbon dioxide, or biogas.[13] The most popular and practical application of biogas currently is to clean it up, convert it to pipeline quality, and inject it into the natural gas pipeline, where it can be sold as

[11] Khan, M. A., Al-Attas, T., Roy, S., Rahman, M. M., Ghaffour, N., Thangadurai, V., ... & Kibria, M. G. (2021) Seawater electrolysis for hydrogen production: a solution looking for a problem?. *Energy & Environmental Science,* 14(9), 4831-4839.
[12] Feitz, A.J., Tenthorey, E., Coghlan, R. (2019) Prospective hydrogen production regions of Australia. Record 2019/15. Geoscience Australia, Canberra, pp. 34-35.
[13] Appels, L., Baeyens, J., Degrève, J., & Dewil, R. (2008) Principles and potential of the anaerobic digestion of waste-activated sludge. *Progress in Energy and Combustion Science*, 34(6), 755-781; EPA (2020) Basic information about anaerobic digestion (AD), *anaerobic digestion (AD).* US EPA.

‘renewable natural gas’.[14] However, the potential uses of biogas extend beyond renewable natural gas; it also holds the potential to be converted into green H_2. Through a process called biogas reforming, the methane content in biogas can be separated and transformed into H_2, which can be safely applied in fuel cells and clean energy systems.[15] This conversion process not only maximises the energy value of biogas but also provides a sustainable pathway to produce green H_2. Recent findings have even suggested that it is possible to maximise H_2 production and limit methane through various processes of influent pretreatment and control of operating conditions, making anaerobic digestion a source for green H_2.[16]

As Australia transitions away from its dependency on a fossil fuel-based economy into a RES system, the bioeconomy emerges as a critical component under a broader circular economy. This transition presents a significant opportunity for the agricultural industry to evolve from the traditional take, make, use, and dispose strategy of a linear economy into a circular economy via the cascading use of agricultural waste streams.[17] Traditionally generating vast amounts of waste from crop (i.e., cotton, grain and cane) and livestock production (i.e., dairy, poultry and cattle), the agricultural industry now sees potential in repurposing this ‘waste’. As this waste can be processed to produce H_2 gas, it can then be used in various applications around the farm. For instance, H_2 derived from animal wastes can be employed for heating systems, a crucial requirement for many livestock operations. Additionally, the produced H_2 can also be fed into fuel cells to generate electricity, providing a clean and reliable power source for essential systems like lighting and ventilation in farm buildings. Such innovations not only help in waste management but also turn them into potential energy sources, highlighting the multifaceted benefits of integrating H_2 technology into farming.[18]

The integration of anaerobic digestion systems into the energy mix offers agribusinesses a dual benefit. On one hand, they achieve efficient waste management, and on the other, they generate an additional revenue stream.[19] This circular economy approach leads to significant reductions in greenhouse gas emissions across the agricultural value chain, further bolstering Australia’s path towards a sustainable future.[20] The National Hydrogen Strategy should embed incentives, motivating agribusinesses towards anaerobic digestion. Investments in research, infrastructure, and outreach can optimise the anaerobic digestion process, facilitate biogas transport, and foster awareness of the potential of H_2 produced via anaerobic digestion. Crucially, a robust regulatory framework ensures biogas quality, while market mechanisms like certification or guarantee of origin schemes highlight green H_2 distinction from relevant counterparts. By coupling the updated National Hydrogen Strategy and policies with stakeholder collaboration across the agricultural, energy, and research sectors, Australia can not only steward their environmental commitments but also spur economic growth through diversified revenue streams and job opportunities for the agricultural sector.

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[14] Wilkie, A. (2005) Anaerobic Digestion: Biology and Benefits. *Dairy Manure Management: Treatment, Handling, and Community Relations.* NRAES-176. Cornell University, Ithaca, NY, pp 63–72.
[15] Kim, S., Choi, K., Kim, J.O., Chung, J. (2013) Biological Hydrogen Production by Anaerobic Digestion of Food Waste and Sewage Sludge Treated Using Various Pretreatment Technologies. *Biodegradation* 24(6):753–764.
[16] Zappi, A., Hernandez, R., Holmes, W.E. (2021) A Review of Hydrogen Production from Anaerobic Digestion. *International Journal of Environmental Science and Technology* 18:4075-4090.
[17] Ellen MacArthur Foundation (2015) *Towards a circular economy: Business rationale for an accelerated transition*.
[18] See Office of Resource Recovery, Department of Environment and Science (2021) ‘Energy from Waste Policy’ report.
[19] Harvey, L. D. Danny. (2010) Energy and the New Reality 2. *Carbon-Free Energy Supply.* Taylor & Francis Group. pp. 429-30.
[20] Scarlat, N., Motola, V., Dallemand, J. F., Monforti-Ferrario, F., & Mofor, L. (2015). Evaluation of energy potential of Municipal Solid Waste from African urban areas. *Renewable and Sustainable Energy Reviews*, 50, 1269-1286.

Prioritisation of domestic needs

Recent trends suggest a concerning increase in energy costs for agribusiness production. For Queensland's agriculture to sustain growth, accessible and affordable energy is vital. As Australia leans towards RES there's a crucial need for better power system adaptability. The Australian Energy Market Commission stated, "Electrolysers can ramp up and down quickly... they can offer several services of value to the grid... Hydrogen can also fulfil a locational role in relation to the provision of a number of these services." [21] This adaptability can minimise RES wastage, stabilise market rates, and make renewable investments more appealing in regional Queensland.[22] As H_2 production for export scales up, Australia should leverage that advantage by building domestic supply and use in industry, heavy transport, and grid firming; ensuring that there is no hindrance to domestic electricity due to competition for resources; no surge in domestic energy prices; and that H_2 production ensures a decrease in overall energy system expenses.

Domestic reservation policies

It is imperative that the Australian government develop a H_2 reservation policy, safeguarding future industrial uses of H_2 from domestic shortfalls during global energy shocks to meet its goals. Such a mechanism should be designed in a way that ensures energy security, affordability, and accessibility, but does not stifle investments in domestic production. Implementing a domestic H_2 reservation policy could be instrumental in helping farmers' transition to H_2-based solutions. The *Fuel Security Act 2021* provides a legislative framework for the Australian government to establish a national fuel reserve through an industry minimum stockholding obligation. At present, entities engaged in specific activities, primarily those related to the refining or importing of certain fuels (i.e., diesel and petrol), may find themselves subject to the minimum stockholding obligation.

The establishment of a consistent, domestic H_2 stock baseline would instil confidence in agribusinesses seeking to adopt H_2. It would offer a safety net against potential supply disruptions, which in turn encourages investment in H_2 infrastructure, vehicles, and production. With a H_2 reserve strategically distributed throughout various locations in Queensland, the advantage of reaching users more rapidly in the event of localised disruptions is achievable. A commitment to a H_2 reserve not only ensures fuel security but would also stimulate production and uptake growth within the H_2 industry. By modernising the *Fuel Security Act 2021* and including a guaranteed supply of H_2 through a domestic reservation mechanism, farmers can confidently invest in H_2-powered infrastructure, knowing that they won't face supply disruptions. A stable domestic H_2 market could lead to reduced energy costs for the agricultural sector in the long run.

Infrastructure costs

[21] AEMC. Hydrogen: the role of the hydrogen production industry in providing system services to the NEM. May 2022.
[22] Flexibility Resources Task Force (2022) Increasing Electric Power System Flexibility: The Role of Industrial Electrification and Green Hydrogen Production, *Reston, VA:Energy Systems Integration Group.*

Distributing clean H_2 via gas pipelines is believed to be technically viable.[23] This method is under testing in the UK and hinted at by H_2 blending experiments in Australia. Nonetheless, it's a costly way to reduce carbon emissions,[24] demanding coordination to switch network segments to H_2 and update consumers' appliances concurrently. Public discussion has not adequately addressed the financial obligations of new energy assets or strategies for managing existing infrastructure costs. This oversight poses the threat of H_2 assets lacking proper funding. Currently, there is a growing sentiment that costs from major electricity and gas infrastructure projects, which have burdened agribusinesses due to cost pass-through, will persist in consumer energy bills. The updated National Hydrogen Strategy needs to be coordinated with energy regulating bodies like the AER to ensure any H_2 policies do not adversely impact the agriculture sector by increasing energy bills for agribusinesses. Clear market signals on assets marked for future H_2 activities and understanding H_2's effect on traditional energy and consumer asset value and growth are crucial.

What are the trade-offs (or synergies) of developing a hydrogen industry with other government goals?

Australia has not had fuels incorporated in any national 'renewable' targets, which to date have been exclusively renewable electricity targets. Mandatory targets are essential for stimulating investment towards more sustainable liquid fuels. For green H_2 to obtain a market in Australia there will need to be a functioning market based on existing technology. Once the market has been established on the basis of the new parameters of carbon saving and sustainability, and there is predictable consumer demand, the private sector will be incentivised to invest in H_2 innovation.

Both energy accessibility and sustainable agriculture are crucial to the development of Australia. Governments at both a federal and state levels have important roles in the investment and scale-up of this facilitation. They can make sure that regulatory requirements can be fulfilled without undue delays, and they can help facilitate industry growth through spatial and infrastructure planning. Governments also have a role in creating and implementing certification schemes, allowing H_2 producers to demonstrate that their H_2 has zero or very low emissions. These certification schemes would be based on benchmarked international sustainability instruments, such as the United Nations' Sustainable Development Goals, notably those related to water-use efficiency (Goal 6) and sustainable energy (Goal 7).[25] European countries are already preparing to subsidise initial deliveries of green H_2 through competitive tender and contract-for-difference arrangements. Getting ahead of the game in this context would provide competitive advantage for Queensland farmers in penetrating high-value domestic and international markets.

[23] Net Zero Australia et. al. (2023) How to make net zero happen: mobilisation report. July 2023.
[24] International Energy Agency, 2022, Global Hydrogen Review.
[25] UN General Assembly, Transforming our world: the 2030 Agenda for Sustainable Development, 21 October 2015, A/RES/70/1.

Summary

Identifying these challenges and leveraging the opportunity to employ green H_2 into the future of Australia's energy mix can help ensure food security while enabling resilient agricultural value chains.

It is vital that the National Hydrogen Strategy seeks to address supply chain constraints, infrastructure, ammonia-based fertiliser supply, alternative water sources, and bioeconomy opportunities, while ensuring the continued supply of energy required by farmers, to safeguard the economic viability of Queensland agriculture.

If you have any queries about this submission, please do not hesitate to contact Ms Sharon McIntosh at sharon@qff.org.au.

Yours sincerely

Jo Sheppard

Chief Executive Officer

Queensland Farmers' Federation

This submission if provided by the Queensland Farmers' Federation

PO Box 12009 George Street, Brisbane Qld 4003
Level 8, 183 North Quay, Brisbane Qld 4000
ABN 44 055 764 488

Contact QFF

E: qfarmers@qff.org.au
P: 07 3837 4720
W: www.qff.org.au

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