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Ms Sophie Rowlands
Stakeholder Relations Manager Department of State Growth
Tasmanian Government,
Hobart, Tasmania

18 September 2020
renewableenergy@stategrowth.tas.gov.au

Dear Ms Rowlands

WWF-Australia is pleased to provide a submission to the *Draft Tasmanian Renewable Energy Action Plan*.

Following our meeting with Minister Barnett earlier this year, WWF wishes to offer our support for Tasmania becoming a renewable export powerhouse. WWF is actively working to make Australia the world's leading renewable export nation by 2030.

Tasmania's near 100% renewable electricity status and strong experience in renewable deployment position the state strategically as a leader in this regard, and WWF would be delighted to support Tasmania to accelerate this opportunity.

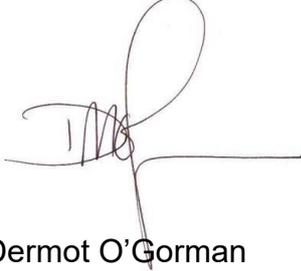
The Government's draft *Tasmanian Renewable Energy Action Plan* provides a strong basis from which to not only decarbonise Tasmania's own energy needs, but also to grow a strong renewable export industry. In our submission we:

1. Commend the proposed 200% renewable energy target by 2040, and outline the benefits of raising it higher to a 300-350% 2040 renewable energy target.
2. Outline the need to strengthen Tasmanian climate legislation as a prerequisite for attracting global business and investors.
3. Propose three additional renewable energy end-use opportunities where Tasmania is likely to have a comparative advantage: domestic electrification of transport and industry, clean shipping and the establishment of a Renewable Energy Industrial Precinct.
4. Identify a series of concrete initiatives and policy levers by which the Tasmanian Government can ensure Tasmanian renewable projects sets world-leading standards for delivering climate benefits that also conserve and restore ecosystems and wildlife, and engender community support and social licence.

WWF is pleased offer its expertise in clean energy solutions and the conservation of biodiversity to help the Tasmanian Government achieve essential renewable energy outcomes, and position Tasmania on a global scale. Specifically, in addition to our founding work with the [Business Renewables Centre](#) - Australia, this submission builds on WWF's ['Renewable Energy Powerhouse' policy paper](#), and 'Energising Australia with Hydrogen' policy paper.

WWF would welcome the opportunity to discuss this submission in greater detail. Please contact Nicky Ison, Energy Transition Manager, directly on 0402 0345 80, or by email nison@wwf.org.au.

Yours sincerely,

A handwritten signature in black ink, appearing to be "Dermot O'Gorman". The signature is stylized with a large loop at the top and a horizontal line extending to the right.

Dermot O'Gorman
Chief Executive Officer
WWF-Australia

TASMANIA'S OPPORTUNITY TO BECOME A RENEWABLE POWERHOUSE

WWF-Australia's Submission to the draft Tasmanian Renewable Energy Action Plan

1. Tasmania's leadership is globally significant

Recommendation 1: Legislate at least a 200% renewables target by the end of 2020 to lock in Tasmania's renewable leadership.

WWF-Australia commends the Tasmanian Government for significant achievements - both the anticipated achievement of 100% renewable self-sufficiency, and also the bold step of proposing to set a world-leading 200% renewables target. WWF believes that the opportunities presented by Tasmania's abundant and high quality renewable resources can be transformed into jobs, new industries, new export opportunities, and economic growth, and that the draft *Tasmanian Renewable Energy Action Plan* sets out significant steps towards Tasmania realising these opportunities and becoming a global renewable energy powerhouse (see Box 1).

As the world moves to act on climate change and fulfil the promise of the Paris Climate Agreement, those places that have the best renewable resources in the world have a significant opportunity. Tasmania with its near 100% renewable status has a first mover advantage.

In the future carbon-constrained world economy, places like Tasmania - which has strong winds, the capacity to capture it, and decades of experience working in a high renewable energy system - will have the lowest cost energy - a significant comparative advantage that the state should act to secure by legislating an export scale renewable target.

Box 1: What is a renewable energy powerhouse¹

WWF-Australia defines a renewable energy powerhouse as a country or jurisdiction that not only uses renewable energy sources to meet its own domestic energy needs, but also establishes a renewable export industry. This renewable export industry should include multiple of the following six renewable export pathways or types:

1. Renewable hydrogen. Renewable electricity can be used to electrolyse water to create renewable hydrogen which can then be converted into a range of derivative commodities such as ammonia and synthetic fuels. Renewable hydrogen will have a huge role to play in decarbonising hard-to-decarbonise places and sectors such as steel.

2. Direct electricity transfer via undersea cables. Exporting our renewables through high-voltage

¹ See more about WWF's Renewable Powerhouse campaign and 700% renewables here <https://www.wwf.org.au/what-we-do/climate/renewables>.

direct current cables.

3. Renewable power products and commodities. Manufacturing energy-intensive commodities such as green steel, advanced manufacturing, aluminium and more using renewable electricity and then exporting embodied renewable energy in the form of these high-value products.

4. Expertise. Expertise, legal, financial, business and engineering, particularly in deploying & managing renewable energy systems, including education and training.

5. Components and recycling of components for clean energy technologies. Australia is uniquely positioned, as we can do everything from produce the minerals essential to clean energy technologies such as lithium, copper and nickel, to manufacturing wind turbine blades, inverters and batteries.

6. Software and services. Our software expertise is helping support the operation of clean energy systems, enabling demand management, microgrids, and grid integration of renewables, we can export this software and these services to the world.

Tasmania is placed to capitalise on at least four of these renewable export opportunities: hydrogen, direct electricity transfer, renewable powered products and commodities and expertise.

2. Tasmania's policy should be scalable

Recommendation 2: Investigate a 300-350% renewable energy target by 2040. This should be underpinned by a study looking at the renewable energy required to decarbonise Tasmania's total energy consumption across all sectors and a detailed investigation of Tasmania's most promising renewable export opportunities and markets.

While doubling Tasmania's renewable energy output over the next two decades is a significant goal, there are benefits to be gained in setting a more ambitious target.

Based on analysis of: (i) Tasmania's current energy use across all sectors; (ii) the potential to export more renewables to mainland Australia; and (iii) the opportunity to both attract new industry and export renewables to the world, **WWF-Australia proposes Tasmania investigate policy mechanisms that will allow for Tasmania's renewable energy achievement to scale to 300-350% renewable energy by 2040.**

Setting a 300-350% would deliver **26,000-29,000 construction job-years and nearly 900-1100 ongoing operational jobs** deploying renewable generation projects, infrastructure, manufacturing and training jobs would be additional.

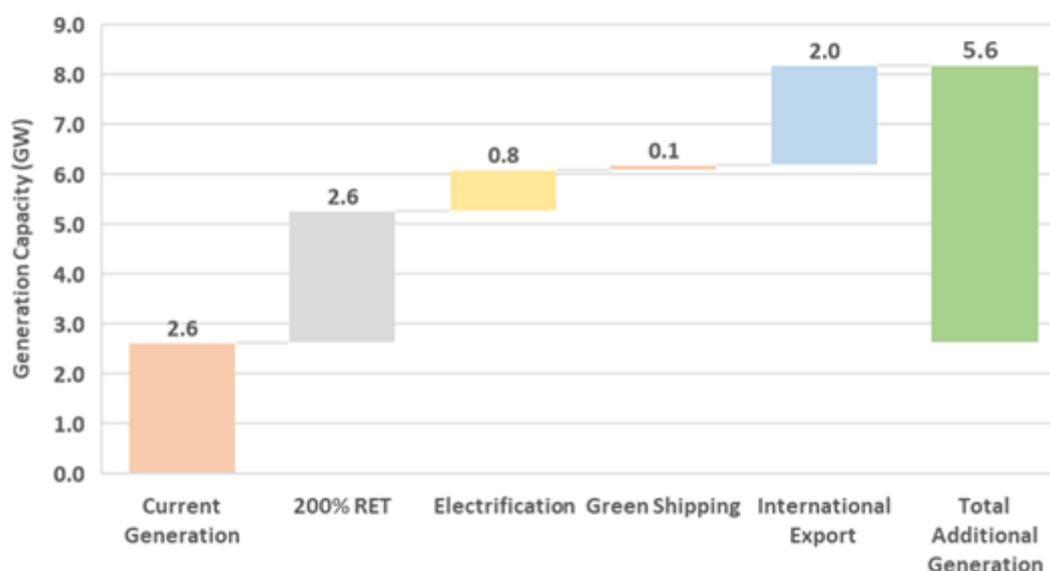
Internationally, energy systems are undergoing a transformation at the scale not seen since the 1800s. Global megatrends towards electrification, decarbonisation and digitisation are combining across the transport, heating and industrial sectors to provide smarter, cleaner, and more efficient and reliable energy sources, which will have hugely disruptive impacts on traditional energy systems. Importantly, some of Australia's biggest trading partners, such as Japan and South Korea, Singapore and even Europe, face significant challenges decarbonizing their energy sectors, largely because of geography - they have relatively reduced sunshine or wind (in the cases of Japan, South Korea, parts of Northern Europe), or too little space (as is the case in Singapore). Meanwhile, major global industries such as shipping, steel and chemical production have been forced to rethink their operational models in the face of carbon constraints. Furthermore, if Australia wants to maintain itself as an energy exporting nation, it will need to grow a renewables industry commensurate with the scale of our current fossil fuel exports. These trends combine to present a huge opportunity for Tasmania - an opportunity on which the draft *Tasmanian Renewable Energy Action Plan* places Tasmanian in a strong position to capitalise.

Table 1 and Figure 1 set out the basis for this expanded target of between 5.6-6.5GWs of new renewable generation on a 2022 baseline. The assumptions underpinning this analysis are provided in Appendix A. While the international export, clean shipping and electrification opportunities are expanded on in more detail in Section 3 below.

Table 1: Tasmanian Renewable Energy Opportunity (Source: Acacia Sustainability, see Appendix A)

	GW	GWh
Current Renewable Energy	2.6	10,801
Estimated Export for 200% (2022 baseline)	2.6	10,500
Additional Generation for Electrification	0.8- 1.7	6,648
Renewable Ammonia for Shipping	0.1	362
Export Opportunities	2.0	7,709
Total	8.2-9.1	32,571- 36,019

Figure 1: Total Renewable Energy Opportunity – Tasmania (GW) (Source: see Appendix A)



3. Stimulating demand for Tasmania’s renewables

The draft *Tasmanian Renewable Energy Action Plan* identifies a number of ways to help stimulate demand for Tasmanian renewable energy, including establishing Renewables Tasmania, a new load growth attraction strategy, global promotion of Tasmania’s 100% renewables status, Marinus Link, the Tasmanian Renewable Hydrogen Action Plan and a transport decarbonisation pathway.

WWF-Australia has identified three additional or expanded opportunities for creating demand for renewable energy and associated jobs and economic growth that we recommend the Tasmanian Government actively pursue.

3.1 Domestic electrification of transport and industry

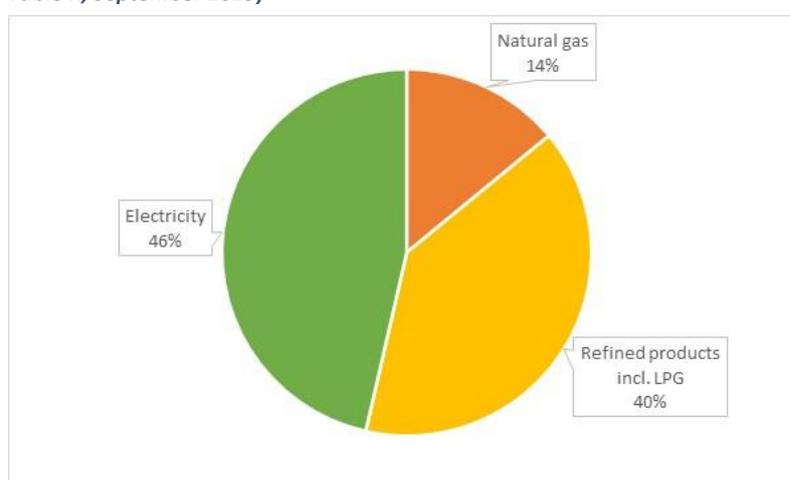
Recommendation 3: Aim to have 100% of Tasmania’s total energy needs powered by renewables by 2040. Develop a transport and industry electrification strategy to achieve this goal and include reference to this in the final *Tasmanian Renewable Energy Action Plan*.

While Tasmania achieving 100% renewable electricity status in the next two years will be a significant achievement, from a total energy-system perspective, there is still a way to go. As shown in Figure 3, 54% of Tasmania’s energy consumption will still be in the form of fossil fuels, specifically natural gas and refined products such as petrol, diesel, LNG etc. WWF encourages the Tasmanian government to make powering Tasmania’s entire economy - power, transport, industry and heat - on renewable energy a priority for the final *Tasmanian Renewable Energy Action Plan*.

After electricity, transport is the largest energy end-use sector (see Appendix A, Table

2), and it is touched on in the draft *Tasmanian Renewable Energy Action Plan*. After transport, manufacturing is the largest user of natural gas and refined products. There are significant opportunities to help decarbonise manufacturing, while in the process helping lower power bills and modernising Tasmanian businesses.² More can and should be done in both sectors.

Figure 2: Energy Consumption in Tasmania 2017-18 by sector (PJ) (Source: Department of the Environment and Energy, Australian Energy Statistics, Table K, September 2019)



WWF encourages the Tasmanian Government to approach the decarbonisation of transport and industry in accordance with the following hierarchy of activities:

1. Energy efficiency and avoidance - reduce demand for energy by incentivising more efficient processes or alternatives (for example remote working to reduce the need to commute). We commend the focus on household and on-farm energy efficiency measures in the draft *Tasmanian Renewable Energy Action Plan* and support their continuation, but encourage an expansion of energy efficiency programs to the manufacturing sector.
2. Electrification - electrical alternatives such as electric vehicles and industrial heat pumps are much more efficient than petrol vehicles and gas boilers. Electrification helps reduce costs for consumers and industry. Electrification also allows these processes to be powered by renewable energy, increasing demand for renewable projects in the process, helping create markets for electricity generators in Tasmania.
3. Renewable hydrogen - while many processes can be electrified, some will find it difficult. WWF-Australia sees a substantial role for renewable hydrogen in the global economy; however, we encourage jurisdictions to pursue hydrogen end-uses that cannot easily or affordably be electrified.³ We commend the Tasmanian Government’s Renewable Hydrogen Action plan and associated \$50million program, and encourage a focus on heavy transport, high temperature industrial processes, and export opportunities.

² See the [Australian Alliance for Energy Productivity](#), [ARENA](#) and [RACE2030](#) for programs and resources supporting the electrification of industry.

³ See WWF-Australia’s report *Energy Australia with Renewable Hydrogen*, provided as an attachment.

3.2 Providing zero emissions fuel to the Tasmanian and global shipping industry

Recommendation 4: Target zero emissions fuel for the global shipping industry as a priority export pathway. To do this we recommend undertaking the following activities:

- Fund a renewable hydrogen/ammonia shipping demonstration project in conjunction with a leading Tasmanian export company.
- Develop a bunkering fuel market development strategy that includes Tasmania's fuel needs, Australia's fuel needs and global fuel needs. This should include engaging with the Getting to Zero Coalition and key bunkering hubs such as Singapore.
- Investigate the infrastructure requirements to establish renewable ammonia bunkering facilities in all major Tasmanian ports, including Bell Bay (see below).
- Establish stringent worker and environmental safety standards and practices for the production and use of renewable hydrogen and renewable ammonia.⁴
- Position Tasmania as a global training centre and centre for excellence in zero emissions shipping.

The shipping industry accounts for 2-3% of global carbon emissions. Historically, shipping has been thought of as one of the hardest sectors to decarbonise as it has difficult to identify potential bunkering fuel⁵ replacements to crude oil. However, with the International Maritime Organisation setting a 50% carbon reduction target by 2050 and the establishment of the Getting to Zero coalition by the Global Maritime Forum, momentum is growing to find viable zero emissions fuel alternatives.

One of the most promising alternatives identified is renewable hydrogen, most likely in the form of renewable ammonia. Indeed, in the last six months, four renewable ammonia deep water shipping demonstration projects have been announced globally.

Globally the supply of bunkering fuel is a \$90billion industry.⁶ Currently, Tasmania and Australia more broadly is a net importer of bunkering fuel. With a targeted approach, Australia could become a net-exporter of zero-emissions bunkering fuel in the next 20 years, creating jobs, new revenue and new demand for renewable energy. Tasmania could lead the way.

As an island state, in an island nation, Tasmania is reliant on shipping for both domestic and international trade. As such, Tasmania has extensive shipping infrastructure and shipping expertise, exemplified by the Global Maritime College. Tasmania should build on this industry advantage and prioritise shipping as a top end-use for a Tasmanian renewable hydrogen industry.

3.3 Establish a Renewable Energy Industrial Precinct in Bell Bay

Recommendation 5: Work with the Bell Bay Advanced Manufacturing Zone and the Federal Government to pilot Bell Bay as Australia's first Renewable Energy Industrial Precinct.

A Renewable Energy Industrial Precinct is a cluster of manufacturers powered by 100% renewable

⁴ While renewable ammonia when combined with catalytic conversion technology does not produce greenhouse gas emissions, it is an environmental toxicant and as such must be used in accordance with stringent environmental safety practices.

⁵ Bunkering fuel is any fuel used to power ships.

⁶ The global market value of marine fuel has been estimated at US\$90.4B based on the consumption of 3.38 mb/d of un-scrubbed high sulphur fuel oil and 0.87 mb/d of marine gas oil in 2018 at prices of US\$421 and US\$458/t respectively.

energy. These precincts are either located within Renewable Energy Zones or connected to renewable energy generation through high voltage transmission lines. They also have access to clean heat and renewable hydrogen production and infrastructure such as port, rail and road logistics, water and recycling. A renewable energy industrial precinct can be thought of as an expanded Hydrogen Hub as proposed in the National Hydrogen Strategy.

Already acknowledged as an [Industry Precinct](#), Bell Bay is arguably already Australia's first Renewable Energy Industrial Precinct (REIP), with heavy industry (including aluminium smelting and alloy production) powered by near 100% renewable electricity. Building on existing infrastructure and the Tasmanian Renewable Hydrogen Action Plan, the next steps to establish Bell Bay as a globally attractive REIP are the development of renewable hydrogen production and associated pipeline, and associated renewable heating and cooling infrastructure (see more in Appendix B).

4. Best practice approach to renewable development

The draft *Tasmanian Renewable Energy Action Plan* identifies a number of ways to help stimulate the development of renewable energy generation in Tasmania, including the development of a Renewable Energy Coordination Framework, a scoping study for a Renewable Energy Centre of Excellence, continuation of the on-farm energy initiative and the Energising Tasmania skills and training initiative.

WWF-Australia encourages the Tasmanian Government to take a best practice approach to renewable energy development, while also creating jobs and benefiting the community, and ensuring the protection of Tasmania's unique natural environment and biodiversity.

4.1 Prioritise the protection of nature and securing local support and social licence for renewable energy development

Recommendation 6: Establish guide rails for the development of new renewable energy projects and associated infrastructure, to ensure the protection of nature and social licence. Policy levers and initiatives that the Tasmanian Government should pursue in addition to strengthening the existing planning system include:

- **Developing a best practice guide to community engagement, benefit sharing and nature protection that is specific to the Tasmanian context. Building on the Clean Energy Council, Victorian and ACT Guides.**
- **Using the selection criteria in reverse auctions or procurement processes to require or reward higher levels of community engagement, benefit sharing and conservation of nature. Note this can also lead to local supply chain and job benefits as well.**
- **Undertake intensive community engagement and co-design tailored community benefit sharing measures and a best practice approach to renewable energy development, by targeting renewable development in three dedicated areas - renewable energy zones (see below).**
- **Establishing a grant program or similar incentive scheme to encourage research and piloting of conservation and habitat regeneration measures integrated into the development of renewable energy projects and associated infrastructure.**

While renewable technologies are much better for both the climate and environment than fossil fuel alternatives, no development is without impact. As such, it is critically important that the Tasmanian government gets out ahead of issues of biodiversity conservation and social licence.

Indeed these should be two guide rails informing the development of both renewable projects and associated transmission infrastructure.

Protection of nature

While many of the environmental impacts of renewable projects, particularly of wind energy, have been overblown, inappropriate siting and operation increases the likelihood of negative impacts and community opposition. As such, ensuring the Tasmanian planning and environmental protection legal and policy frameworks have the right tools and criteria to influence the siting and operation of renewables projects is critical. This should include no-go zones for high conservation value areas, and avoiding reliance upon offsetting major impacts upon threatened species and ecological communities. Aquatic ecosystems should be protected as much as possible from operations or modification of hydropower dams .

Internationally, we can draw upon innovative new renewable energy projects that are both a net benefit to the climate and to the enhancement of local biodiversity. For example in the US and the UK there is a push to develop [pollinator friendly solar farms](#). In South Australia, degraded land now being used for solar arrays are also being sown to [native grasses](#) to reduce dust, while small native marsupials are recolonising the restored grasslands. Income from wind farms can also provide additional income, allowing farmers to put aside areas for native grassland or other habitat regeneration such as Chepstowe Wind Farm in Victoria, while in Norway [a recent study](#) found that by painting one blade of a wind turbine black reduced bird deaths by 78%.⁷

Social licence

Through engaging the community early, embedding the project into the culture and history of the community, listening and responding to concerns and ensuring the community genuinely benefits from the project in the form of jobs, income, lower power bills, local amenities and more, renewable developers and associated government agencies can engender active support for projects.⁸ However, not all renewable companies have a culture of or practice good community engagement nor put in place community benefit sharing schemes that the community actually wants. The Tasmanian Government needs to encourage and reward good community engagement and benefit sharing practices in the industry to ensure social licence for the next wave of renewable development.

4.2 Take a science-based approach to bioenergy development

While there are some bioenergy technologies such as anaerobic digestion of food, animal and human waste that has a net positive environmental and climate impact, the same cannot be said for many bioenergy and biofuel projects and technologies globally.

WWF-Australia recommends that the Tasmanian Government should not actively pursue the development of a bioenergy industry. Firstly, it is not needed to meet Tasmania's energy needs. Secondly, there are higher quality uses of plantation fiber than burning it for heat or electricity. Thirdly, international experience shows that by establishing a bioenergy industry it is likely that it will create demand for woodchips or other biomass material that goes beyond current waste streams (as indicated in the draft *Tasmanian Renewable Energy Action Plan*) and is thus unsustainable, with huge potential environmental implications from further deforestation and forest degradation.

⁷ It should be noted that wind farms across Australian and around the world are responsible for very few bird deaths and significantly less than [cats, buildings and trucks](#).

⁸ Two organisations that specialise in community engagement and benefit sharing in the renewables industry are the Australian Wind Alliance and Community Power Agency.

5. Positioning Tasmania to become a Renewable Powerhouse

Renewable energy and other zero-emission technology solutions, including renewable hydrogen, are clear solutions to climate change, helping countries and industries move away from carbon polluting alternatives. However, that does not mean these technologies and associated infrastructure come without other environmental and social impacts. It is essential that as we transition to clean energy, new clean industries, including hydrogen, are developed sustainably. We need to make all efforts to reduce or eliminate negative environmental, social, health and safety impacts and externalities. Opportunities for co-benefits and net-positive sustainability outcomes should be actively pursued.

Concerning hydrogen, there are three major issues that WWF-Australia believe must urgently be addressed that are outlined in more detail below.

5.1 The power of attraction: leaning in on the MONA effect

Over 2018/19, Tasmania's was the fastest growing economy in Australia, with 3.6% growth in GSP – the best in fifteen years, the best employment growth in the country, and the population increasing [at its fastest rate in over a generation – 1.1% YoY](#). Key amongst the drivers for these achievements has been the emergence of new “attractors”, increased numbers of high-end tourism businesses and activities, MONA and Tasmania's other excellent cultural sector attractions (festivals, TMAG, east coast drive etc), and boom in the popularity of Tasmanian goods – e.g., wine, whisky, cider, seafood, high end manufactured goods. A boom in construction has followed, with new residents and new businesses helping fuel growth.

While COVID-19 has dented Australia's economy broadly, the underlying drivers of the Tasmanian boom have not changed, and the state's economic success is likely to continue once state and national borders are reopened, with further potential growth as major employers in mainland capitals discover the potential of remote work. Tasmania is well-placed to leverage this, with good lifestyles and high-quality internet attracting precisely the “raw urbanites” and “erudites” that Brand Tasmania seeks to attract.⁹ Setting and then working to achieve a high renewable energy target will lean in on this advantage, noting that this is likely to be well-received publicly.

A high target has the capacity to act as a magnet for talented people, business and innovative industry, helping drive economic growth. Renewable energy's capacity to position a brand positively can be seen by the rush of major companies to commit [to RE100+ targets](#), to set near zero emissions targets, or even set far more ambitious targets - as per the Tasmanian government's trailblazing leadership. Over 250 major global corporations have committed to powering their operations with 100% renewable energy. Australian members of the RE100¹⁰ initiative include Australia's major banks, Telstra, Aldi, Lion Brewing (owners of Boags, XXXX, Hahn etc). Tasmania's high renewable targets can help attract innovative and forward thinking business to Tasmania. Indeed, this phenomenon can already be seen, with Sanjeev Guptas's recent purchase of [TEMCO at Bell Bay](#). Importantly, high renewables targets will have this impact in a way that fits well with Tasmania's history and culture.

With a proactive approach, Tasmania can join other world-leading countries and jurisdictions that are blessed with high quality hydro resources, to leverage their near 100% renewable energy status, into a first mover advantage in other clean energy and environmental opportunities. For example, Norway has built off its hydro industry to become the acknowledged world leader in [electric vehicle uptake](#).

⁹ <https://www.tourismtasmania.com.au/marketing/campaigns/brand-launch/faqs>

¹⁰ The [Business Renewables Centre](#) which was cofounded by WWF, works closely with the RE100 supporting its members to access renewable PPAs.

5.2 Climate legislation as a business attractor

Recommendation 7: Expedite the Climate Change Act community consultation process, including consultation on:

- **Bringing forward Tasmania's net-zero emissions target to 2040.**
- **Undertaking carbon budgeting in line with the Paris Agreement and the best available climate science to set interim (2025 and 2030) climate targets.**
- **The development of climate mitigation plans for every sector of the economy, and in those plans identifying co-benefits to action.**

Increasingly, economic competitiveness will align with international decarbonisation efforts as the Paris agreement and global business commitments help lower carbon pollution globally. The Tasmanian Government government's draft *Renewable Energy Action Plan* maps out a direction that can drive Tasmanian economic growth and meaningful climate action while also contributing to national energy security. By complementing The Plan with ambitious climate legislation, the Tasmanian Government will signal that addressing climate change is a priority. This in turn will help create the impetus for greater investment in clean energy solutions and domestic markets for products and services that may also have international markets, while signaling to global investors and companies looking for low-risk low-carbon opportunities that Tasmania could be a good location in which to invest.

WWF-Australia commends the Tasmanian government's commitment to undertake community consultation on an ambitious net zero emissions target and an update of the Climate Change Act and would welcome the opportunity to be involved.

5.3 Leveraging the expertise created

Recommendation 8: Expand the focus of the proposed Renewable Energy Centre for Excellence to the expertise that will be developed in clean manufacturing and other priority end-use sectors.

One of the six renewable export opportunities WWF-Australia has identified is in expertise. Tasmania has a track record of successfully leveraging its expertise in hydro power into export jobs. For example, Entura a subsidiary of Hydro Tasmania is an engineering consultancy that provides renewable energy expertise internationally. The Tasmanian Government should continue to pursue this approach with the next wave of renewable energy development, translating a first mover advantage in renewable hydrogen and the decarbonisation of industry into training, consulting, innovation and other business and jobs opportunities that other states and other countries will find valuable.

WWF supports the series of measures identified in the Draft Plan including a Renewable Energy Centre for Excellence and the Blue Economy CRC, that aim to translate the deployment of renewable generation into training and expertise-based opportunities. However, we encourage the Tasmanian Government to look at ways to support and leverage the expertise that will be developed in the end-use sectors, particularly where Tasmania already has a strong skill base to build on, for example, clean shipping and electrifying heavy industry.

For more information contact:



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Appendix A: Tasmanian Renewable Energy Target Assumptions

WWF-Australia engaged Acacia Sustainability to undertake supporting research into the Tasmanian energy market used through this submission, including the renewable opportunity analysis. The assumptions and methods used to calculate the figures in this submission are set out in this Appendix. More information about Acacia Sustainability is available at www.acaciasustainability.com or from info@acaciasustainability.com.

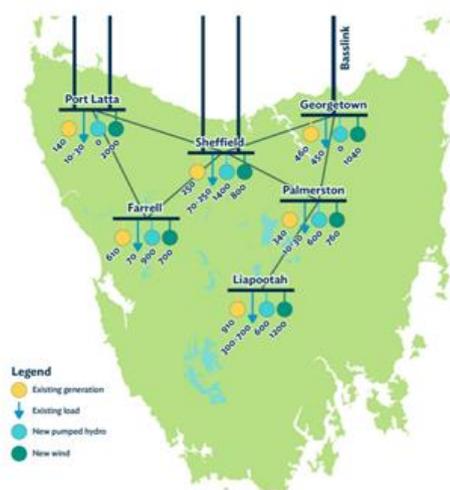
Capacity Factor: Throughout the calculations by Acacia Sustainability, a capacity factor of 44% was used. The capacity factor was calculated by dividing the total renewable energy produced in Tasmania in 2019 as reported in the Australian Energy Statistics, 2020 (Department of the Environment and Energy, 2019) by the renewable energy capacity of Tasmania as reported in AEMO's Integrated System Plan (AEMO, 2020) multiplied over a year as seen in the below formula:

$$\text{Capacity Factor} = \frac{\text{Generation (GWh)}}{\text{Capacity (GW)} * 8760}$$

$$44\% = \frac{10,173 \text{ (GWh)}}{2.632 \text{ (GW)} * 8760}$$

Renewable Resource Availability: [AREMI](#) maps Australia's renewable energy potential. Hydro Tasmania have used this data as well as other sources to model the potential for renewable energy generation in Tasmania (Figure 3).

Figure 3: Potential 5 Interconnector Strong Build-out Scenario with Indicative Interconnection (Hydro Tasmania, 2018)



Current Renewable Energy: Tasmania's 2019 renewable energy generation of 10,173 GWh as reported in the Australian Energy Statistics (Department of the Environment and Energy, 2019) was used as well as the current renewable generation capacity across Tasmania of 2.632 GW as reported in the Integrated System Plan (AEMO, 2020).

Estimated Export for 200% (2022 baseline): The Tasmanian Government have highlighted within the draft *Tasmanian Renewable Energy Action Plan* (Tasmanian Government, 2020) that the target of 200 per cent would be equivalent to 200 per cent of 2022 electricity generation levels which is suggested as a commitment to generate an additional 10,500 GWh per year by 2040.

Using the calculated capacity factor of renewable energy currently in the Tasmanian energy system of approx. 44 per cent, it is assumed that an additional 2.6 GW of renewable generation would be required to meet the 200% target.

Additional Generation for Electrification:

Australian National University – The Australia National University (ANU, 2020) have estimated an energy demand of 14 TWh from electrification for Tasmania (fully decarbonised electricity system along with electrification of heating, transportation and industry, excluding aviation and shipping).

Subtracting the current renewable energy generation of 10.8 TWh from the ANU's estimated 14 TWh leaves 3.2 TWh of additional generation to electrify Tasmania's energy system (excluding aviation and shipping). Using the capacity factor calculated of 44 per cent, results in an additional 0.8 GW of renewable energy capacity to cover the additional demand.

Acacia Sustainability – Considering Tasmania's energy demand for natural gas and refined products by industry as reported in the Australian Energy Statistics (Department of the Environment and Energy, 2019), a ratio of direct fuel energy to electrical energy (GJ switched: GJ) was applied to estimate the electrified energy demand. A ratio of 3.6:1 for mining and 2:1 for all other subsectors as identified by ClimateWorks was used (ClimateWorks, 2020).

This resulted in an additional electricity demand of 7 GWh to decarbonise Tasmania's energy usage. Applying the capacity factor of 44 per cent, this results in 1.8 GW of additional renewable energy capacity required.

Table 2: Estimated Electricity Demand by Totally Decarbonising Tasmania's Energy Use

Industry	Energy Demand (PJ) ¹¹			Electrified Energy Demand (PJ) ¹²			Electrified Energy Demand (GWh)			
	Natural gas	Refined products	Electricity	Electrification of Natural gas	Electrification of Refined products	Electricity	Electrification of Natural gas	Electrification of Refined products	Electricity	Total Electricity Demand
Agriculture	0.0	3.7	0.3	0.0	1.9	0.3	2.4	516.1	81.7	600.1
Mining	0.0	1.6	1.6	0.0	0.4	1.6	1.8	122.0	431.1	554.9
Manufacturing	4.5	5.2	23.4	2.3	2.6	23.4	628.9	727.5	6,506.9	7,863.3
Electricity generation	8.6	0.2	3.1	4.3	0.1	3.1	1,193.6	31.3	855.0	2,079.9
Construction	0.0	1.5	0.0	0.0	0.8	0.0	0.0	209.0	0.8	209.9
Transport	0.0	23.1	0.0	0.0	11.5	0.0	0.4	3,207.8	12.5	3,220.7
Gas supply	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.7	0.3	1.3
Water and waste		0.0	0.3		0.0	0.3	0.0	0.6	83.3	83.9
Commercial and services	0.1	1.2	7.3	0.0	0.6	7.3	12.2	160.4	2,028.6	2,201.3
Residential	0.1	0.9	8.4	0.1	0.4	8.4	15.0	118.6	2,320.0	2,453.6
Other		0.4			0.2		0.0	61.1		61.1
Total	13.4	37.8	44.4	6.7	18.6	44.4	1,855	5,155	12,320	19,330

Renewable Ammonia for Shipping: The current consumption of bunker fuels related to Tasmania's international and coastal consumption was used as reported in the Australian Energy Statistics (Department of the Environment and Energy, 2019).

A total of 673,000 GJ of bunker fuel was found to be used. To calculate the tonnes of renewable ammonia required to produce the same amount of energy, a Lower Heating Value for ammonia of 18.6 GJ/t was used and found 36,183 tonnes of ammonia would be required.

¹¹ (Department of the Environment and Energy, 2019)

¹² Calculated using ClimateWorks identified ratio of direct fuel energy to electrical energy (GJ switched: GJ): 3.6:1 for mining and 2:1 for all other subsectors.

The current best available technology to produce green ammonia requires 10 MWh of renewable energy per tonne. Applying this factor results in an electricity demand of 362 GWh. When applying the capacity factor of 44 per cent, a total of 0.09 GW of renewable generation would be required to produce the green ammonia.

Export Opportunities: If Tasmania built an additional 2 GW's of renewable energy to support international export opportunities in the form of ammonia, hydrogen or heavy industry, this would result in additional generation of 7,709 GWh after applying the capacity factor of 44 per cent.

Jobs: Assuming the 2.5 GW battery of the nation project for pumped hydro with the balance wind projects, up to 29,200 construction jobs have been estimated and 1,080 operations jobs.

Table 3: Estimated Jobs

	Jobs Factors ¹³		6.5 GW		5.6 GW	
	Construction	Operations	Construction	Operations	Construction	Operations
	Job Years/MW	Jobs/MW				
Pumped Hydro	7.2	0.08	18,000	200	18,000	200
Wind	2.8	0.22	11,200	880	8,680	682
Total			29,200	1,080	26,680	882

References

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Appendix B: Renewable Energy Industrial Precincts Briefing Paper

Provided as an attachment

¹³ (UTS Institute for Sustainable Futures, 2020)