Hydrogen from abundant
low-cost reliable Tasmanian
renewable energy

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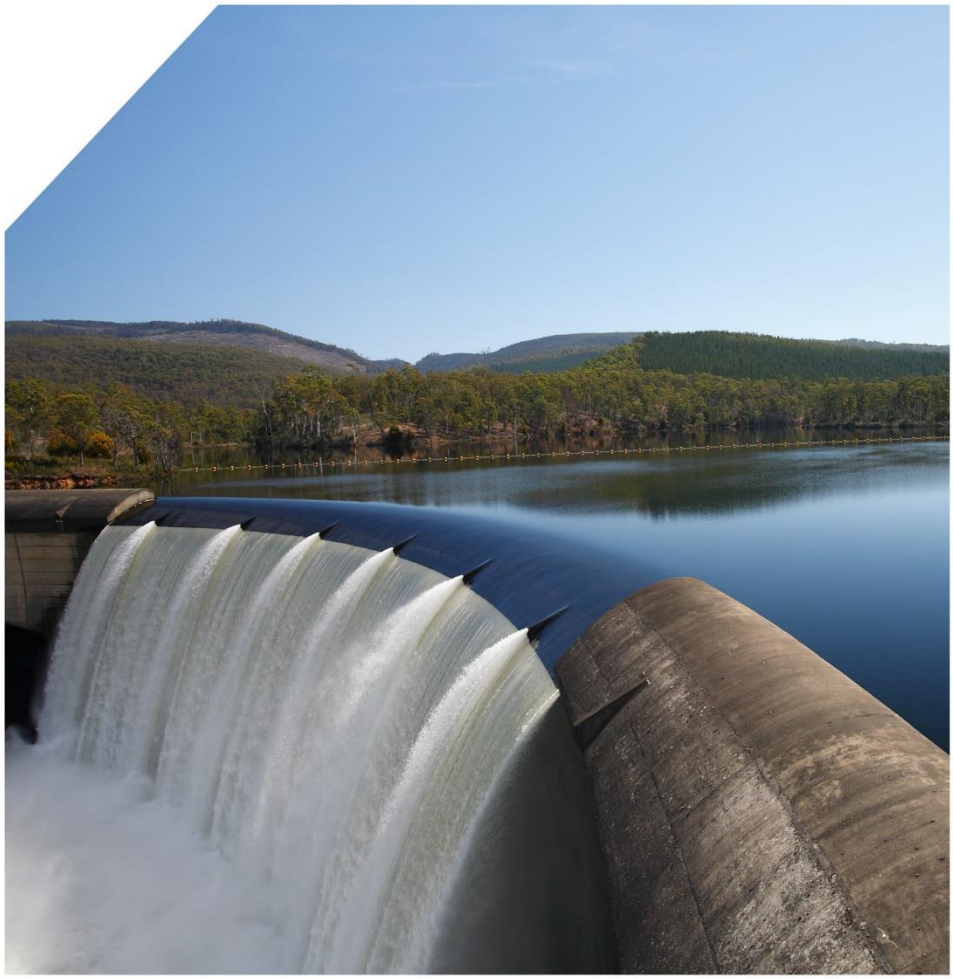
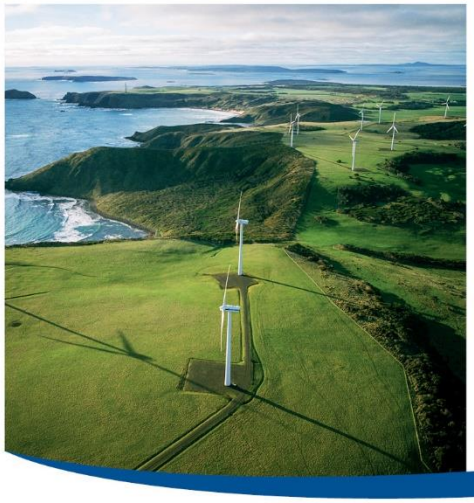
Tasmanian Renewable Hydrogen Action Plan





Department of State Growth

Tasmanian Government

Ministerial foreword

The global supply and use of energy is dramatically shifting as countries are now looking to cleaner, renewable forms of energy in order to decarbonise their economies. The use of hydrogen, produced from renewable energy, is emerging as a means of achieving these goals.

Tasmania is ideally positioned to play its part in this transition. Tasmania has a proud 100 year history of hydro-industrialisation which has established our presence as the renewable energy state of Australia. Indeed, the overwhelming majority of our electricity is generated from our substantial hydro resources, as well as a significant contribution from our world-class wind resources.

We have a large number of wind generation projects under construction, or being planned, and are on-track to be self-sufficient in renewables by 2022. Tasmania will be the first state in Australia, and among an elite few locations globally, with 100 per cent renewable power generation. There is also significant opportunity to expand on our existing renewable energy capacity, with 8 700 megawatts of wind power, and 3 400 megawatts of pumped-hydro potential available in Tasmania, identified through Hydro Tasmania's Battery of the Nation analysis.

Access to low cost and reliable Tasmanian renewable energy makes us the perfect location for renewable 'green hydrogen' production, for export and for use in Tasmania. Importantly, with our existing renewable energy, this can commence now.

The firming capability of Tasmania's Government-owned hydro power, combined with our world-class wind resource, provides us with a key advantage in being able to produce renewable hydrogen at low cost. Indeed analysis indicates renewable hydrogen production costs could be 10 to 15 per cent lower in Tasmania than from other Australian power grids and 20 to 30 per cent lower than from dedicated off-grid variable renewables.

Tasmania also has high quality industrial precincts, including the Bell Bay Advanced Manufacturing Zone, with access to deep-water ports, strong transmission infrastructure, significant water availability and road and rail infrastructure to enable renewable hydrogen production, straight from our electricity grid. It is clear that Tasmania is the perfect location for a renewable hydrogen industry, for export and for local use, with capacity for gigawatt scale production over the longer term.

This draft Tasmanian Renewable Hydrogen Action Plan articulates the Government's vision and a suite of actions to develop a renewable hydrogen industry in Tasmania. Our Plan will benefit investors through access to low cost hydrogen production, and will benefit Tasmanians through job creation and economic growth, particularly in regional areas.

The Tasmanian Government is establishing a comprehensive package of measures, including a Tasmanian Renewable Hydrogen Fund, to support the development of a renewable hydrogen industry in the state. Details on the Tasmanian Government's support measures will be provided with the final Tasmanian Renewable Hydrogen Action Plan. We welcome the opportunity to share our vision, and encourage you to engage with our draft Tasmanian Renewable Hydrogen Action Plan.

Hon Guy Barnett MP

Minister for Energy

Contents

Tasmanian renewable hydrogen

The factors to realise a global hydrogen economy are starting to emerge, and Tasmania is well placed to be at the forefront of this new industry.

Why hydrogen?

As the global push to decarbonise gathers pace, low carbon sources of energy will become increasingly important to achieve sustainability objectives. With no carbon emissions when produced from renewable energy, hydrogen is recognised as an important enabler for the transition to a global clean energy system.

Why now?

The potential of renewable hydrogen as a clean and flexible energy carrier has been recognised for many years, however the economic and technological challenges associated with creating a hydrogen economy have only recently started to be overcome.

With declining costs of renewable energy and hydrogen technology, and emerging export markets, the factors required to develop a global renewable hydrogen sector are starting to be realised.

Why Tasmania?

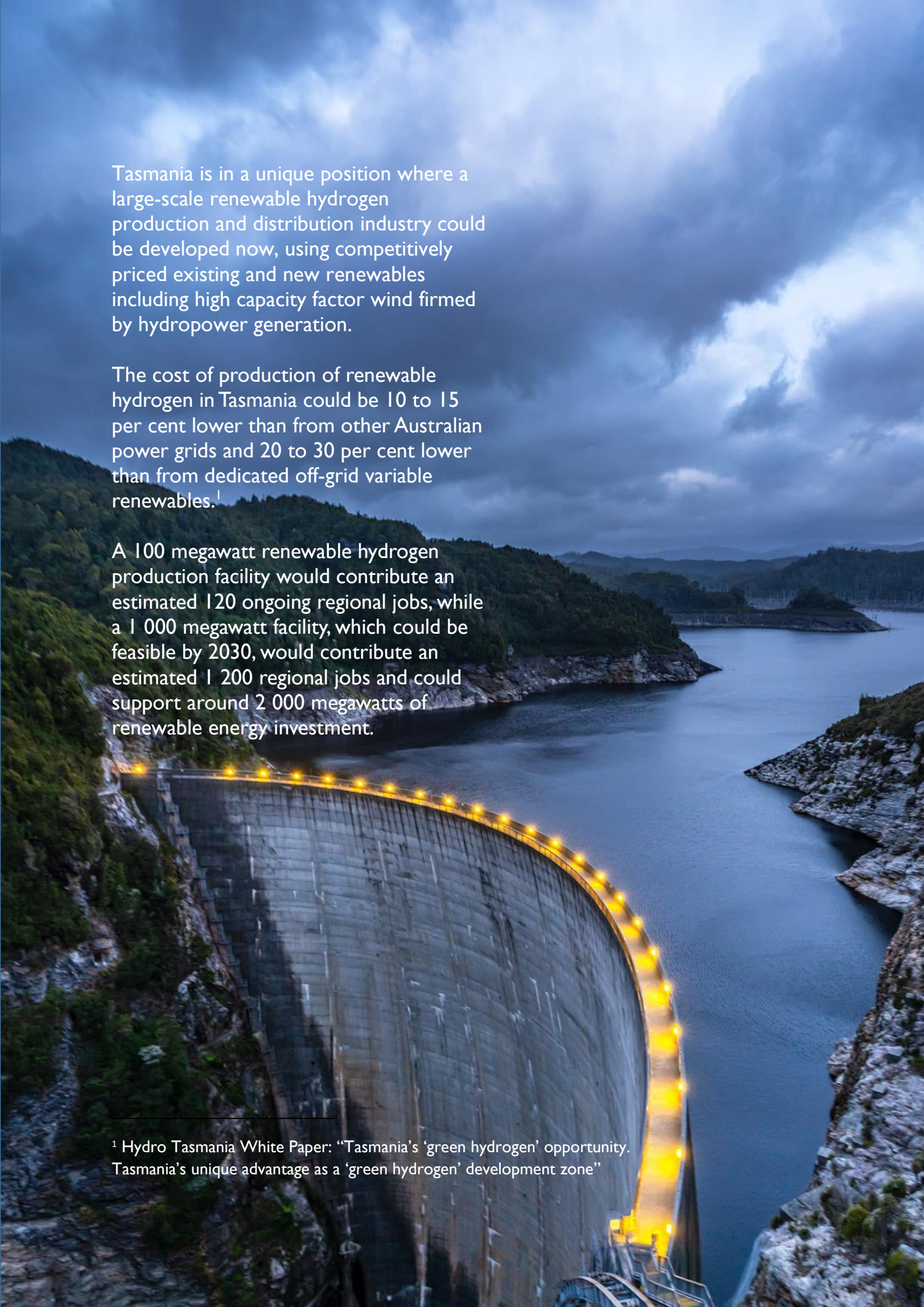
Tasmania is in a unique position to take advantage of the global momentum behind hydrogen. With its abundant renewable energy and water resources, Tasmania is well positioned to capitalise on this new global industry.

The Tasmanian Government is actively preparing for this exciting opportunity in recognition that Tasmania's strengths make it an ideal location for the development of renewable hydrogen projects.

Importantly, our mix of established renewable generation can enable a renewable hydrogen industry much sooner, and likely at lower cost, than can be achieved in other Australian states.

Tasmania's key competitive advantages include:

- high renewable energy contribution from low cost reliable hydropower and wind
- access to abundant fresh water
- industrial precincts with available land and access to high quality infrastructure.



Tasmania is in a unique position where a large-scale renewable hydrogen production and distribution industry could be developed now, using competitively priced existing and new renewables including high capacity factor wind firmed by hydropower generation.

The cost of production of renewable hydrogen in Tasmania could be 10 to 15 per cent lower than from other Australian power grids and 20 to 30 per cent lower than from dedicated off-grid variable renewables.[1]

A 100 megawatt renewable hydrogen production facility would contribute an estimated 120 ongoing regional jobs, while a 1 000 megawatt facility, which could be feasible by 2030, would contribute an estimated 1 200 regional jobs and could support around 2 000 megawatts of renewable energy investment.

[1] Hydro Tasmania White Paper: "Tasmania's 'green hydrogen' opportunity. Tasmania's unique advantage as a 'green hydrogen' development zone"

Vision and goals

Vision

Tasmania will use our existing and expandable renewable energy and water resources to become a leader in large-scale renewable hydrogen production. By 2030 we will be a significant global supplier of renewable hydrogen for export and domestic use.

Goals

By 2022

- Tasmania has commenced production of renewable hydrogen.
- Locally produced renewable hydrogen is being used in Tasmania.
- Export based renewable hydrogen production projects are well advanced.

By 2025

- Tasmania has commenced export of renewable hydrogen.

By 2030

- Tasmania is a significant global producer and exporter of renewable hydrogen.
- Locally produced renewable hydrogen is a significant form of energy used in Tasmania.

The emerging hydrogen opportunity

Hydrogen: a highly versatile fuel

Hydrogen – element number one in the periodic table – is the lightest, smallest and most abundant element in the universe. As an atom, it consists of one proton and one electron. As a molecule (H_2), it is a colourless, odourless, non-toxic gas. It is a highly versatile fuel that is carbon free when produced from renewable energy.

Hydrogen is an excellent carrier of energy and can be used in a broad range of energy applications, including as a fuel for transportation, as a substitute for natural gas, and for electricity generation. It can also be used as a feedstock in a range of industrial applications.

However, hydrogen does not naturally occur in a useful energy form. It needs to be produced from substances containing hydrogen, such as water.

Renewable energy can be used to electrolyse water to produce hydrogen and oxygen. Hydrogen produced in this way is commonly termed renewable hydrogen or 'green hydrogen', and has no carbon emissions associated with its production or use.

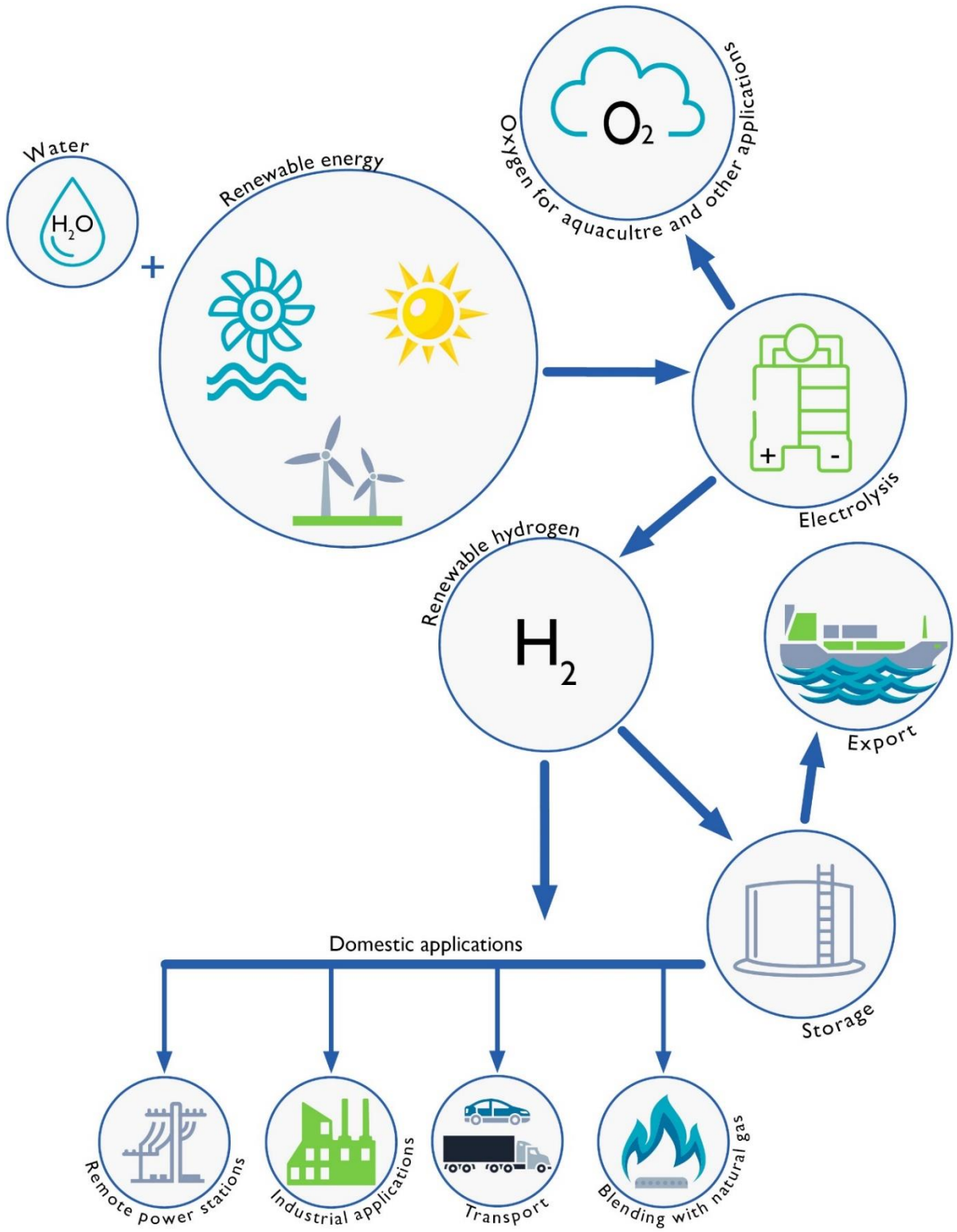
Tasmania is ideally placed for the production of renewable hydrogen using its abundant renewable energy and fresh clean water.

The combination of being an emissions free and versatile fuel makes renewable hydrogen an attractive energy carrier.

Renewable hydrogen can be produced, distributed, and used locally in a range of applications or exported to international markets. Developing international supply chains to move hydrogen in bulk quantities is actively being investigated with the aim to effectively and safely transport hydrogen worldwide. Options include transport by ship as liquefied hydrogen, or in other hydrogen carrying forms such as ammonia (NH_3) or liquid organic hydrogen carriers.

While the costs of hydrogen production and distribution are currently relatively high compared with other fuels, these costs are expected to fall significantly as production scale increases and with further technology development.

Tasmanian renewable hydrogen production and potential end uses



Global demand

Renewable hydrogen is projected to be an increasingly significant energy carrier as countries seek to decarbonise their economies, and global demand is projected to increase.

Conservative estimates suggest that global demand for hydrogen for energy is likely to exceed eight million tonnes by 2030, and about 35 million tonnes by 2040.[2]

Countries such as Japan and South Korea have given clear indications that they will need to import significant quantities of emissions free hydrogen as they transition their economies, as a substitute for fossil fuel products for energy and transport purposes. For example, Japan's hydrogen strategy indicates that it expects to import 300 000 tonnes by 2030 and potentially five to 10 million tonnes per year in the long term.[3] The Korean hydrogen roadmap indicates a requirement for over five million tonnes of hydrogen per year by 2040, with South Korea aiming to produce 6.2 million hydrogen cars for domestic use and export, and build 1 200 refuelling stations by 2040.[4]

This presents a significant opportunity for Australia, and in particular Tasmania given its key renewable hydrogen production advantages. Analysis by ACIL Allen projects the value of Australia's low-emission hydrogen exports could amount to $2.2 billion by 2030 and $5.7 billion by 2040.[5]

[2] Opportunities for Australia from Hydrogen Exports, ACIL Allen Consulting for ARENA, 2018, page iii, under its medium projected global demand scenario at https://arena.gov.au/assets/2018/08/opportunities-for-australia-from-hydrogen-exports.pdf.

[3] Basic Hydrogen Strategy (Key Points), Ministry of Economy, Trade and Industry at https://www.meti.go.jp/english/press/2017/pdf/1226_003a.pdf.

[4] Hydrogen Economy Plan in Korea, 18 January 2019 at https://www.rvo.nl/sites/default/files/2019/03/Hydrogen-economy-plan-in-Korea.pdf.

[5] Opportunities for Australia from Hydrogen Exports op. cit,, page v.

National Hydrogen Strategy

A National Hydrogen Strategy, led by Australia's Chief Scientist Dr Alan Finkel, is currently being developed under the auspices of the COAG Energy Council. The Tasmanian Minister for Energy is a member of the Energy Council and is strongly supportive of the National Strategy.

The Tasmanian Government and industry is actively participating in the development of the National Strategy, and will continue to work to implement the National Strategy Actions.

The National Strategy, through work carried out by Geoscience Australia, has identified Tasmania as having very high potential for renewable hydrogen production. This is due to: strong renewable energy resources dominated by existing hydropower and wind, abundant fresh water, and good access to existing infrastructure.

A focus of the National Strategy is the importance of developing hydrogen hubs to facilitate industry development, with the intent of developing hubs in areas that can most efficiently leverage existing infrastructure, have access to energy and water, and have the potential to aggregate demand for export and/or for domestic uses.

The Tasmanian Government is highly supportive of the hydrogen hub concept, and has a number of sites well suited to hydrogen hub development. In particular the Bell Bay Advanced Manufacturing Zone is ideally suited to large-scale production focussed on exports. Other potential sites include industrial precincts linked to ports in the north-west and at industrial precincts located at Brighton, Westbury and Longford, which are well suited to domestic applications.

A range of important actions will be implemented collaboratively by governments under the National Strategy, including enabling hydrogen industry growth through engaging with international markets, providing assistance to build demand and ensuring appropriate regulations and standards are in place. Enabling community benefits will also be a focus, through community education and confidence-building, and support for skills, training, research and development.

Crucially, the National Strategy will raise Australia's profile and potential as a key player in an emerging global hydrogen industry. This Action Plan complements the National Strategy, by identifying and facilitating Tasmania's unique renewable hydrogen industry development opportunities.

Tasmania's key advantages

Tasmania is uniquely placed to develop a competitive large-scale renewable hydrogen industry using its abundant existing and expandable world-class renewable wind energy firmed by hydro power, abundant fresh water, and access to industrial zones with high quality infrastructure.

Tasmania has several key competitive advantages for the development of a renewable hydrogen sector.

- Highly cost-competitive and reliable hydropower and wind generation, reflecting the world-class nature of Tasmania's renewable energy resources, with close to three gigawatts of installed renewable energy capacity.
- A very high renewable energy contribution (96 per cent in 2018)[6], with Tasmania on track to meet its target to be self-sufficient in renewables by 2022, making it the first state or territory in Australia with 100 per cent renewable power generation.[7] This is almost unique globally, and provides Tasmania with the capacity to develop a large-scale renewable hydrogen industry now.
- Feasible and abundant further renewable energy development potential, including approximately eight gigawatts of wind and multi gigawatts of pumped-hydro, which could support hydrogen production on a multi gigawatt scale over the longer term.
- The combination of wind power and capacity firming hydropower (and proposed future pumped-hydro schemes) that can provide a high electrolyser utilisation, compared to regions which have wind and solar generation, but limited firming of this variable renewable generation.[8]
- Tasmania has industrial precincts with available land and access to high quality infrastructure, notably the Bell Bay Advanced Manufacturing Zone which has existing and expandable port facilities, strong transmission infrastructure, and access to abundant fresh water.
- Access to a highly skilled and innovative workforce, supporting Tasmania's renewable energy and major industries, and world-class educational and research institutions including the Blue Economy Cooperative Research Centre led by the University of Tasmania.
- The comparatively small geographic size of Tasmania (relative to mainland Australia) means hydrogen infrastructure investment can be minimised while reaching the majority of the population. For example, a relatively small number of hydrogen refuelling stations would be required as part of an initial roll-out.

Together, these advantageous characteristics make Tasmania a highly attractive low cost location for a large-scale renewable hydrogen production industry providing economic and environmental benefits.

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[6] Clean Energy Australia Report 2019, Clean Energy Council at https://www.cleanenergycouncil.org.au/resources/resources-hub/clean-energy-australia-report.

[7] Self-sufficient on a net basis from renewable power generation located in Tasmania.

[8] The capacity firming ability of Tasmania's hydro power means that renewable energy is available when required.

1. Tasmania is a renewable energy powerhouse

Over the past 100 years Tasmania has built its economy around highly cost-competitive renewable energy, through Government-owned hydro power and network assets, with the existing power system supporting a range of energy intensive major industries across the state.[9] Tasmania's comparative advantages in renewable energy continue to provide a key platform for the development of major industries such as hydrogen.

Tasmania's existing electricity supply is dominated by hydropower, consisting of 30 power stations and more than 50 dams with a combined capacity of 2 283 MW.[10] Wind power is making an increasingly important contribution, with a total installed capacity of 564 MW once construction of the Cattle Hill and Granville Harbour wind farms is complete. The capacity of solar photo-voltaic power is also increasing in Tasmania, with approximately 135 MW currently installed.[11]

This substantial investment in renewable capacity is taking advantage of access to Tasmania's world-class renewable energy resources, which allows for highly cost competitive renewable energy production.

Tasmania generated 11 584 GWh of renewable energy in 2018, the highest of any Australian state or territory and represent 24 per cent of Australia's total renewable energy generation.[12] This is from a state with only two per cent of Australia's population. Tasmania is in the enviable position of already having a very high renewable energy contribution and is on track to be 100 per cent self-sufficient in renewable electricity production by 2022. [13]

The fully dispatchable (firm) nature of Tasmania's hydro generation can complement Tasmania's high capacity factor wind generation to provide renewable energy that is available when required. This allows for hydrogen production to be optimised with low energy price periods, and for high hydrogen production plant utilisation rates which can minimise the capital investment to achieve required production levels.

This unique combination of attributes allow for lower cost renewable hydrogen production, from highly cost-competitive Tasmanian renewable energy, relative to regions without significant emissions-free firming capacity to support their renewable energy generation.

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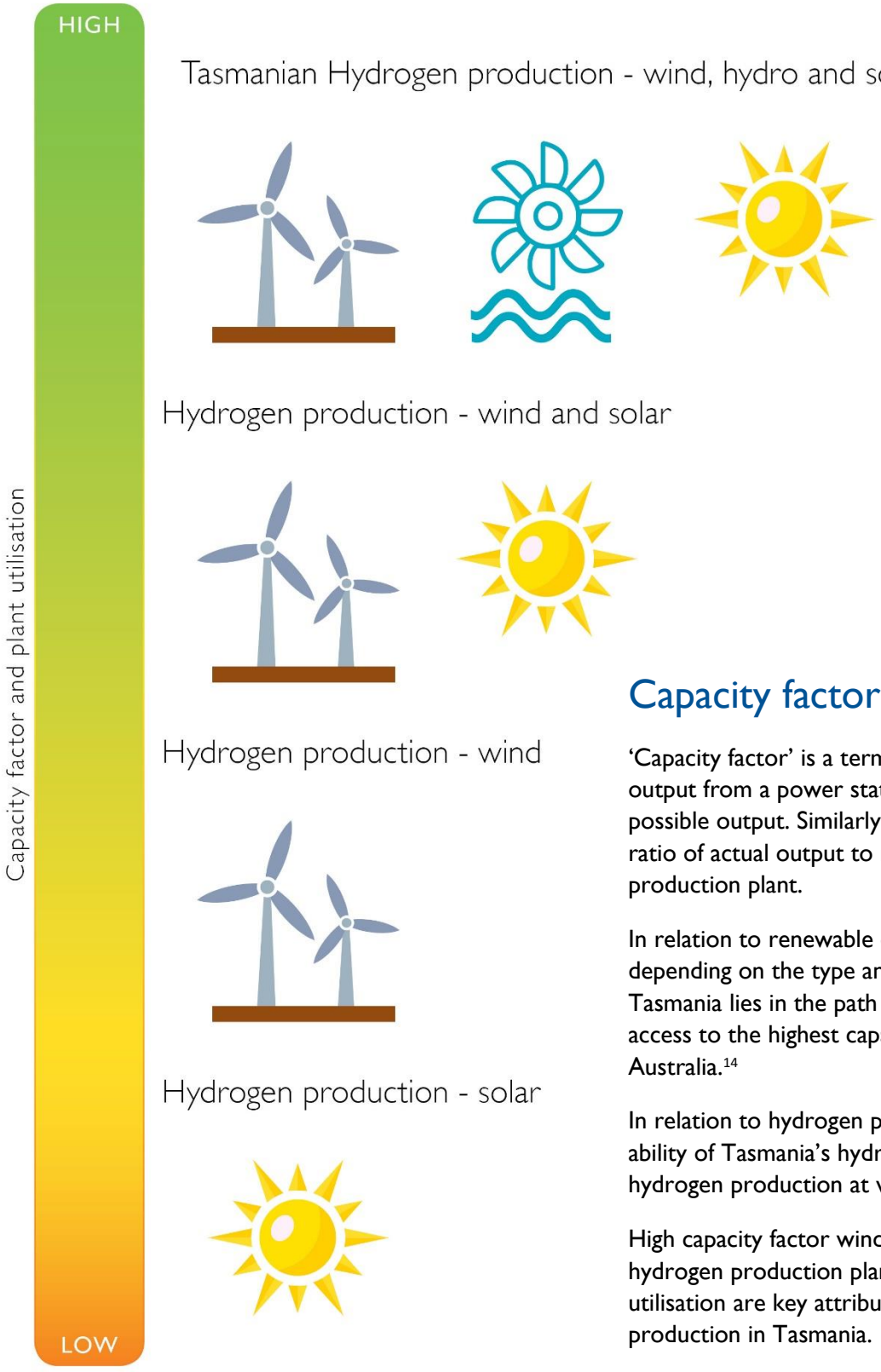
[9] Including energy intensive metals smelting and paper manufacturing industries.

[10] Hydro Tasmania 'The Next Generation of hydropower' Annual Report 2018 at https://www.hydro.com.au/about-us/our-governance/annual-report

[11] Clean Energy Australia Report 2019 op. cit, page 63.

[12] Ibid., page 10.

[13] 100 per cent self-sufficient on a net basis from renewable power generation located in Tasmania.



Capacity factor and plant utilisation

'Capacity factor' is a term that relates to the ratio of actual output from a power station relative to its maximum possible output. Similarly, 'plant utilisation' refers to the ratio of actual output to maximum possible output from a production plant.

In relation to renewable energy, capacity factors vary depending on the type and quality of the resource. Tasmania lies in the path of the Roaring Forties and has access to the highest capacity factor wind resources in Australia.[14]

In relation to hydrogen production plants, the firming ability of Tasmania's hydro generation allows for renewable hydrogen production at very high plant utilisation.

High capacity factor wind and the capability for renewable hydrogen production plants to operate at very high plant utilisation are key attributes for low cost hydrogen production in Tasmania.

[14] Tasmanian Energy Security Taskforce Interim Report, December 2016, Department of State Growth, page 77.

The critical determinants of overall hydrogen production costs are electricity prices and electrolyser utilisation. Tasmania's relatively low renewable energy prices and ability to support very high electrolyser utilisation translates to competitive costs of renewable hydrogen production.

Analysis indicates that Tasmanian renewable hydrogen production is likely to be 10 to 15 per cent more competitive than grid-connected supply in other parts of Australia which need to offset emissions, and 20 to 30 per cent more competitive than off-grid supply from dedicated new wind or solar supply due to relatively low electrolyser utilisation.[15]

Importantly, Tasmania's renewable energy capabilities for renewable hydrogen production already exist, as the hydro system is not capacity constrained and, in combination with new wind energy developments, could support significant additional load growth from large-scale hydrogen production.

In addition to substantial existing renewable energy generation, Tasmania has the potential to add significant new renewable energy infrastructure to support renewable hydrogen production. Analysis under the Battery of the Nation initiative indicates multi-gigawatt wind development is feasible with scope for substantial pumped-hydro capacity by 2040.[16]

The Australian Energy Market Operator has also identified that Tasmania has among the most promising Renewable Energy Zones for wind energy development in Australia, with zones in the north-west, north-east and central highlands regions.

Tasmania also has access to significant offshore renewable energy resources, including offshore wind, tidal and wave resources, which may become increasingly viable as the technologies to harness these resources further develop.[17]

Tasmania's combination of existing cost competitive reliable world-class hydro and wind energy, its unique ability to optimise hydrogen production through the firming capabilities of hydropower, and access to abundant additional renewable energy resources including pumped-hydro schemes, make Tasmania an ideal location for the development of a large-scale renewable hydrogen industry.

With future wind resource expansion Tasmania could be capable of multi-gigawatt renewable hydrogen production in the long term. A one gigawatt renewable hydrogen production facility, for example, could contribute approximately 10 per cent of the 1.3 million tonne Australian export potential identified by ACIL Allen by 2040.[18]

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[15] Hydro Tasmania White Paper: "Tasmania's 'green hydrogen' opportunity.Tasmania's unique advantage as a 'green hydrogen' development zone".

[16] Battery of the Nation Report, Hydro Tasmania at https://www.hydro.com.au/docs/default-source/clean-energy/battery-of-the-nation/future-state-nem-analysis-full-report.pdf.

[17] Perspectives on a way forward for ocean renewable energy in Australia. Renewable Energy, Hemer, M.A., R. Manasseh, K.L. McInnes, I. Penesis and T. Pitman (2018), vol 127, pages 733-745.

[18] Opportunities for Australia from Hydrogen Exports op. cit,, page v.

Battery of the Nation and Project Marinus

Tasmania's Battery of the Nation initiative and additional Bass Strait interconnection (through Project Marinus) are projected to play a vital role in ensuring a reliable and affordable National Electricity Market as it transitions away from one dominated by coal generation to a more diverse supply mix with increasing levels of variable renewable generation.

The Battery of the Nation initiative has identified around 3 400 MW of pumped-hydro energy storage and around 8 700 MW of wind power development is feasible, together with 400 MW of 'latent' capacity in the existing hydro system.

Investigations into Project Marinus have identified that up to 1 500 MW of additional interconnection from Tasmania to Victoria across Bass Strait by the mid-2020s may be feasible. This would unlock more low-cost, reliable and clean Tasmanian renewable energy for the benefit of the nation.

Feasibility studies have identified that Tasmania's total wind and hydro energy solutions are cost competitive against all other known solutions, including the cost of interconnection.

In addition to providing low-cost and reliable clean energy to support the National Electricity Market, the significant additional wind and pumped-hydro schemes identified through Battery of the Nation could support a gigawatt scale Tasmanian renewable hydrogen industry.

The development of a large-scale renewable hydrogen industry is complementary to Battery of the Nation and Project Marinus, reflecting the underlying strength of Tasmania's existing and expandable renewable energy resources. Initial analysis by TasNetworks indicates Project Marinus can co-exist with hydrogen industry development in Tasmania.

Hydro Tasmania has also indicated hydrogen industry development in Tasmania would be complementary to Battery of the Nation, particularly where these opportunities are developed in parallel, allowing revenue and risk diversification.[19]

[19] Submission to National Hydrogen Strategy Request for Information – Discussion paper, March 2019, Hydro Tasmania, at https://consult.industry.gov.au/national-hydrogen-strategy-taskforce/national-hydrogen-strategy-request-for-input/.

2. Access to abundant water

While Tasmania is less than one per cent of Australia's land area, it has 12 per cent of Australia's fresh water supply and 27 per cent of Australia's freshwater dam storage capacity.[20]

Access to clean fresh water is a critical element of hydrogen production. While desalination of sea water is possible, this adds to the costs of hydrogen production.

Renewable hydrogen production in Tasmania, even on a gigawatt scale, would only use a small fraction of the available fresh water and would not be expected to impact on other water users or environmental flows. For example, a 1 000 MW renewable hydrogen production facility would require up to an estimated 4 000 ML of water per year, equivalent to around one per cent of Tasmania's total fresh water consumption in 2016-17.[21] [22] Options for purification of wastewater could also be explored.

[20] Australian Water Resources Assessment 2012, Bureau of Meteorology, Tasmania at http://www.bom.gov.au/water/awra/2012/documents/tasmania-lr.pdf

[21] Australian Bureau of Statistics, 4610.0 – Water Account, Australia, 2016-17. Released 26/2/2019. https://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/4610.0Main%20Features32016-17?opendocument&tabname=Summary&prodno=4610.0&issue=2016-17&num=&view

[22] In 2016-17, Tasmania consumed 387 gigalitres of water, and 453 gigalitres in 2015-16. While a 1000 MW renewable hydrogen production facility could require up to four gigalitres of water per year, this is relatively low compared to total Tasmanian agricultural industry water consumption of 250 gigalitres in 2016-17.

3. Existing high quality supporting infrastructure

Tasmania has a number of industrial precincts with available land and access to high quality infrastructure, including access to electricity transmission, roads, rails and ports.

The Bell Bay Advanced Manufacturing Zone in particular is an ideal site for large-scale renewable hydrogen production for export. Key attributes include:

- existing strong transmission connection built for major industry
- deep all-weather port with scope for expansion
- access to abundant fresh water
- an established industrial precinct with available space for large-scale development.

Other strategic industrial precincts include Devonport, Burnie and Port Latta on the north-west coast of Tasmania which all have deep water port access and transmission connections, making these sites particularly suited to renewable hydrogen production for export.

Industrial precincts at Westbury and Brighton are situated close to strong electricity transmission and natural gas distribution connection points, and are strategically located on major Tasmanian transport corridors. These precincts are particularly well suited to renewable hydrogen production for domestic applications, such as for use in transport, for blending in natural gas distribution networks or as feedstock for agricultural products (such as ammonia for fertiliser).

Bell Bay Advanced Manufacturing Zone: an ideal hydrogen hub

The International Energy Agency (IEA) has identified developing hydrogen hubs as a cost-effective route to achieving scale within industry.[23] The facilitation of hydrogen hubs is a key focus of the National Hydrogen Strategy.

Hydrogen hubs are suitable regions in which there is existing infrastructure – such as powerlines, pipelines, roads, port infrastructure and railway lines – which can support economies of scale in producing and delivering hydrogen to end users. Location of hydrogen hubs at or near areas with high production potential can further increase cost-effectiveness.

The Bell Bay Advanced Manufacturing Zone meets all these requirements and is ideally placed to become a hydrogen hub, utilising Tasmanian renewable energy for large-scale renewable hydrogen production and storage, particularly for export and also potentially for domestic applications.

The Bell Bay Advanced Manufacturing Zone is Tasmania's premier large-scale major industrial precinct, located just 45 kilometres from Launceston. It has a suite of existing infrastructure well suited to renewable hydrogen production, including access to high voltage transmission assets, fresh water, as well as access to the precinct by rail, road, air and sea links, with close proximity to an adjacent deep water port which handles domestic and international bulk goods.

The Zone has available industrial zoned land suitable for large-scale renewable hydrogen production and storage, with the deep water port being adaptable for hydrogen exports. Bell Bay is also adjacent to the connection point for the Basslink interconnector. As such, electricity transmission connections at the Zone are strong, with existing transmission capacity available for new developments.

The Bell Bay region has a long-held reputation for actively supporting and promoting business, industry and job opportunities, including housing the first aluminium smelter in the southern hemisphere. It is a hub of knowledge and expertise in light and heavy industry, and the precinct has attracted a number of energy intensive major industries, including Bell Bay Aluminium, South 32 TEMCO (manganese smelting), Ecka Granules, wood fibre facilities and the Tamar Valley Power Station.

Community acceptance and support will also be critical for hydrogen hub developments. The local community in the Bell Bay region has a proud history of supporting major industries, and there is strong interest in the region for renewable hydrogen industry development.

The Tasmanian Government will continue its focus on establishing the Bell Bay Advanced Manufacturing Zone as Tasmania's premier hydrogen hub for large-scale renewable hydrogen industry development.

[23] The Future of Hydrogen, Seizing today's opportunities, International Energy Agency for the G20, Japan, June 2019.

Potential hydrogen production capabilities at the Bell Bay Advanced Manufacturing Zone

A renewable hydrogen production facility in the range of around 10 to 100 MW could be a viable first-stage commercial scale facility at the Bell Bay Advanced Manufacturing Zone. This could be developed without transmission network augmentation and could be situated on a number of available industrial development sites in the Zone. It could be directly supplied with Tasmanian renewable energy (wind and hydro power), enabling high electrolyser utilisation and cost-competitive renewable hydrogen production.

A 100 MW renewable hydrogen production facility would contribute an estimated 120 ongoing regional jobs.[24] It could produce up to 14 000 tonnes of renewable hydrogen per year as either pure hydrogen or embedded within derivatives such as a liquid hydrogen, ammonia or methanol. It would be likely to consume up to around 400 megalitres of water per year which could be sourced through existing infrastructure.

Such a first-stage facility could be built around export demand but also offer hydrogen to the domestic market for applications such as injection to the local natural gas network and as a substitute for transport fuel (including road, rail and marine). Compressed hydrogen could be distributed from Bell Bay either by road or rail.

Future expansion to a 1 000 MW renewable hydrogen production facility in the Bell Bay Advanced Manufacturing Zone is feasible with further infrastructure investment, and could produce up to 140,000 tonnes of hydrogen per year, representing around eight per cent of Japan's import target for 2030.[25]

A 1 000 MW facility would contribute an estimated 1 200 regional jobs, and could support around 2 000 MW of renewable energy investment. Existing hydro power and planned pumped-hydro augmentation could back additional wind generation to continue to provide high electrolyser utilisation for competitively priced renewable hydrogen production.

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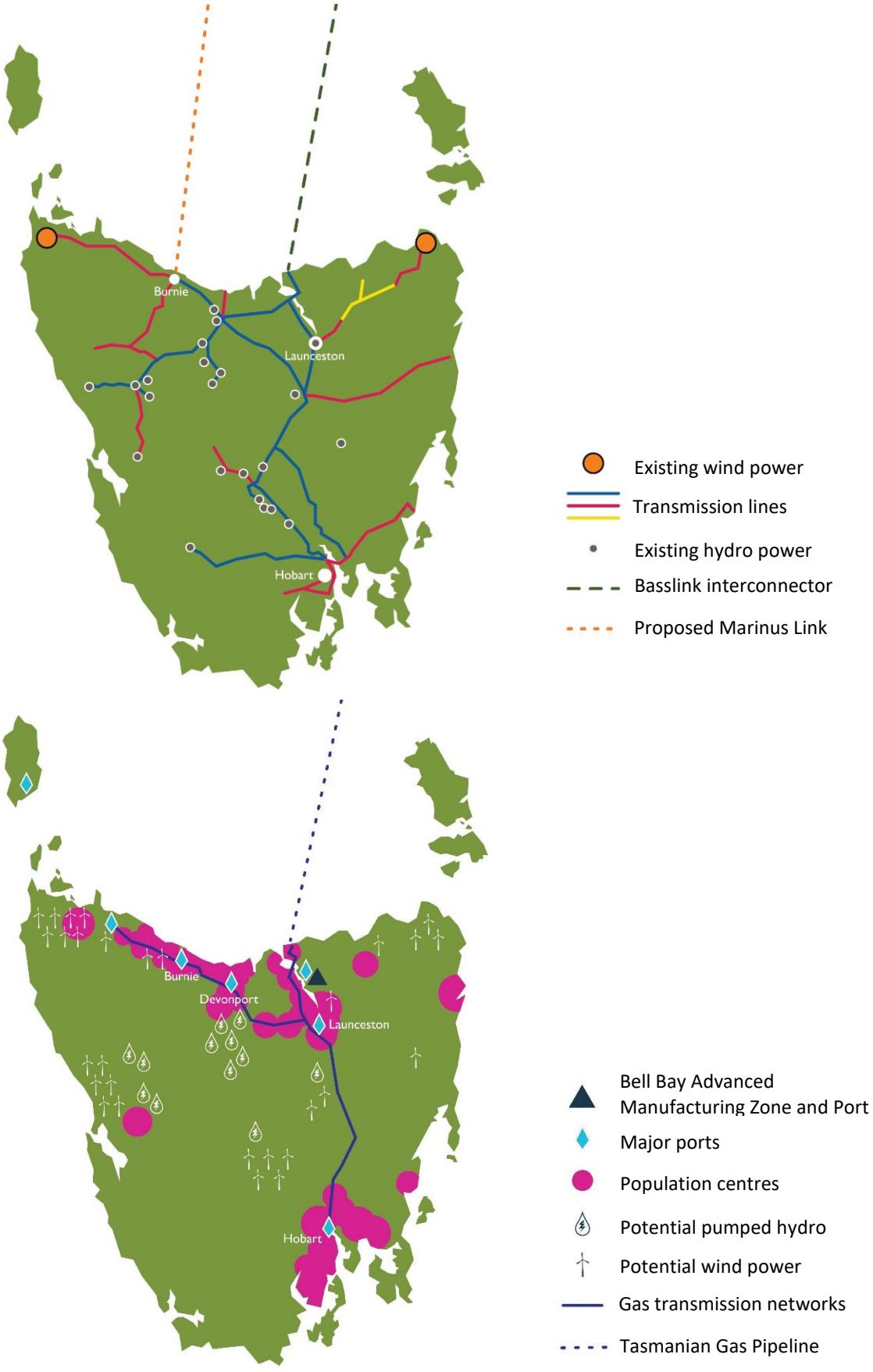
[24] Derived from Opportunities for Australia from Hydrogen Exports, op. cit.

[25] Ibid., page iii

Tasmanian renewable energy resource potential and existing key infrastructure



4. Other key attributes

In addition to its access to abundant renewable energy, clean fresh water and quality infrastructure, Tasmania has other key attributes that will support the development of a viable renewable hydrogen industry in the state.

Highly skilled workforce and world-leading educational and research institutions

Tasmania's existing renewable energy and major industrial businesses employ thousands of highly skilled Tasmanian workers.

Many of these workers received their training through Tasmania's world-class educational and training institutions, including the University of Tasmania and TasTAFE, which offer courses tailored to meet the needs of major Tasmanian industries.

The capacity of Tasmania's workforce will soon receive a major boost, through the $17 million 'Energising Tasmania' initiative which will provide training in priority skills needs to further increase Tasmania's skilled workforce capacity, in readiness for major energy developments in Tasmania including Project Marinus, Battery of the Nation and hydrogen industry development.

Tasmanian businesses and educational institutions have a proven history of innovation, particularly in regard to the research, development and delivery of renewable energy-based solutions to overcome technical challenges and provide environmental and economic benefits.

Blue Economy Cooperative Research Centre

The University of Tasmania is leading Australia's largest-ever Cooperative Research Centre (CRC), the $329 million Blue Economy CRC, bringing together expertise in aquaculture, marine renewable energy and offshore engineering. The 10-year collaboration will involve 45 national and international partners from industry, research and government and will support a research community of 50 PhD students and 50 postdoctoral research fellows.

Investigation into renewable energy systems to support offshore aquaculture will be a key research area for the CRC, with a focus on renewable hydrogen which is expected to play a critical role in storing, transforming and distributing renewable based energy in the offshore marine environment. Research areas will also include the use of hydrogen as a fuel for powering offshore vessels and the supply of oxygen for aquaculture as a co-product of hydrogen production by electrolysis.

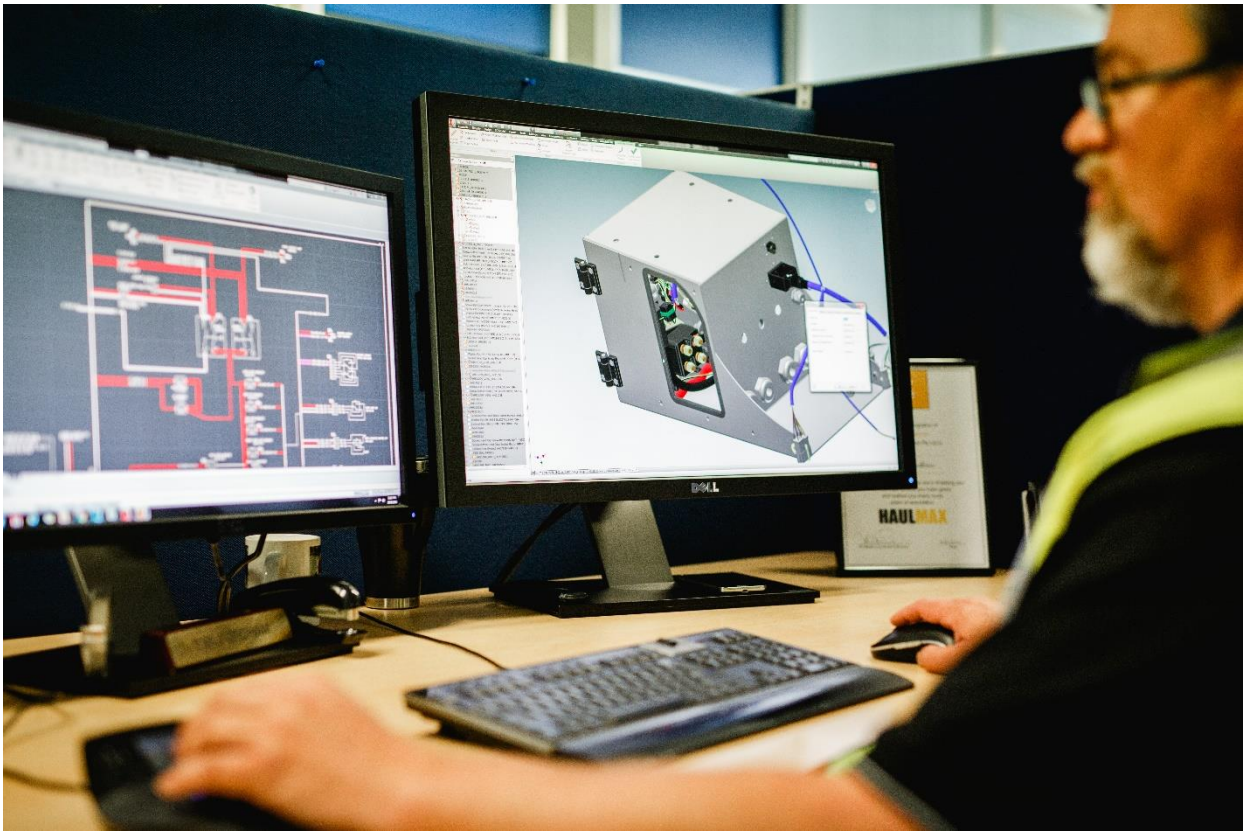
This research will be crucial to establishing commercial pathways to transition away from fossil fuels, such as diesel, toward renewable energy hydrogen-based systems to support offshore aquaculture.

The potential for offshore renewable hydrogen production for export will also be investigated, recognising the beneficial synergies this could provide through scale and access to additional markets in contributing to the costs of offshore infrastructure.

UTAS Future Energy group

The University of Tasmania has an established Future Energy collaborative research group with a vision for Tasmania to be an internationally recognised experimental hub for energy. The group brings together diverse disciplines including engineering, economics, law, marine science, social science and humanities to research and develop options for future energy provision in Tasmania. Research into renewable hydrogen production and use is an emerging key research theme for the Future Energy group.

Hydrogen research work currently being scoped out includes the identification of Tasmania's competitive renewable hydrogen industry advantages that could foster economic growth, the potential for decarbonising Tasmanian industries using renewable hydrogen, and the integration of renewable hydrogen production into the state's power system.



Hybrid Energy Solutions – innovative renewable energy for remote communities

Hydro Tasmania, with the assistance of the Australian Renewable Energy Agency, has delivered innovative hybrid energy solutions for large remote communities including King and Flinders Island. These ground-breaking systems significantly reduce dependence on diesel and are capable of operating on up to 100 per cent variable renewable energy, the first megawatt scale off-grid systems with this capability in the world.

The production and use of hydrogen presents further opportunities to reduce dependence on diesel in these communities.

Entura

Entura, a part of Hydro Tasmania, is one of the world's most experienced specialist power and water consulting firms, with technical expertise grounded in more than 100 years of experience. Since the 1990's, Entura has taken this experience and knowledge and applied it to solve complex issues for businesses in Australia and around the world.

Entura provides consulting services from strategy, planning, design and construction through to operation, maintenance, risk management and training, to create safe and sustainable power and water solutions.

Entura was significantly involved in the development of Hydro Tasmania's Hybrid Energy Solutions, and continues to provide innovative energy solutions, including the opportunities that hydrogen presents to power remote communities.

Pro-industry government and favourable planning processes

The Tasmanian Government is focussed on facilitating and growing competitive and sustainable Tasmanian industries, that enables economic growth through supportive policy and effective regulatory frameworks.

The Government established the Office of the Coordinator-General in 2014 with the specific purpose of attracting and securing investment in major projects that support Tasmania's economic growth.

Through the Coordinator-General, the Tasmanian Government is actively working with a range of proponents, including prominent international proponents and consortia, to facilitate investment in renewable hydrogen production for export and domestic use. This includes assistance in navigating state regulatory and planning approval processes, with a key focus on timely assistance that puts community safety and social acceptance at the forefront.

In March 2019, the Tasmanian Government undertook a trade and investment mission to Japan, headed by the Premier and Coordinator-General. A number of meetings were held with Japanese Corporations as a part of the mission, in relation to renewable hydrogen production opportunities in Tasmania for export to Japan.

These meetings stimulated significant interest in the prospects of cost-competitive renewable hydrogen production in Tasmania for export, with a number of Non-Disclosure Arrangements subsequently signed to further investigate these opportunities.

The Tasmanian Government is also engaging with the South Korean government and industry through H2Korea, which is a public-private partnership established with a goal to promote the hydrogen energy industry in line with the Korean Governments Hydrogen Economy Roadmap.

Tasmania has implemented planning arrangements that enable industry development. To streamline these arrangements for major developments, the Tasmanian Government is progressing the *Land Use Planning and Approvals Amendment (Major Projects) Bill 2018* which will amend the *Land Use Planning and Approvals Act 1993* to introduce a new assessment process to streamline approval processes for major projects.

Hydrogen-ready gas distribution network

Tasmania has a relatively new natural gas distribution network, constructed from High Density Polyethylene (HDPE) which does not suffer the potential pipe embrittlement and leakage issues associated with high hydrogen blends in older gas distribution networks constructed from steel.

Therefore, the existing natural gas network has the potential to store a high proportion of hydrogen (blended with natural gas), with the possibility of carrying 100 per cent hydrogen to be investigated.

Geographically compact

Tasmania's relatively compact geographical size (relative to mainland Australia) can reduce costs and facilitate the ease of doing business, including potentially minimising hydrogen infrastructure investment while reaching the majority of the population. For example, a relatively small number of hydrogen refuelling stations would be sufficient to cover the main population centres and heavy transport routes.

Benefits of a large-scale renewable hydrogen industry

Developing a large-scale renewable hydrogen industry in Tasmania, using low-cost Tasmanian renewable energy, has the potential to provide significant benefits for Tasmania.

Development of a renewable hydrogen export industry is likely to be the key driver, which in turn could facilitate significant renewable energy and associated infrastructure investment.

Analysis undertaken by ACIL Allen indicates that under relatively conservative estimates, the economic benefits of Australia's potential hydrogen industry could reach approximately $0.5 billion by 2025, $1.6 billion by 2030, and $4.3 billion by 2040, with additional employment of approximately 800 new jobs by 2025, 2800 jobs by 2030, and 7100 jobs by 2040. [26]

Tasmania is ideally placed to take advantage of this emerging hydrogen industry, providing economic and employment benefits particularly for regional areas.

Importantly, large-scale renewable hydrogen production would provide significant load growth for Tasmania, further strengthening Tasmania's status as an ideal location for major industry development.

The highly flexible nature of renewable hydrogen production can provide valuable benefits for keeping the electricity system stable, for example through the provision of frequency control ancillary services. Large-scale hydrogen production facilities could also participate in network special protection schemes to maximise network capacity.

While large-scale production of renewable hydrogen for export is likely to provide the greatest economic benefit for Tasmania, there could be significant opportunities for local use of renewable hydrogen across a range of end-use sectors including in transport, fuel substitution in gas networks, industrial applications and for remote power supplies (such as the Bass Strait Islands).

The use of locally produced renewable hydrogen could provide significant energy security benefits by reducing Tasmania's dependence on fossil fuel energy imports and increasing energy diversity.

Locally produced renewable hydrogen could also reduce Tasmania's greenhouse gas emissions across the stationary energy, transport and agriculture sectors. This could play an important role in contributing to Tasmania meeting its 2050 net zero greenhouse gas emissions target.

[26] Opportunities for Australia from Hydrogen Exports, op. cit., page v-vi

Tasmania's hydrogen action plan

Focus areas for developing a Tasmanian renewable hydrogen industry

Tasmania will use its comparative renewable energy advantages to support the development of a viable and cost-competitive Tasmanian renewable hydrogen industry.

Focus areas for Tasmanian renewable hydrogen industry development include:

- facilitating large scale hydrogen production for export
- investigating and enabling opportunities for the use of hydrogen in Tasmania.

Facilitating large-scale renewable hydrogen production for export

Tasmania is ideally placed to develop a large-scale renewable hydrogen production and export industry, using its cost competitive and available renewable energy and access to industrial sites with existing port access. The capability to support a large-scale industry already exists, with the potential to support production and export on a multi gigawatt scale over the longer term in conjunction with further development of Tasmania's abundant world-class renewable energy resources.

Tasmania's Coordinator-General will continue its investment attraction and industry development work, including with prominent international proponents and consortia, to facilitate investment in renewable hydrogen production for export.

Partnering with importing countries and international consortiums provides mutual benefits, with importing countries and businesses providing access to market, technological expertise and production investment, and Tasmania providing low cost firm renewable energy, access to existing infrastructure and a supportive investment environment.

The Tasmanian Government will continue to foster these international partnerships and to strengthen relationships through facilitating and attending trade delegations.

The Bell Bay Advanced Manufacturing Zone, with its strong transmission connections for renewable energy supply, access to a deep water port and abundant fresh water, will continue to be promoted as a prime hydrogen hub location for large-scale renewable hydrogen production, storage and export.

The Coordinator-General will publish a Renewable Hydrogen Prospectus by the end of 2019 that will provide industry-specific detail on renewable hydrogen development opportunities in Tasmania, particularly in relation to the Bell Bay Advanced Manufacturing Zone.

The importance of assessing local infrastructure requirements to support hydrogen infrastructure investments is recognised and is being considered through the National Hydrogen Strategy. The Tasmanian Government will work collaboratively with infrastructure assessments carried out under the National Strategy.

The Tasmanian Government will also work with local infrastructure providers to assess infrastructure requirements associated with renewable hydrogen developments. This will include working with TasNetworks to assess the network requirements at identified sites including the Bell Bay Advanced Manufacturing Zone, and explore options for minimising network costs. Water requirements will be assessed in consultation with TasWater.

In recognition of the nascent state of the hydrogen industry, and its significant potential in Tasmania, funding assistance for eligible projects and activities will be available through the Tasmanian Renewable Hydrogen Fund on a co-contribution basis.

'Green Ammonia' and 'Green Methanol'

The greatest current demand for hydrogen is as feedstock for ammonia production, which is a mature industry with well-established storage, distribution and export processes already in place. However, this production is almost entirely derived from fossil fuels with associated greenhouse gas emissions.

Production of 'green ammonia' from renewable hydrogen presents a significant opportunity to not only de-carbonise the ammonia production industry, but also to provide a cost-effective route to building renewable hydrogen industry scale through an established industry. Indicators are that ammonia may be the most effective means of storing and exporting hydrogen, with the benefit of being able to use existing storage and shipping technologies. Ammonia may also be able to be used directly as a clean fuel, saving on energy conversion costs back to hydrogen for end-use.

Methanol production derived from fossil fuels is also a mature industry, with similar opportunities and benefits associated with transferring to 'green methanol' production from renewable hydrogen.

Tasmania is ideally placed for the production of 'green ammonia' and 'green methanol'. The state's unique capability to provide renewable energy on a continuous basis is particularly valuable for the downstream process of 'green ammonia' production from renewable hydrogen, which requires a steady electricity supply.

Investigating and enabling opportunities for the use of renewable hydrogen in Tasmania

While supporting the development of a hydrogen export sector is a strategic priority for the Tasmanian Government, the creation of a domestic market for hydrogen in parallel is recognised to be equally important.

As hydrogen end-use technologies (such as fuel-cells) develop and become more cost competitive, the local use of Tasmanian renewable hydrogen may become an increasingly important future energy source for the state across a range of end-use sectors. In the longer term, the use of locally produced hydrogen in Tasmania could provide valuable energy security and environmental benefits by reducing dependence on imported fossil fuels.

Hydrogen could be used in a broad range of end-use applications in Tasmania, including in transport, blending with natural gas, for remote power and for industry applications. The Tasmanian Government will further investigate the opportunities for using locally produced renewable hydrogen in Tasmania, and how it can best facilitate these end-use industries.

The development of Tasmanian hydrogen end-use activities could occur alongside activities associated with hydrogen production for export, providing synergies that could provide valuable hydrogen industry capability building and lead to more effective overall industry development.

Transport

The transport sector is one early adoption end-use application for hydrogen, as the price of hydrogen is approaching cost-competitiveness as a substitute for conventional transport fuels such as diesel and petrol. The use of hydrogen for transport can also provide significant environmental benefits, through reducing transport related greenhouse gas emissions and air pollution.

Hydrogen mobility technologies, in particular running hydrogen through a fuel cell to power an electric drive-train, have been implemented in a broad range of transport applications around the world. These technologies are seen to offer a comparable user experience to traditional internal combustion engine vehicles including driving experience, driving range and refuelling time. Hydrogen fuel cell technologies are also significantly more efficient than traditional engine vehicles.

The use of hydrogen is likely to be particularly well suited to fuel cell based heavy vehicle applications, as it can avoid the potential weight issues associated with using batteries to power heavy electric vehicles, with quicker refuelling times.

Together with battery electric vehicles, hydrogen mobility technologies provide the opportunity to harness Tasmania's renewable energy to power the state's transport sector and provide associated economic, environmental and energy security benefits.

The Tasmanian Government will investigate opportunities for the use of hydrogen transport technologies in the state, with an initial focus on 'return-to-base' transport activities, such as buses, fleet vehicles, freight (including road and rail) and marine applications (such as ferries or barges), as this can allow for the most efficient utilisation of associated hydrogen refuelling infrastructure.

The Tasmanian Government will explore opportunities to trial hydrogen fuel cell electric vehicles within its fleet to gain first-hand experience of the technology and act as a potential catalyst for broader uptake across the private sector.

The use of hydrogen as a shipping fuel to support offshore aquaculture operations will be investigated by the Blue Economy CRC.

Gas networks

Hydrogen can be blended with natural gas in existing gas distribution networks. This has already been successfully trialled at blending rates of 10 per cent hydrogen in Australia. Existing gas appliances can safely use hydrogen blends at this level.

The incumbent natural gas distribution network infrastructure owner and operator is actively investigating opportunities for blending hydrogen at 10 per cent in parts of its network.

Tasmania has a unique advantage in that its relatively new HDPE gas network is compatible with hydrogen and could potentially allow for hydrogen gas blends up to 100 per cent.[27] This provides an important opportunity for Tasmania to trial higher blends of hydrogen than is possible in older steel-based gas distribution networks in other parts of Australia. For example, a controlled trial could be carried out in a small part of the network in conjunction with end-users, noting end-use facilities and appliances would need to be compatible with high hydrogen gas blends, and that appropriate safety arrangements would need to be in place.

The Tasmanian Government will work with the incumbent natural gas distribution network infrastructure owner to explore opportunities for hydrogen blending at 10 per cent and to investigate potential trials of higher hydrogen blends.

Remote power supplies

The use of hydrogen could be particularly well suited to powering remote communities and commercial operations, as a fuel replacement for imported diesel.

While diesel consumption to power the Bass Strait Islands has reduced significantly as a result of Hydro Tasmania's innovative renewable hybrid energy systems, diesel is still required as a back-up fuel. The use of hydrogen, particularly if it is locally produced from the abundant renewable energy resources available on the Bass Strait Islands, could remove the need for expensive diesel imports for power generation. It also provides the significant benefit of being able to utilise otherwise wasted 'spill-over' renewable energy to produce hydrogen for later use.

Hydro Tasmania will investigate the production and use of renewable hydrogen as a component of its hybrid energy systems on King and Flinders Island, and for incorporation into its hybrid energy solutions services.

The Tasmanian-based Blue Economy CRC will investigate the use of hydrogen based renewable power systems to support offshore aquaculture operations.

[27] Noting hydrogen blending up to 100 per cent requires further technical investigation.

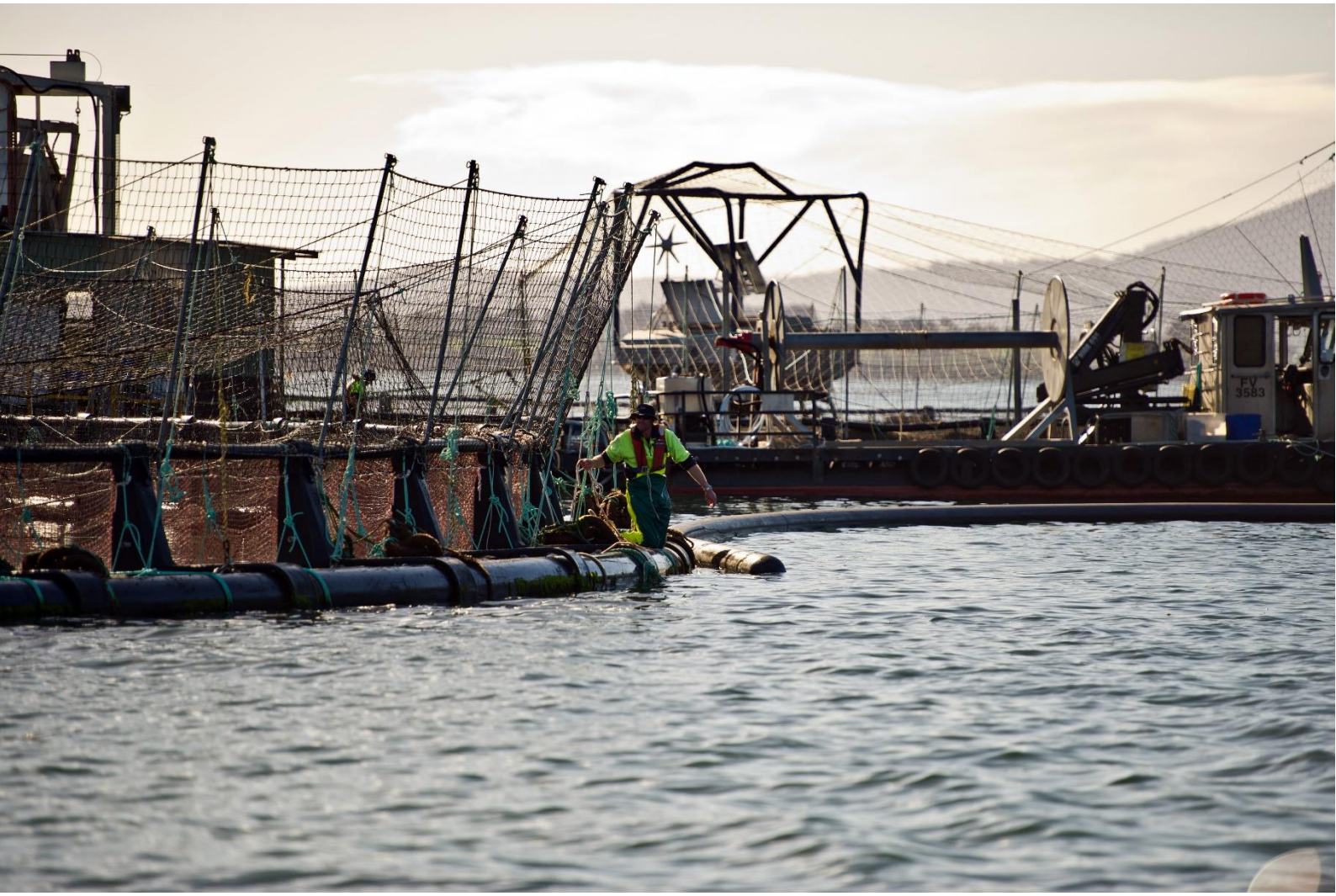
Industrial applications

Hydrogen is already used as a feedstock in a range of industrial applications, such as chemicals manufacturing.

There may be opportunities for renewable hydrogen to be used as a carbon-neutral feedstock in a range of Tasmanian industries, for example in ammonia production for agriculture or in industrial processes. This could leverage off any larger-scale production of 'green' ammonia in Tasmania for export.

The Tasmanian Government will investigate opportunities for the use of 'green' ammonia and related products, derived from Tasmanian renewable hydrogen, for use in the Tasmanian agricultural sector.

Oxygen is a potentially valuable co-product of renewable hydrogen production by electrolysis, particularly for use in the aquaculture industry and potentially for water treatment. The Blue Economy CRC is investigating opportunities to add value to hydrogen production by electrolysis by utilising the oxygen co-product in Tasmania's aquaculture industry.



Tasmanian Government support

The Tasmanian Government is establishing a comprehensive package of measures, including a Tasmanian Renewable Hydrogen Fund, to support the development of a renewable hydrogen industry in Tasmania.

Funding assistance will help activate hydrogen industry development and reduce investor risk, recognising that international and domestic markets are still emerging and hydrogen technologies are not yet mature.

The Tasmanian Renewable Hydrogen Fund will be available where co-contributions are made from private industry and/or other funding programs, such as the Australian Renewable Energy Agency. The Tasmanian Government will provide assistance to eligible proponents in accessing Tasmanian and national funding.

The Fund will be broad in scope and be available to support feasibility studies and capital investment for pilots, trials, demonstrations and pre-commercial projects associated with renewable hydrogen production, storage, export and use within Tasmania. The Fund will also be available for eligible Tasmanian research and development projects related to hydrogen.

The Fund may also be available to support infrastructure assessments of industrial sites such as the Bell Bay Advanced Manufacturing Zone, depending on the outcomes of infrastructure assessments carried out under the National Hydrogen Strategy.

The Fund will also support activities to implement the *Tasmanian Renewable Hydrogen Action Plan*, and support Tasmania's contribution to implementation of the National Hydrogen Strategy through the establishment of a Renewable Hydrogen Development Unit within the Department of State Growth.

Other support measures being considered by the Government include the provision of in-kind support from Tasmania's Government-owned energy businesses such as concessional electricity pricing, discounted loans to support the establishment of commercial scale production facilities subject to business case assessments, and payroll tax relief for up to three years for hydrogen related business operations established in regional areas of Tasmania.

Other supporting activities

There is also a range of important activities the Tasmanian Government will facilitate and participate in that will support the development of a viable hydrogen industry in Tasmania. Many of these activities are being considered under the National Hydrogen Strategy, and the Tasmanian Government will work cooperatively with related National Strategy implementation actions.

Regulations and standards

The production, storage, distribution and use of hydrogen, particularly in relation to energy applications and at scale, is relatively new and emerging. It also cuts across many sectors, reflecting the broad potential end-use applications of hydrogen, such as in transport, gas supply and electricity generation.

It is recognised that governments have a key role to play in ensuring consistent, robust and predictable regulations and standards are in place, that are also responsive and flexible, to support the emergence of a viable and safe hydrogen industry.

The Tasmanian Government will review state-based legislation and regulations that are relevant to the hydrogen industry, particularly in regard to safety, and will participate in national regulatory review and reform processes implemented under the National Hydrogen Strategy.

Tasmania will adopt the approach of facilitating national consistency where appropriate, while ensuring specific state based regulations are in place that reflect Tasmania's unique situations.

Renewable hydrogen accreditation

Global demand projections are for hydrogen produced from emissions free sources, to assist countries decarbonise their economies. A hydrogen certification or guarantee of origin scheme will provide importing countries and end users with assurances that the hydrogen they are purchasing is from sustainable resources and produced using renewable energy, and can legitimately contribute to carbon reduction goals.

Tasmania's emissions-free renewable energy supply will avoid the need for costly carbon offsets or credits, which are likely to be required by hydrogen production projects receiving supply from emissions-intensive grids in other parts of Australia in order to achieve 'green' hydrogen certification status.

The Tasmanian Government will work collaboratively with other governments and industry to facilitate the development of a certification scheme that recognises and values Tasmania's renewable energy characteristics and sustainable water resources.

Community awareness

The development of a viable hydrogen industry will only occur with community satisfaction that the production and use of hydrogen is safe, can provide local economic benefits, and protects the environment.

The Tasmanian Government will ensure nationally developed community education and awareness raising materials and programs related to hydrogen are relevant for, and made available to, the Tasmanian community.

Skilled workforce

Tasmania already has access to a highly skilled and innovative workforce related to its renewable energy and major industries. The Tasmanian Government has recognised this existing skilled workforce base will require a further boost to ensure ongoing access to an appropriately skilled workforce as Tasmania implements its major energy initiatives, including the development of a renewable hydrogen industry and the Battery of the Nation and Marinus Link initiatives.

The Tasmanian Government will facilitate the implementation of the Australian Government funded $17 million 'Energising Tasmania' initiative, to provide training in major energy development related priority skills needs areas such as engineering, project management, civil construction and trades.

Research and innovation

Ongoing research and innovation will be critical to enable the development of a viable cost-effective hydrogen industry that provides economic, social and environmental benefits. Tasmania has established businesses and educational institutions with a proven history of renewable energy and major industry development focussed research and innovation.

The University of Tasmania is leading and hosting the $329 million Blue Economy CRC, which is investigating the potential applications of renewable hydrogen in the offshore marine environment as a key research theme. The Tasmanian Government is a supporting partner of the Blue Economy CRC, together with many Tasmanian industries.

In addition, the University of Tasmania is seeking to expand its research capabilities related to low carbon energy futures for Tasmania, with a key focus on Tasmanian renewable hydrogen production and use, through an ARC Industrial Transformation Training Centre funding application. This will build on the UTAS Future Energy group's multi-disciplinary research work that is already underway.

The Tasmanian Government is supporting the University of Tasmania's ARC Industrial Transformation Training Centre funding application through a $100 000 cash and in-kind contribution to support renewable hydrogen research.

Actions

Action	Description	Responsibility
1	The Tasmanian Government is progressing the Land Use Planning and Approvals Amendment (Major Projects) Bill 2018 which will amend the Land Use Planning and Approvals Act 1993 to introduce a new assessment process to streamline approval processes for major projects.	Department of Justice
2	Tasmania's Coordinator-General will continue its investment attraction and industry development work, including with prominent international proponents and consortia, to facilitate investment in renewable hydrogen production for export.	Office of the Coordinator-General
3	The Tasmanian Government will continue to foster international partnerships with governments and businesses in countries seeking to import renewable hydrogen, including Japan, South Korea and China, and to strengthen relationships through facilitating and attending trade delegations.	Office of the Coordinator-General // Department of State Growth
4	The Coordinator-General will continue its renewable hydrogen industry development role and will publish a Renewable Hydrogen Prospectus by the end of 2019 that will provide industry-specific detail on renewable hydrogen development opportunities in Tasmania, particularly in relation to the Bell Bay Advanced Manufacturing Zone.	Office of the Coordinator-General
5	The Tasmanian Government will work collaboratively with national infrastructure assessments carried out under the National Hydrogen Strategy.	Department of State Growth
6	The Tasmanian Government will work with local infrastructure providers to assess infrastructure requirements associated with renewable hydrogen developments. This will include working with TasNetworks to assess the network requirements at identified sites including the Bell Bay Advanced Manufacturing Zone, and explore options for minimising network costs. Water requirements will be assessed in consultation with TasWater.	Department of State Growth // TasNetworks // TasWater
7	The Tasmanian Government will investigate opportunities for the use of hydrogen transport technologies in the state, with an initial focus on 'return-to-base' transport activities, such as buses, fleet vehicles, freight (including road and rail) and marine applications (such as ferries or barges).	Department of State Growth // Department of Premier and Cabinet
8	The Tasmanian Government will explore opportunities to trial hydrogen fuel cell electric vehicles within its fleet to gain first-hand experience of the technology and act as a potential catalyst for broader uptake across the private sector.	Department of Treasury and Finance // Department of State Growth // Department of Premier and Cabinet
9	The Tasmanian Government will work with the incumbent natural gas distribution network infrastructure owner to explore opportunities for hydrogen blending at 10 per cent and to investigate potential trials of higher hydrogen blends in Tasmania's hydrogen compatible gas distribution networks.	Department of State Growth // Department of Justice // incumbent natural gas distribution network infrastructure owner

10	Hydro Tasmania will investigate the production and use of renewable hydrogen as a component of its hybrid energy systems on King and Flinders Island, and for incorporation into its hybrid energy solutions services.	Hydro Tasmania
11	The Blue Economy CRC, in collaboration with Government, will investigate: - the use of hydrogen as a shipping fuel to support offshore aquaculture operations; - the use of hydrogen based renewable power systems to support offshore aquaculture operations; and - opportunities to add value to hydrogen production by electrolysis by utilising the oxygen co-product in Tasmania's aquaculture industry.	Blue Economy CRC
12	The Tasmanian Government will investigate opportunities for the use of 'green' ammonia and related products, derived from Tasmanian renewable hydrogen, for use in the Tasmanian agricultural sector.	Department of Primary Industries, Water and the Environment
13	The Tasmanian Government will review state-based legislation and regulations that are relevant to the hydrogen industry, particularly in regard to safety, and will participate in national regulatory review and reform processes implemented under the National Hydrogen Strategy.	Department of State Growth // Department of Justice
14	The Tasmanian Government will work collaboratively with other governments and industry to facilitate the development of a renewable hydrogen certification scheme that recognises and values Tasmania's renewable energy characteristics and sustainable water resources.	State Growth – Office of Energy Planning // Department of Premier and Cabinet
15	The Tasmanian Government will ensure nationally developed community education and awareness raising materials and programs related to hydrogen are relevant for, and made available to, the Tasmanian community.	Department of State Growth
16	The Tasmanian Government will facilitate the implementation of the Australian Government funded $17 million 'Energising Tasmania' initiative, to provide training in major energy development related priority skills needs areas such as engineering, project management, civil construction and trades.	Department of State Growth
17	The Tasmanian Government is supporting the University of Tasmania's ARC Industrial Transformation Training Centre funding application through a $100 000 cash and in-kind contribution to support renewable hydrogen research.	Department of State Growth // University of Tasmania
18	The Tasmanian Government is establishing a comprehensive package of measures, including a Tasmanian Renewable Hydrogen Fund, to support the development of a renewable hydrogen industry in Tasmania.	Department of State Growth // Department of Treasury and Finance
19	The Tasmanian Government will fund a dedicated Renewable Hydrogen Development Unit within the Department of State Growth to support implementation of the *Tasmanian Renewable Hydrogen Action Plan*, and support Tasmania's contribution to implementation of the National Hydrogen Strategy.	Department of State Growth

Tasmanian Government

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