UNIVERSITY of TASMANIA

A blueprint for a climate-positive Tasmania

A SUBMISSION TO THE REVIEW OF TASMANIA'S CLIMATE CHANGE ACT AND CLIMATE ACTION PLAN

Prepared by the
Tasmanian Policy Exchange
at the University of Tasmania
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This submission has been prepared by the Tasmanian Policy Exchange (TPE) at the University of Tasmania.

The TPE has been established to enable the University of Tasmania to make timely and informed contributions to key policy debates occurring in Tasmania thus making a positive contribution to the future of our state and its people. This submission provides a blueprint for climate action to maximise the long-term benefits for the Tasmanian community.

The TPE is grateful to the many researchers and staff across the University who contributed their time and expertise to the preparation of this submission.

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Executive Summary

Climate Change is the greatest contemporary challenge facing humanity and demands a concerted and comprehensive response encompassing individual, community, business and government action.

As the global economy recovers from the COVID-19 crisis there have been unprecedented commitments to more ambitious emissions reduction targets and investment in low-carbon technology and infrastructure to support economic growth and help address the worsening climate crisis. As of April 2021, more than 110 countries, accounting for more than 85 percent of global economic output, have made net-zero pledges.

Much of the attention focuses on international agreements and national emissions targets but there is also growing recognition that state and regional governments have a critical role to play in promoting climate action. Indeed, some of the most significant initiatives aimed at reducing emissions and preparing for the impacts of climate change have been at the subnational level.

The current review of Tasmania *Climate Change Act* and the associated *Climate Action Plan* is timely given this critical juncture in global climate action provides Tasmania with an important opportunity to consolidate and capitalise on its world-leading carbon emissions profile and renewable electricity assets.

However, Tasmania cannot be complacent. This submission argues that Tasmania's climate action strategy must include more ambitious sectoral emissions reduction targets and comprehensive, sector-specific climate adaptation strategies to build our reputation as a resilient, competitive and prosperous climate-positive economy.

A commitment to a 'climate positive' Tasmania will not only ensure that Tasmanians are making an important contribution to addressing climate change but a more systematic focus on adaptation will also help reduce the impacts of unavoidable climate change on the Tasmania's and communities and environment.

Specifically, a 'climate-positive' approach to climate action involves:

- A commitment to maintain the net negative emissions profile Tasmania first achieved in 2016 over the medium to long term to ensure that Tasmania is making a sustainable, long-term contribution to reducing atmospheric CO2.
- The development and implementation of detailed adaptation plans to reduce the impacts of unavoidable climate change on the Tasmanian community and environment.
- The promotion of innovation and investment in low and zero-carbon technology, products and practices to underpin future economic growth and to further reduce emissions in Tasmania and beyond.

Despite the clear costs and risks of global warming, being a leader on climate action also provides opportunities given the accelerating global transition to low-carbon technologies and processes. Tasmania has the potential to capitalise on its climate-positive status to attract investment, industries and people seeking to contribute to a more sustainable low-carbon world.

This submission has been informed by the research and analysis of experts from a range of academic disciplines across the University of Tasmania who share a commitment to practical, evidence-based climate action in the long-term interests of all Tasmanians.

The aims of the submission

Reflecting the guidance provided in the Tasmanian Government's opportunities paper on *Developing a Climate Change Action Plan for Tasmania* and the discussion paper prepared for the Independent Review of the *Climate Change Act*, this submission has two broad aims:

- To present the most recent scientific evidence on the likely climate challenge facing Tasmania.
- Inform the development of the next Tasmanian *Climate Change Act* and the associated *Climate Action Plan* to ensure that Tasmania attains climate-positive status and can continue to credibly claim to be an international leader on climate action.

More specifically, and reflecting a climate-positive strategy described above, the submission argues that Tasmania should adopt legislated sectoral emissions targets to deliver a 50% reduction in gross emissions by 2030, from 2005 levels, for the transport, energy, industry, agriculture, and waste sectors.

Tasmania's sectoral emissions and 2030 targets (kt CO2-e)
(data source: State and Territory Greenhouse Gas Emissions 2020. Detailed analysis is provided in Part 2)

Sector*	2005 emissions	2018 emissions	2030 target	% reduction on 2018
Energy	1960	2245	980	56%
Transport	1852	1587	926	42%
Industrial processes	1531	1719	766	55%
Agriculture	2281	2294	1141	50%
Waste	405	354	203	43%

These targets are consistent with international best practice and would drive innovation and emissions reduction across the entire Tasmanian economy while reducing dependence on land use credits, thereby maintaining a climate-positive emissions profile over time. The analysis of specific targets is presented in Part 2 of the submission and evidence-based strategies for reducing sectoral emissions are described in Part 3.

Climate modelling suggests that even under the best-case scenario, Tasmania will experience warming of at least 2 degrees C relative to long-term averages, with increased incidence and severity of extreme weather events by the second half of the century. Given these significant and unavoidable impacts, the next Tasmanian *Climate Change Act* and *Climate Action Plan* should commit to building on existing policies and programs to develop comprehensive climate adaptation strategies for key community sectors and ecological systems. Evidence-based climate adaptation strategies designed to promote resilience and reduce climate impacts in Tasmania are presented in part 4 and the submission concludes with a summary of recommendations which should be considered during the development and implementation of Tasmania's next *Climate Change Act* and *Action Plan*.

Climate action is challenging and requires a committed, collective response that promotes individual, community and business action supported by public policy and investment. While technical, political, and economic barriers to effective climate action abound, Tasmania's COVID-19 response demonstrated how governments working closely with communities can successfully develop and implement an effective response to an unprecedented crisis. Given our assets, expertise and growing community-wide commitment Tasmania can become an example to the world on climate action. Our hope is that this submission contributes to achieving that goal.

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1.1: Introduction - the climate challenge

Climate change is an existential threat that requires urgent action. Evidence suggests that in the absence of new strategies to mitigate climate change, global warming may exceed 3°C by the end of the century. This would be catastrophic for life on this planet. In the face of this threat, governments, businesses, communities and individuals around the world are mobilising to reduce carbon emissions.

Growing concerns about the extent and impact of global warming are driving the development of new, comprehensive, and ambitious climate action strategies by governments the world over. These climate action plans establish policies to reduce carbon intensity and drive the transition to clean energy sources while preparing communities for the risks associated with unavoidable climate change. These risks include increased frequency, duration, and intensity of extreme climatic events such as drought, bushfire, extreme rainfall and storm activity. Significantly, climate action strategies also promote innovation and investment in low-carbon technologies, infrastructure, and industries which provide jobs and promote long-term prosperity. Finally, given the scope and magnitude of the climate change challenge, there is a growing recognition that climate action must be 'mainstreamed' as central consideration in decision making across all levels of government, business and the community.

At this critical juncture, there is cautious optimism at the international level that a combination of more ambitious multilateral agreements, unilateral commitments and technological developments may at last curb growing greenhouse gas (GHG) emissions and slow the rate of global warming later in this century. Over the last decade, the cost of renewable energy technologies has fallen by as much as 90% and capital markets and entrepreneurs are actively seeking low-carbon investment opportunities. At the same time carbon-intensive industries and businesses are being forced to disclose their emissions while being subjected to a range of environmental taxes. The beginning of this long-overdue response represents a gradual shift towards true recognition of the cost arising from use of fossil fuels and carbon-intensive industry and development.

Also, political momentum for more ambitious climate action is building ahead of the next UN Climate Change Conference in Glasgow in November 2021 and, following the Biden Administration's commitment to achieve net-zero emissions by 2050, more than 110 countries, accounting for more than 85 percent of global economic output, have made net-zero pledges.

The current review of the *Climate Change (State Action) Act 2008* (Tas) (henceforth '*Climate Change Act*' or '*the Act*') and the Tasmanian *Climate Action Plan* ('*Action Plan*') provide a timely opportunity to clearly establish Tasmania as a leader on climate action and a global example of how to transition sustainably towards a climate-positive economy. Consolidating and promoting Tasmania's position as an international leader on climate action will require committed leadership and a concerted community-wide effort but, if successful, could firmly establish the state as an innovative, prosperous and sustainable island at the forefront of responding to climate change.

This submission has been prepared by a team of researchers from the University of Tasmania with expertise in a wide range of relevant disciplines. Reflecting the University's commitment to make informed, evidence-based contributions to issues that are central to Tasmania's future, the submission proposes pragmatic insights and policy options to inform the next iteration of the *Climate Change Act* and associated *Action Plan* which, if adopted, would firmly establish Tasmania as a credible leader on climate action.

TASMANIA'S 2030 CLIMATE ACTION VISION

Climate change is the most complex challenge currently facing the planet, and a comprehensive climate strategy should be informed by a clear vison and set of principles that can be used to set priorities and guide the implementation of the plan. The overarching vision that informs this submission is:

To ensure Tasmania remains a leader on emissions reduction, in developing and deploying low and zero carbon technologies and practices and in preparing for the impacts of unavoidable climate change. These measures will contribute to building a competitive and prosperous climate-positive economy.

To achieve this vision the *Climate Change Act* and *Action Plan* should:

- Ensure that Tasmania retains its net-negative emissions status and develops and promotes a broader 'climate-positive' strategy for Tasmania
- Follow established best practice and develop legislated medium-term (2030) sectoral emissions targets and adaptation plans to enhance accountability and to ensure emissions reduction and climate change preparedness across the Tasmanian economy and community
- Ensure the provision of robust data on Tasmania's emissions performance and state-level climate outlook to assess progress, inform decision making and promote climate awareness
- Promote collaboration between individuals, communities, business and all levels of government. Effective climate action requires a coordinated, collective effort

ADOPTING A SECTOR-BASED APPROACH TO ESTABLISHING A CLIMATE-POSITIVE TASMANIA

This submission argues that Tasmania should aspire to become a world-leading climate-positive economy. A 'climate-positive' approach (see Part 2.1) involves a commitment to maintain the net-negative emissions profile Tasmania first achieved in 2016 (net-zero in 2015) over the medium to long term to ensure that Tasmania is making a long-term contribution to reducing atmospheric CO2. Beyond this commitment to emissions reduction a climate-positive approach also requires the development and implementation of detailed adaptation plans to reduce the impacts of unavoidable climate change on the Tasmanian community while promoting innovation and investment in low-carbon technology, products and practices which can be used to further reduce emissions in Tasmania and beyond.

A sectoral approach to emissions reduction (including legislated targets) and climate adaptation is required to achieve a climate-positive outcome over the longer term. As is explained in greater detail in Parts 2.2 and 2.3, it will be important to reduce emissions across the entire Tasmanian economy to maintain a net-negative emissions profile as land-use credits decline over time. A sectoral, or systems-based, approach to adaptation and likely climate risks is necessary given that climate change will impact on different communities, industries and social and ecological systems in different ways. Given the need to develop sectoral strategies the report outlines sector-specific emissions targets and mitigation and adaptation strategies.

OUTLINE OF THE SUBMISSION

Parts 1 and 2 are guided by and respond to the discussion questions contained in the Jacobs Independent *Review of the Tasmanian Climate Change Act* and the associated *Options Paper* published by the Tasmanian Climate Change Office.

This Part 1 of the submission provides an overview of the climate change challenge facing the planet including the outlook for the Tasmanian climate. It concludes with a summary of the key elements of a nation-leading *Climate Change Act*. This part, as noted above, makes the case that Tasmania should legislate a sector-based approach to greenhouse gas mitigation and climate adaptation to ensure its status as a national leader on climate change.

Part 2 of the submission provides more detailed analysis of specific 2030 Tasmania sectoral-level emissions targets that should be legislated to enable Tasmania to maintain status as a leader on climate action. Specifically, Part 2 advocates a legislated, uniform sectoral reduction targets set at 50% of 2005 CO2-equivalent emissions levels.

Parts 3 and 4 of the submission are guided by the key questions in the Tasmanian Climate Change Office (TCCO) Opportunities Paper.

Part 3 describes practical sector-specific emissions reduction policies and strategies that can help achieve the sectoral emissions reduction targets which we believe should be included in the next iteration of the *Climate Change Act*. Sectoral targets will also drive innovation and help establish Tasmania as a national leader in the transition to a low-carbon economy.

The final part of the submission (Part 4) focuses on minimising the environmental, social and economic impacts of unavoidable climate change and outlines a number of practical sectoral, or 'systems-based', climate adaptation approaches and policies that could be implemented to achieve the plans developed under *the Act*.

1.2 The increasing impact of climate change

1.2.1 BACKGROUND

Climate change is already having a profound impact on the planet and human activities. Over the last 150 years, atmospheric carbon dioxide levels have increased from 280 to 414 parts per million resulting in approximately 1.0° C warming above pre-industrial levels (Figure 1.1).[1]

While there is some local variation in annual mean temperature, this global trend has also been evident in Tasmania over the last half a century (Figure 1.2).

Tasmania has an extremely varied landscape, ranging from cool-temperate to alpine climates, which requires more granular, regional climate modelling than is available from global circulation models. This was recognised in the 2000s when the Climate Futures for Tasmania (CFT) Project (2008-2011) brought together state-of-the-art climate modelling with extensive stakeholder consultation and community engagement to provide climate information essential for planning for Tasmania's future. At the time, the downscaled information was at the finest spatial and temporal resolution available in Australia, establishing Tasmania as a leader in the application of regional climate information to identify emerging climate risks. Impacts of the research were wide-ranging, including improved infrastructure development, water allocation policies and natural disaster management, and more efficient and effective planning for agriculture, public health, biodiversity conservation and industry investment.

The Climate Futures for Tasmania projections were completed in 2011 using the most up-to-date climate models available at the time. The global climate models came from the archive of Phase Three of the Coupled Model Intercomparison Project (CMIP3), which coordinated the work of modelling groups from around the world to provide the scientific basis for the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change.[2] Since then, two new archives of climate models have been released, the CMIP5 and CMIP6 model archives. The general trends in future climate described in the new climate models have not changed, but there are some important differences in climate sensitivity and the seasonality of precipitation and extremes in the latest models.

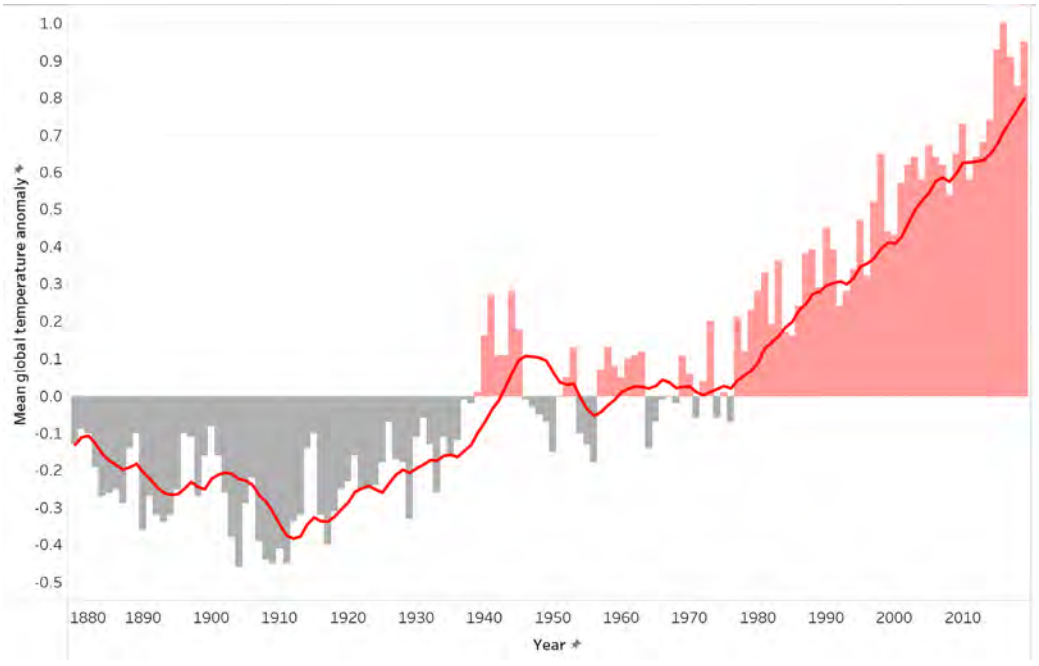


Figure 1.1: Global land and ocean temperature anomalies, 1880-2021
(data source: National Oceanic and Atmospheric Administration 2021)

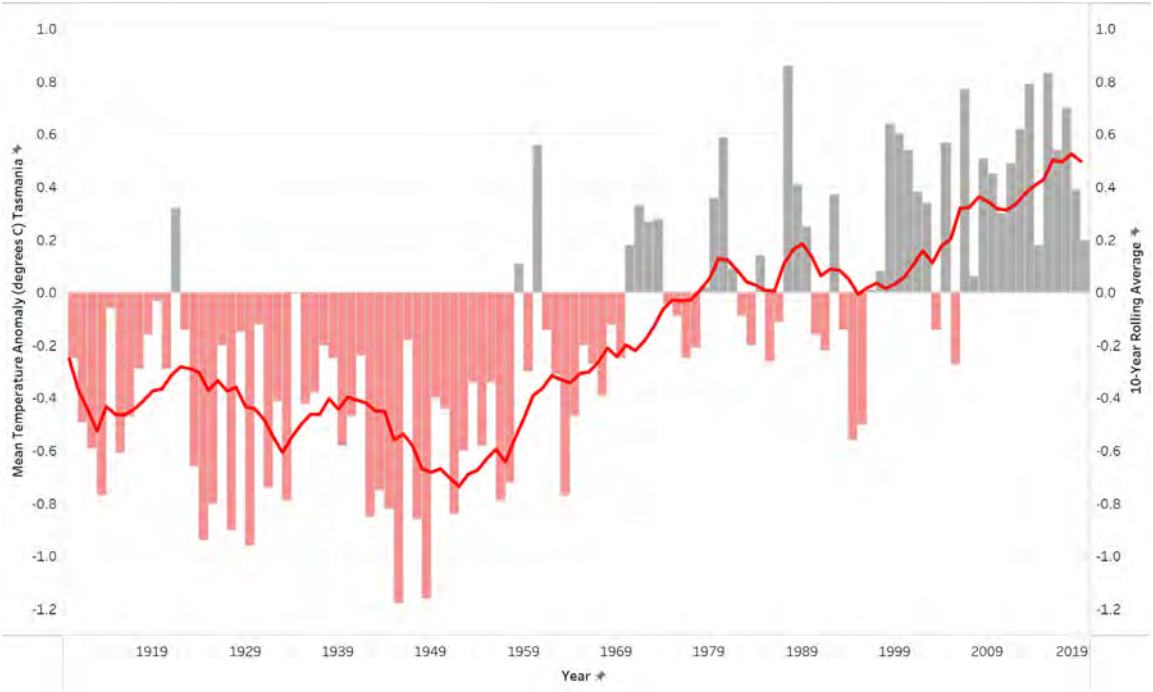


Figure 1.2: Tasmania's annual mean climate temperature anomaly, 1920-2020
(data source: BOM 2021)

Given the advances in technology since 2011 and the importance of updated and accurate information on Tasmania's changing climate, there is a real need for an update of the dynamically downscaled regional climate modelling, a decade on from the Climate Futures for Tasmania Project. Updated climate information would enable the assessment of climate change impacts on Tasmania's biosecurity, agriculture, tourism, Indigenous culture and water and energy security. With improvements in modelling, it is now possible to produce climate information at the scale of 1km, which would position Tasmania as the best prepared state in Australia and a leader in climate change impact science and adaptation across the world.

Since the CFT project, there have been numerous focused studies (either on specific regions or for specific sectors), but these have not provided general climate assessments across the entire state. Nevertheless, these more recent studies do contain insights that are expected to be transferrable across the state and have been used to inform the analysis presented below. The CFT project outputs are still the most current analyses available for terrestrial decision-making. For coastal and marine analyses, these are more closely linked to global circulation models and have evolved as the Coupled Model Intercomparison Project (CMIP) archives have become available.

1.2.2 TASMANIA'S CLIMATE OUTLOOK

Temperature

Tasmania is virtually certain to experience a warming climate into the future. Compared to historic temperatures, by 2050 Tasmania is projected to experience an increase of at least 1.5°C, even under a low-emissions scenario.[3] After 2050, alternative emissions scenarios result in differing trajectories of change, with a rise below 2°C only possible in a low-emissions scenario (which includes dramatic emissions reductions from 2020 onwards; see Figure 1.7 below). In all other scenarios, projections show a greater increase,

Climate Futures

The Climate Futures program at the University of Tasmania manages and curates the highest resolution future climate projections available for Tasmania. These include: the Climate Futures for Tasmania archive, based on CMIP3, which is ~10km spatial and 6-hour temporal resolution; the Climate Futures for Australasia 2019 archive, based on CMIP5, which is ~10km spatial and 1-hour temporal resolution. These are dynamically downscaled using the CSIRO CCAM model to transform coarse-resolution global circulation model outputs into high-resolution limited-domain outputs of greater utility for decision

with the strongest warming trends projecting an approximate 3°C temperature rise across all locations in Tasmania and more than 4°C in alpine regions.[4] All scenario assessments indicate an increase in all types of high temperature extremes, including maximum daily temperatures, heatwave intensity and heatwave duration.[5]

Increased temperatures also result in an increase in the number of warmer days. For example, while Launceston experienced an average of 29 days over 25°C per year in 1961-1990, by 2070-2099 this is projected to be around 75 days per year, an almost three-fold increase. Furthermore, severe or extreme heatwaves currently occur in Launceston approximately once every two years. However, by 2100 this is projected to increase to two per year and be of far greater duration in a 'business as usual' scenario.[6]

Rainfall

It is likely that Tasmania will experience less annual rainfall into the future, however this is less certain than projections for temperature, fire danger and soil dryness given differences in projection models. While some models suggest a change in the seasonality of rainfall (with more rainfall in summer and autumn, less in winter and spring, and with minimal change annually),[7] this may be a best-case scenario for Tasmania. It is far more likely that there will be a gradual decrease in annual rainfall over Tasmania as the frequency of westerly, rain-bearing fronts decreases.[8] Additionally, there is growing evidence that regions across the state over 800m will experience less rainfall than currently experienced in response to a warming climate.[9]

Furthermore, as air temperatures rise, rainfall intensity increases—a well-known relationship known as the Clausius-Clapeyron equation.[10] However, a larger driver of rainfall intensity is the type of weather system that produces the rainfall. In Tasmania, it is an east-coast low event that typically carries the damaging, high-intensity rainfalls in populated areas that cause severe flooding.[11] In some models projecting a wetter scenario, it is the increase in the frequency of east-coast lows that balances the overall annual rainfall totals, at the cost of a dramatic increase in the frequency of higher-intensity rainfall events, particularly in the north-east, east and south-east regions.[12] In other models that project a drier scenario, there is also an increase in the frequency of east-coast lows, although not as large an increase as in the wetter models.[13]

Drought

Water is a major asset for Tasmania linked to livelihoods, energy production, irrigated and rainfed agriculture, environmental management and conservation. Competing demands for water intensify during droughts. Indices of meteorological and agricultural drought generated through fine-scaled climate projections indicate that the episodic and regional nature of drought events in Tasmania will continue.[14] It is predicted that by 2070-99, rainfall in autumn and summer in western Tasmania will have declined by 10-20%, with the east coast of Tasmania being especially prone to drought.

Soil dryness

All assessments project a gradual decrease in soil moisture into the future, as measured by the Soil Dryness Index.[15] This is largely driven by evaporation in models projecting a wetter scenario, and by a combination of evaporation and reduced rainfall in models projecting a drier scenario. The largest absolute changes are in the wettest regions (where there is more water to evaporate), whereas the largest percentage changes are in the drier regions (where small changes in volume result in larger percentages).

Increased soil dryness will impact agricultural productivity and sustainability and is a major contributor to bushfire risk. As such, an increase in soil dryness results in an increase in bushfire risk.

Fire danger

As a consequence of the climatic trends outlined above, the number and intensity of bushfires driven by anthropogenic climate change will increase. Modelling shows, for example: a steady increase in fire danger in Tasmania throughout the current century, with increased acceleration in the latter half of the century; an increase in the length of the fire season; and an increase in the number of days at the highest range of fire danger.[16] These fire events will also reduce the carbon storage capacity of forests, thereby exacerbating further climate change.[17]

Across Tasmania there are many landscapes with differing key fire weather influences.[18] In all cases, the drying of the landscape is increasing the risk of fire into the future. By the end of this century there will be twice the danger, over twice the area, twice as often. This is an 8-fold increase in fire risk.[19] All metrics indicate a lengthening of the fire season, with sharper transitions from winter to summer and vice versa.[20] This means the length of the 'fire management seasons' (late spring / early autumn) is projected to be reduced. Across the natural landscapes, some areas, including parts of the South-West Wilderness area (See figure below) are projected to become so much drier they will be experiencing fire risk for the first time in thousands of years (if ever).[21] The risk for human settlements is ever increasing, either directly from a drier landscape, more prone to ignite, or due to smoke being transported into settlements from fires burning in remote areas.[22]

The Black Summer Bushfires of 2019/2020 were unprecedented in both the area impacted and the variety of ecosystems across mainland Australia. Unfortunately, such events are to become increasingly common. The fire burned 7.2 Mha, representing some 42% of the total coverage of eucalyptus forests and woodland in eastern Australia. While the precise emission of carbon is unknown it is likely to be somewhere between 0.31 and 1.03 Pg.[23] Similarly, the impacts of climate change in the form of bushfires are having an increasing impact on Tasmania's environment (Figure 1.3), including on our

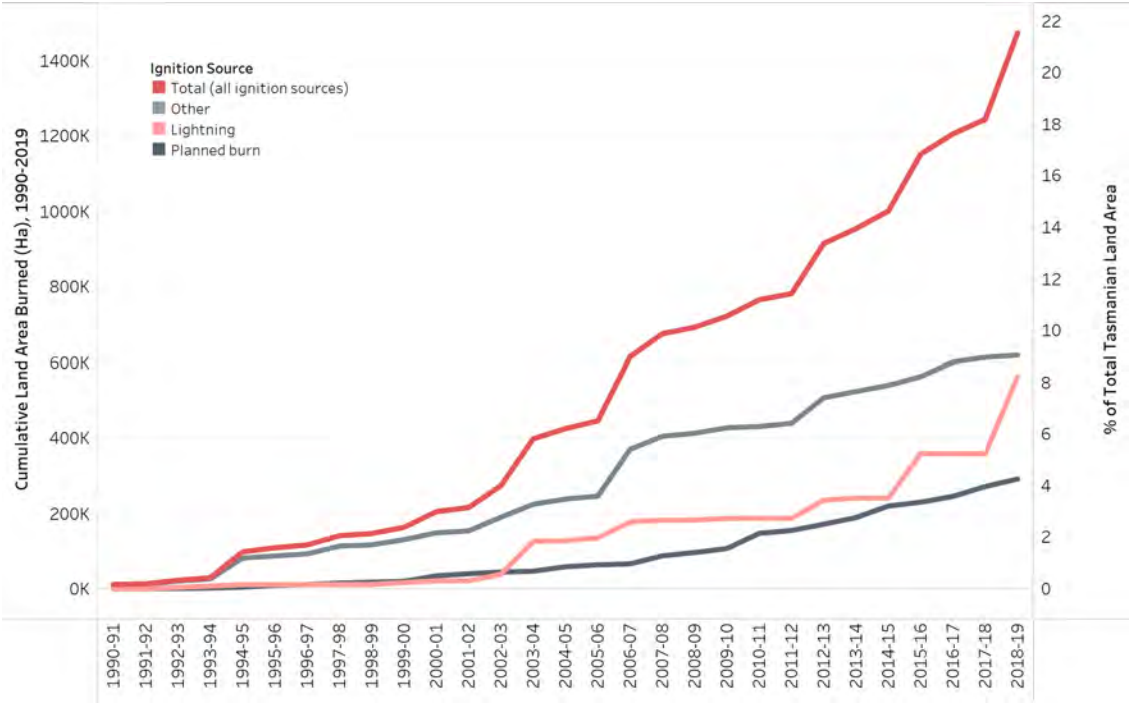


Figure 1.3: The percentage of Tasmania burned from fire, 1990-2019,
(data source: LIST; prepared by Grant Williamson)

Figure 1.4: Average number of fires per season Tasmanian South-West Wilderness Area
(data source: Styger et al. 2018)

Sea-level rise

Sea-level rise was the first climate change impact to be recognised internationally, with strong consensus around the rate of rise expected by the end of this century featured in the Third Assessment Report from the International Panel on Climate Change.[24] In Tasmania, sea-level is expected to rise by 0.8-1.0m by 2100,[25] exposing some low-lying regions with human and industrial settlements. Local governments responsible for these areas are mindful of this issue and developing community awareness and management responses. The Tasmanian Climate Change Office has been instrumental in coordinating the production of sea level rise allowances to inform new construction projects, which have been incorporated into operational processes in recent years.

Following this rate of sea-level rise, the exposed locations are projected to see a 1-in-100-year coastal inundation event move towards an event occurring almost every year (annual high tide). However, the areas managing these risks are small, well defined, and the rate of change means responses can be adequately managed.

Land ecosystems and threatened species

The IPCC has consistently identified threatened natural systems as some of the most vulnerable systems to climate change. Tasmania is home to a large number of threatened species (more than 650 animals and plants) and native vegetation communities (as at February 2021, there were 39 listed communities), and unique and threatened ecosystems such as the Tasmanian Gondwanan rainforest and alpine peat bogs.[26] The effects of a rapidly changing climate system will have a significant, and in some cases irreversible, impact on our natural environment. Increasing extreme weather conditions will impact animal numbers and distribution either directly, through thermal stress and fires, or indirectly, by influencing food or habitat availability. In contrast, extreme heavy rainfall events are associated with booms in rodent populations.[27]

Marine warming, heatwaves and ecosystems

While warming waters are occurring generally, waters around Tasmania represent a global warming hot spot (Figure 1.5). These warming waters have caused a widespread decline in giant kelp forests and the ecosystems that go with them. For example, since the 1980s declines in kelp of 95% have been recorded around Freycinet and Maria Island and a 98% decline around Bruny Island.[28] Further impacts of warming waters include Distribution southwards of other macroinvertebrates, such as octopus tetricus and eastern rock lobster. Tasmania's coastal ocean is associated

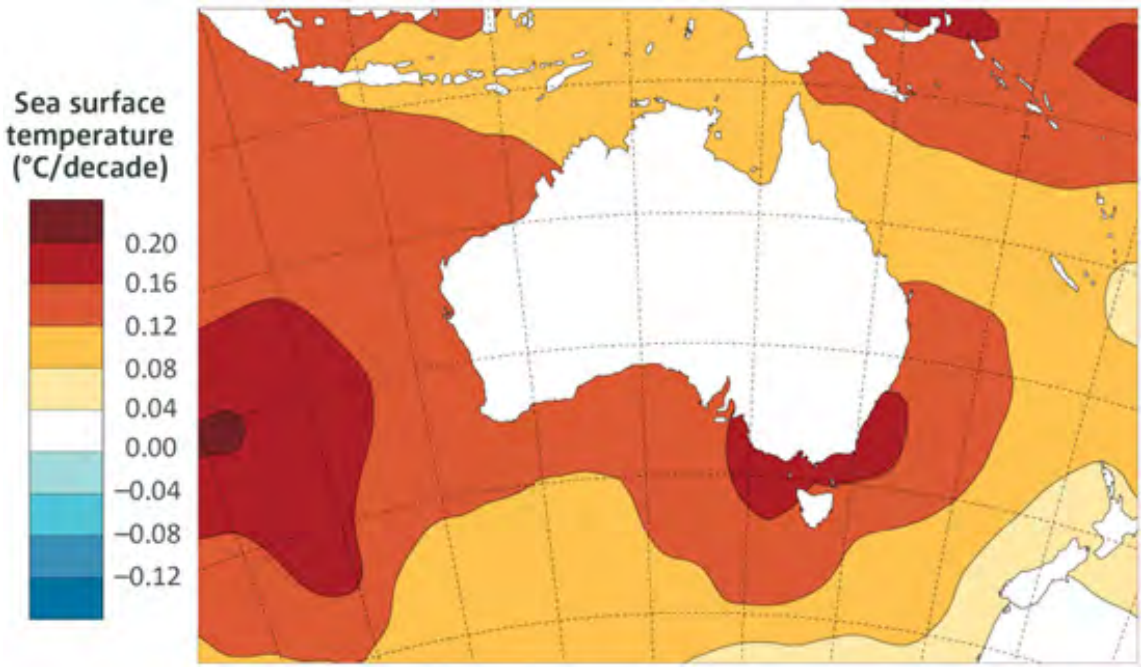


Figure 1.5: Trends in Australian sea surface temperatures, 1950 to 2017
(data source: BOM)

with more records of range shifting species than any other region of Australia's surrounding ocean. This includes dozens of fish species: at least 48 species have exhibited major distributional shifts, with at least 7 newly established species.[29] This warming has also allowed the incursion of sea urchins from more northerly waters, causing 'sea urchin barrens' - as they overgraze on available sea plants. The percentage of reef as barrens across eastern Tasmania has increased from 3.4% in 2001/02 to 15.2% in 2016/2017, equating to a ~10.5% increase per annum over the 15-year period.[30]

In addition to marine warming, Tasmanian waters have exerienced more intense marine heatwave periods, notably in the Tasman Sea over the summers of 2015/16 and 2017/18. Impacts of these heatwave events include evidence of mortality of black-lip abalone due to warmer waters as well as decreased performance of farmed Atlantic salmon.[31] These events have also led to the occurrence of new strains and species, such as Pacific Oyster Mortality Syndrome (POMS)).[32]

In short, the 'the combined influence of climate change on eastern Tasmanian rocky reefs, and the humans that depend on them, is already manifestly large'.[33]

According to research conducted by the NESP Earth Systems and Climate Change Hub, under a low emissions scenario, marine heatwave intensities in the Tasman Sea like those of the 2015/16 and 2017/18 events are expected to occur once every 15 years by the end of the century. Under the high emissions scenario, such events are expected to occur almost every year.[34]

Human health and wellbeing

Climate change impacts will have serious consequences for human health and wellbeing.

A growing number of prominent health bodies both locally and internationally, including the Australian Medical Association and the Australasian College for Emergency Medicine, are recognising the importance of this issue, declaring climate change a 'health emergency'.[35]

Direct impacts of climate change on health include illness, injury and even death as result of exposure to heatwaves, bushfires, cyclones, floods and severe storms (resulting from, but not limited to, heat stroke, burns, fractures and lacerations).

Indirect impacts are widespread and varied. They include (but are not limited to) emerging environmental challenges such as increased pollen and air pollution leading to various chronic medical conditions; loss of biodiversity, including an increase in pests; water and food insecurity (including the price and quality of food) due to the impact of extreme events and ocean acidification, resulting in reduced aquacultural and agricultural productivity.

Other indirect impacts of climate change include challenges to mental health as a result of displacement, trauma and migration and other social factors including decreased work capacity, increased levels of migration ("climate refugees"), and homelessness.

Research undertaken in Tasmania illustrates the effects of climate-induced heatwaves and bushfires on Tasmanian communities. In terms of Tasmanian heatwaves:

- Ambulance dispatches increase by 34% during extreme heatwaves, by 10% during severe heatwaves and by 4% during low-intensity heatwaves. Impacts are especially severe for the elderly, the young and for regions with the greatest socio-economic disadvantage.[36]
- Hospital emergency presentations increase by 5% across the whole population, by 13% for children 15 years and under, and by 19% for children 5 years and under.[37]

Tasmania has a greater proportion of elderly people, a greater proportion of those living with a chronic condition, and the highest proportion of those living in disadvantaged regions when compared to other Australian jurisdictions,[38] meaning the Tasmanian population is potentially more vulnerable to heat-related illness when heatwaves occur.

Research on Tasmanian bushfires and air quality illustrates that there are increases in mortality, asthma emergency presentations, cardiovascular disease hospital admissions and respiratory hospital admissions attributed to planned burns and bushfires.[39]

Table 1.1: Summary of climate change in impacts in Tasmania *(based on most likely scenarios)*

	Impacts
Temperature	Increase of 1.5 °C to 3°C temperature rise across all locations with more than 4°C in alpine regions by 2100.
Rainfall	Gradual decrease in rainfall, with changed seasonality of rainfall and areas of rainfall.
Drought	Increasing episodic droughts, especially on the east coast
Soil dryness	Gradual decrease in soil moisture
Fire danger	Steady increase in fire danger, with increased acceleration in the latter half of the century – an 8-fold increase in fire risk.
Sea-level rise	Rise in sea-level of 0.8 to 1.0 metre by the end of the century.
Land ecosystems and threatened species	Continued threats and some irreversible impacts to animal and plant species and their ecosystems
Marine heatwaves and ecosystems	Continuing warming of waters and heatwaves around Tasmania with effects including incursion of northerly species, destruction of giant kelp forests and reefs, decrease in size and production of abalone, salmon and lobster etc.
Human health and wellbeing	Impacts on health and wellbeing, including injury and death from direct effects, and illness and death from exacerbations of common chronic conditions, such as heart and lung disease

Climate Change Anxiety and Grief

Many climate change impacts are difficult to quantify, especially indirect effects such as mental health impacts. However, there is an acute need to acknowledge and address climate anxiety, especially among younger members of the Tasmanian community (Jones and Davison 2021). Climate anxiety/climate grief is occurring amongst young Tasmanians and comprises fear of a future impacted by climate change, feelings of being disempowered in the face of climate change, and a belief that positive climate action is not being undertaken by other generations. Other cohorts are vulnerable to climate change mental health impacts – this is especially the case for those whose livelihoods are threatened by extreme weather events and a warming environment, such as farmers. Vulnerable cohorts need to be included in collective approaches to climate action and need to feel that their concerns are taken seriously and acted upon by chief decision makers. Policy responses in this space require systems thinking approaches rather than exposure-outcome approaches common in environmental health research.

1 .3 International climate policy

Climate change is a global challenge that requires an international response. This response has been pursued under the United National Framework Convention on Climate Change (UNFCCC), established at the "Earth Summit" in 1992. There are now 197 countries that are parties to the Convention and meet at regular Conferences of Parties (COP) meetings to negotiate and commit to national emissions targets and associated strategies such as the Clean Development Mechanism and Emissions Trading to reduce global CO2 output in an efficient and equitable way. Furthermore, momentum on climate action has been given a further boost at the recent American-hosted Earth Day Summit where President Joe Biden pledged to slash US greenhouse gas emissions in half by 2030. Other countries, too, committed to new targets: Japan raised its target to 46 per cent by 2030, a 26 per cent increase; Canada raised its goal to 40-45 percent by 2030 below 2005 levels, up from 30 per cent. These commitments, when added to Britain and the European Union's commitments made prior to the Summit, mean that countries accounting for more than half the world's economy are now committed to keeping global temperatures from going above 1.5 degrees.[40]

Hopefully the global trend in addressing climate change is changing with countries becoming less reluctant to incur short-term economic costs for long-term survival benefits and disputing how the relative burden of climate action should be distributed between developed and less developed countries. Until recently, these tensions and the challenges of enforcing international agreements have contributed to a failure to reduce annual global CO2 emissions in a meaningful way (Figure 1.6).

The collective challenge facing humanity is two-fold.

Firstly, at the international level, jurisdictions need to commit to and meet more aggressive emissions reductions targets than those established under the 2015 Paris Agreement. Modelling now suggests that in the absence of more ambitious emissions reduction targets global warming may exceed 3°C by the end of the century with profound implications for natural ecosystems and humanity (Figure 1.7).[41] Notwithstanding the new Earth Summit commitments, recent pledges to reduce emissions beyond Paris commitments may reduce end-of-century warming to approximately 2.6 degrees. Clearly more needs to be done by governments, business and communities to avoid dangerous climate change.

Secondly, preparing for the myriad consequences of unavoidable climate change even under the most optimistic scenarios will require a concerted effort and sustained focus by governments and communities alike. Even a 1.5°C warming scenario will result in more

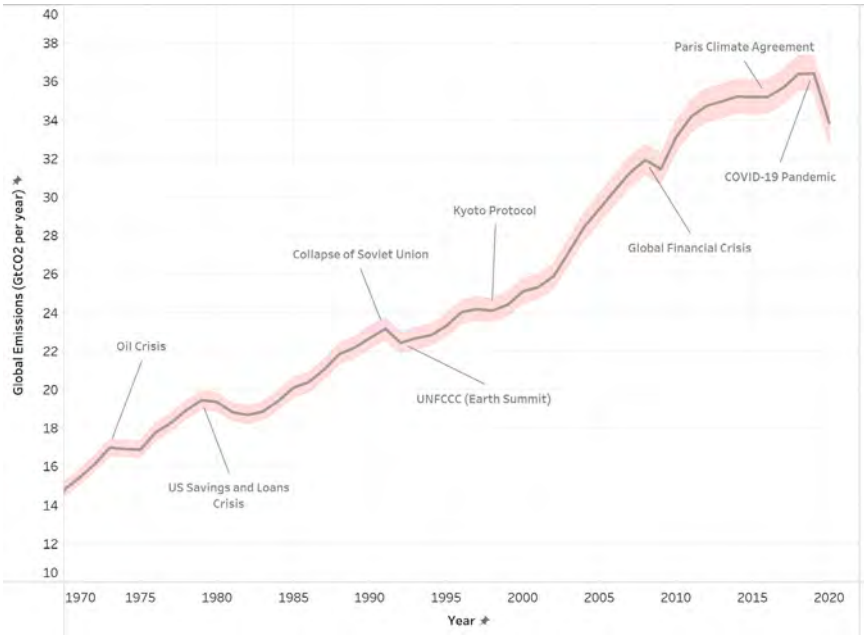


Figure 1.6: International events and carbon dioxide emissions rise
(data source: Le Quere, C. et al. 2020)

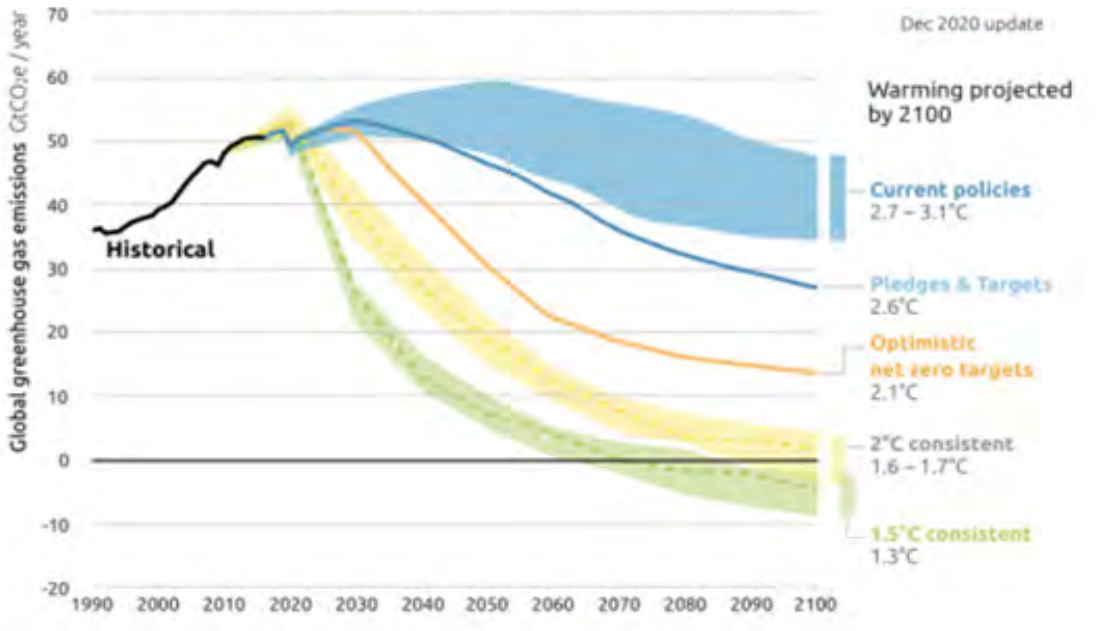


Figure 1.7: 2100 warming projections: Emissions and expected warming based on pledges and current policies
(source: Climate Action Tracker)

extreme weather events, a shift in rainfall patterns and an estimated 50cm sea-level rise as well as increased ocean acidity. Taken together, this will disrupt ecosystems and reduce biodiversity. In terms of impacts, climate change will affect agricultural production, increase the risk of natural hazards such as bushfire and floods, and have a negative impact on human health, livelihoods, food security, infrastructure and water supply, and economic growth.

Given the clear and growing impacts of climate change, developing comprehensive adaptation strategies to increase community preparedness for climate change must be a central element of Tasmania's next *Climate Change Act* and *Plan*. This is especially true for state governments given that most climate impacts are best managed at a regional or community level. The priorities for a comprehensive Tasmanian climate adaptation strategy are outlined in Part 4 of this submission.

Concerns about the generally slow progress of international climate negotiations and commitments highlight the important role that subnational governments can and must play in securing a low-carbon and climate-positive future.

1.4 Business response and low-carbon opportunity

Growing awareness of climate impacts combined with the inevitability of a transition to low- or zero-carbon technologies is also having a profound impact on business strategy and investment decisions. In recent years, the private sector response to climate change has been more significant and strategic than the policy response of many national governments in part because major companies and investors are more focused on the longer-term impacts and opportunities associated with climate change.

Several related factors are contributing to the growing business focus on climate change.

Reflecting growing community awareness and concern about climate impacts (1.5 below), consumer preferences are changing and demand for climate-friendly products and services is increasing.

Investors too are increasingly concerned about climate impacts and risks and are reluctant to invest in carbon-intensive industries. A key development in this regard has been the G20's establishment of a framework for reporting climate-related financial disclosures (Taskforce Climate-related Financial Disclosures or TCFD) for reporting likely future financial risks due to climate impacts. Given growing preferences for investing in transparent, climate-friendly businesses, the number of large companies which have adopted the TCFD since 2018 has increased from 580 to 1884 while the number of firms which have pledged to meet specific net-zero emissions targets under the Science-Based Targets Initiative (SBTI) has increased from 216 to 1250 over the same period.[42] While this growing commitment to emissions reduction and disclosure is heartening, it is also important to note that early adopters are dominated by less energy intensive and consumer-facing firms.

The transition to a low carbon economy is challenging for many energy-intensive firms but there are also significant opportunities for businesses and communities that can innovate and lead in the development and deployment of new technologies and practices to reduce emissions. As Larry Fink, the CEO of BlackRock, the world's largest funds manager recently stated, 'climate change and our response to it is already transforming both investment decisions and the structure of the global economy and the most profitable and successful firms over the next generation will be those who manage to lead in the transition to a low-carbon future'.[43]

Finally, business may be leading government action on climate change but in many cases corporate emissions reduction strategies have also been developed in anticipation of the more concerted policy efforts and public investment which are now being implemented. In late March, 2021 the Biden Administration announced a US 1$ trillion investment in emissions reduction over the next eight years with the goal of eliminating energy emissions by 2035 and achieving NZE by 2050. Similarly, in December 2020, the EU committed to reducing its 2030 emissions reduction to 55% below 1990 levels by 2030, a significant change from the previous target of a 40% reduction. More generally, as noted above, most national governments are focusing on climate change initiatives as central elements of their COVID-19 recovery strategies. Overall, the fact that businesses globally are facing growing demands from consumers, investors and governments to report and reduce emissions while developing low-carbon technologies and practices represents an economic opportunity for Tasmania which a world-leading *Climate Action Plan* will help realise.

The University of Tasmania's zero-carbon investment strategy

In late 2020, the University announced that it would divest from fossil-fuel exposed investment funds by the end of 2021. The University has committed to applying a negative investment screen to fossil fuels and a positive screen to companies and funds which contribute to the United Nations Sustainable Development Goals. Effective from the announcement, the University will make no further investment in companies or funds with exposure to fossil fuels.

"As a university that operates in an island place, we understand that we need to work with and not against our ecologies and ecosystems," University Vice-Chancellor Professor Rufus Black said. "We are now looking at a world where those people and places which are connected to the old carbon-based economy are vulnerable. Those places where people and companies are embracing the emerging low-carbon economies are thriving. We need to be an active part of this transition from the old carbon-based economy to a new zero-carbon economy" (University of Tasmania 2020)..

Building Tasmania's climate-positive brand

Building a reputation as an innovative climate-positive state will greatly enhance Tasmania's 'place brand' - an authentic and widely-held vision of our core values and aspirations which can be used to build a more prosperous, inclusive and sustainable community both in Tasmania and beyond.

Building a shared community-wide vision for Tasmania's long-term ambitions for addressing climate change will deliver significant social and economic benefits to all Tasmanians. The challenge is to create a connection between the high-level policy objectives and commercial imperatives central to Tasmania's *Climate Action Plan* and the aspirations and day-to-day concerns of members of the Tasmanian community. Detailed research conducted by Brand Tasmania with a broad cross-section of Tasmanians identified a strong commitment to climate action and alignment with widely held Tasmanian values, including being innovative and using natural resources in respectful and sustainable ways.

With careful and considered engagement and collaboration there is an opportunity to continue to foster grass roots community support for ambitious climate action in Tasmania. However, this will require a strong commitment to supporting community participation and engagement including grass roots programs to support 'being climate-positive' in a wide range of ways which are of relevance to Tasmanians and their communities.

Establishing an authentic climate-positive brand can be a powerful marketing tool, potentially delivering significant economic and social benefits.

Tasmania already has an international reputation as a jurisdiction which can offer quality wilderness and cultural experiences and an enviable lifestyle, a reputation which in recent years has underpinned our strong tourism and export performance and migration-led population growth. The *Climate Action Plan* and establishing Tasmania as a climate-positive economy has the potential to build on this existing brand and enhance Tasmania's reputation as a:

- place to visit and to live whether for tourism, education or for longer-term migration
- producer and supplier of sustainable, low-carbon products
- place to invest and innovate in renewable energy and low-emissions technologies, systems and products.

Achieving a credible and effective brand as leading climate-positive state requires more than marketing and acquiring formal recognition and certification, it demands deep engagement from across the Tasmanian community and commitment to changing practices over time.

1.5 Community support for climate action

Polling on climate change consistently indicates high levels of support for pro-climate policies, providing a clear mandate for action. In Australia, polls consistently show 70-80% of the population is worried about climate change. A January 2020 YouGov poll for the Australia Institute found 79% of people were concerned about climate change.[44] The 2020 Australia Talks National Survey (n=54,000) showed that 72% of Australians consider climate change a problem for them personally.[45] The Australia Institute's October 2020 Climate of the Nation Report established that 82% percent of Australians were worried that climate change would result in more extreme bushfires in Australia.[46] Seventy-one percent of respondents wanted Australia to be a global leader in solutions to climate change, and 68% supported a net-zero by 2050 target for Australia. The Lowy Institute has found similar results, with support for strong action steadily rising since 2012. Furthermore, in 2019 it found that 61% of Australians held the view that climate change is a serious and pressing problem and that steps should be taken to address it even if this involves significant costs.[47]

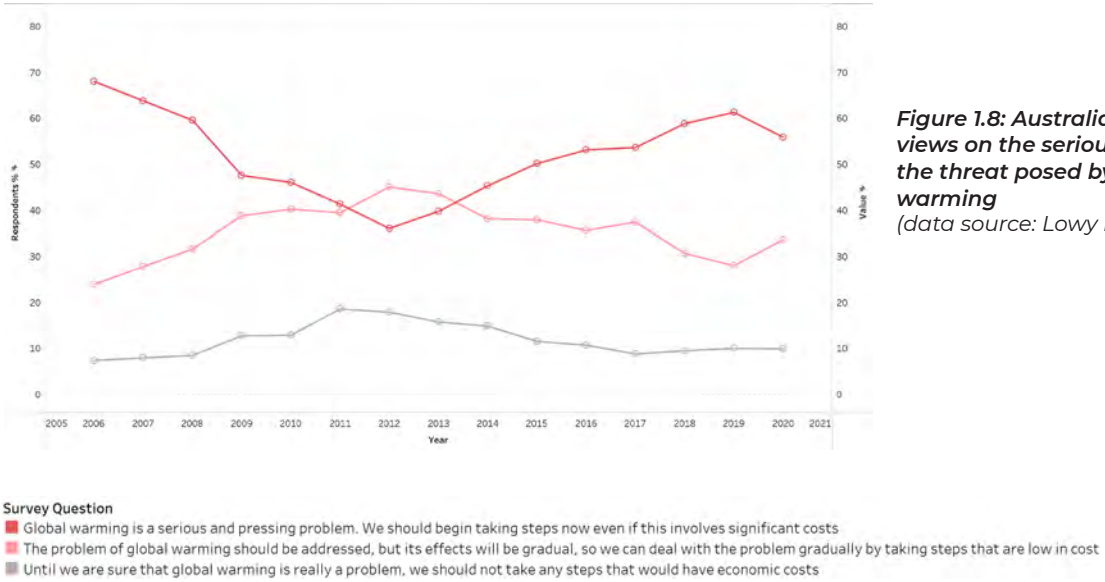


Figure 1.8: Australians' views on the seriousness of the threat posed by global warming
(data source: Lowy Institute)

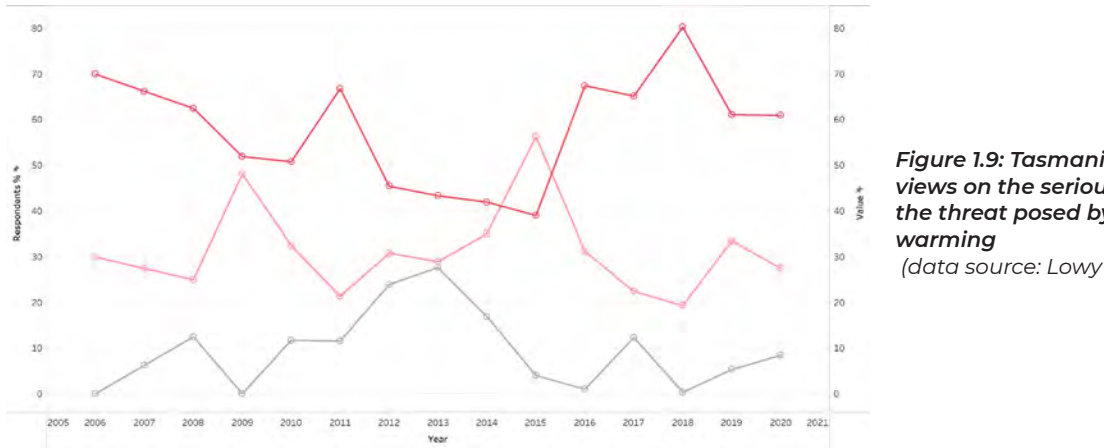


Figure 1.9: Tasmanians views on the seriousness of the threat posed by global warming
(data source: Lowy Institute)

PART 2: THE GOALS OF CLIMATE ACTION AND DEVELOPING A NATION-LEADING CLIMATE CHANGE ACT

The need for comprehensive climate action has never been greater. This need is being translated into unprecedented climate action at the international, national and community level.

There is also broad recognition of the important role which sub-national governments can play in this process with the 2015 Paris Agreement specifically identifying sub-national governments as key actors in the effort to reduce carbon dioxide emissions and support societies adapting to unavoidable climate change. To develop a nation-leading *Climate Change Act* and *Climate Action Plan* it is first necessary to establish the goals of climate action. This submission argues that Tasmania should aspire to become a leading, climate-positive jurisdiction which maintains a net-negative emissions profile over the longer term while developing detailed adaptation plans to reduce the significant risks associated with unavoidable climate change. The third pillar of a climate-positive strategy is to promote innovation, investment and employment in low-carbon technologies, industries, infrastructure and practices to ensure that Tasmania can capture economic and social dividends from the most significant structural shift in the global economy over the next generation.

2.1 TOWARDS A CLIMATE-POSITIVE TASMANIA

Committing to and achieving climate-positive status would deliver long term environmental, social and economic benefits to Tasmania.

Tasmania's emissions profile and renewable electricity assets provide a strong foundation upon which to establish its role as a leader in emissions reduction and climate change mitigation. The state's net emissions per capita rank among the lowest in the developed world (Figure 2.1), and Tasmania can currently claim to be Australia's only net-negative emissions jurisdiction. However, this net-negative status is heavily dependent on land use credits and offsets from the transfer of forestry land into reserves after 2010 (Figure 2.2). While storing carbon in forests and soils does absorb atmospheric carbon pollution (see Part 2.3), maintaining Tasmania's current emissions profile will likely require a stronger commitment to reducing gross emissions across the entire Tasmanian economy.

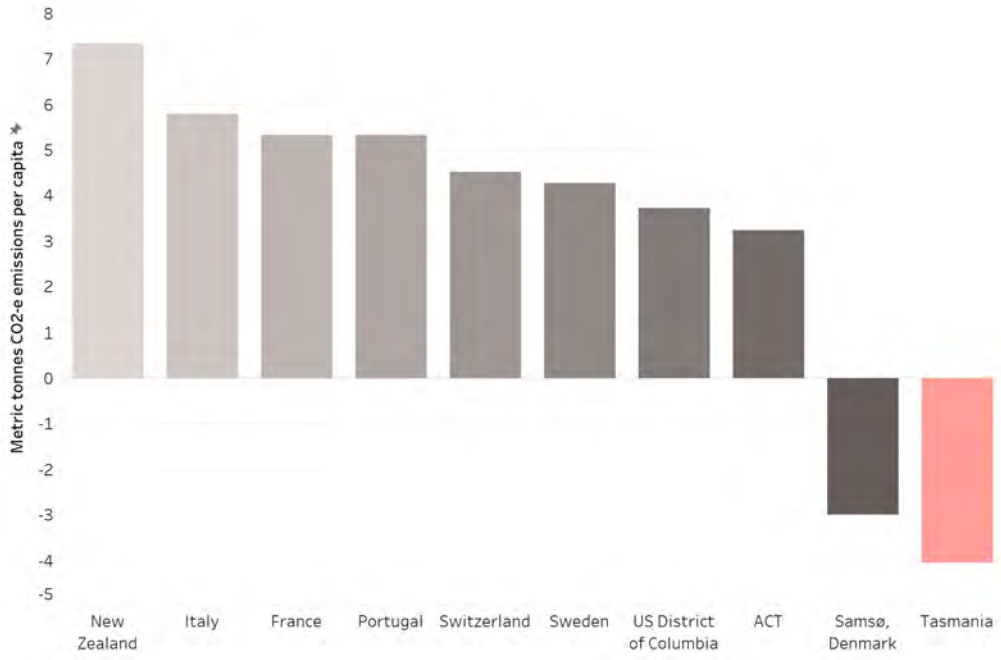


Figure 2.1: Tasmanian per capita net emissions

As noted in Part 2.3 below, future emissions reduction from land use change in Tasmania is uncertain and unlikely to sustain the state's net-negative profile over the longer term, highlighting the need for emissions reduction across the wider Tasmania economy. The increasing risk of bushfires poses a further risk to emissions reduction gains made through carbon storage in forests. Moreover, as fires become more frequent, intense, and widespread, existing carbon sinks may even become large sources of carbon emission, highlighting the important role of bushfire management in carbon sequestration. For these reasons, Tasmania's ability to sustain its current emissions profile and status as a leader on climate action will require a commitment to reducing gross emissions across the entire economy.

Tasmania achieved net-carbon neutrality in 2015 (Figure 2.2), which has since become the basis of its claim to be "a world leader in climate change mitigation".[48] In order to consolidate and capitalise on this emissions profile, however, the State's *Climate Action Plan* should embrace an ambitious 'climate-positive' framework.

A climate-positive approach recognises that while land use change and carbon sequestration are important, gross emissions should also be reduced over time by actively mitigating existing sources of carbon pollution. It also recognises the importance of a broader focus on sustainability, ecosystem services, resilience, and adaptation. Specifically, a climate positive-strategy would include:

- Development of evidence-based strategies to maintain the state's net-negative emissions profile over the long term. Such initiatives will need to reduce real, gross emissions across all sectors of the Tasmanian economy and promote low-emissions practices through innovation in key areas of Tasmanian industry.
- Development and implementation of sectoral adaptation plans to build resilience and capacity to adapt to the impacts of unavoidable climate change.
- Investment and innovation in low-carbon technologies, industries, infrastructure and practices to ensure that Tasmania can capture economic dividends from the profound structural shift to be experienced in the global economy over the coming generation.
- Making a positive contribution to national and international emissions reduction through exporting renewable energy and innovation.
- A commitment to robust carbon reporting and disclosure, analyses of carbon balances including gross emissions, and sequestration in forests or other biomass sources, thereby building a more accurate picture of the state's real carbon emissions footprint.
- A whole-of-community and whole-of government response to climate change, underpinned by the 'mainstreaming' of climate action across all areas of government and community activity.

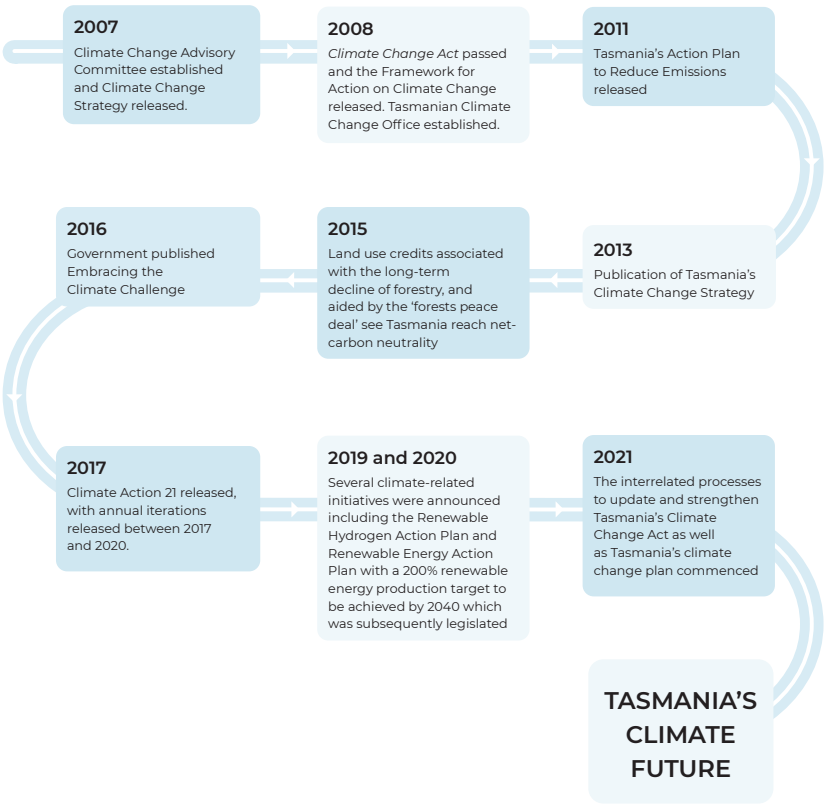
Figure 2.2: Tasmania's emissions by sector, 1990-2019
(data source: State and Territory Greenhouse Gas Inventory 2020)

2.2 Establishing Tasmania as a climate leader

Tasmania has a world-leading emissions profile and a strong history of climate action (Figure 2.3). Nevertheless, reflecting the growing commitment to climate action globally, other Australian states and territories have now developed ambitious climate action strategies reflecting key elements of the climate positive framework outlined above. In order to consolidate and capitalise on our position as a climate leader the next Tasmanian *Climate Change Act* and *Action Plan* should learn from and build upon recent developments in other Australian states.

Tasmania was an early mover on Australian subnational climate change policy with the Climate Change Advisory Committee established in 2007 and the subsequent release of Tasmanian Government's first Climate Change Strategy. Further developing Tasmania's climate efforts is a priority of the current Gutwein Government.

Figure 2.3: The development of Tasmanian climate change policy



Australian states and territories have developed and are implementing ambitious climate action and clean energy strategies (Table 2.1), most of which include emissions reduction targets and detailed sectoral innovation plans. Victoria, New South Wales, Queensland and South Australia (as well as Tasmania) have committed to net-zero emissions by 2050, while the ACT recently brought its net-zero emissions deadline forward to 2045. Together these jurisdictions account for over 80% of Australia's emissions.

Some jurisdictions have enshrined their emissions targets in legislation while others have settled for aspirations and pledges (Table 2.1 below).

The ACT has legislated provisions for making voluntary sectoral emissions reduction agreements, but none have yet been made.

The South Australian Government has established a program that encourages businesses, civil society groups and local governments to enter voluntary agreements with the state government to reduce emissions. These ad-hoc, opt-in agreements can relate to entities agreeing to increase energy efficiency, reduce energy consumption, and support R&D and climate education programs.

The Victorian Government has the strongest sector-based approach to emissions reduction targets in the country and should be the benchmark for Tasmanian climate action. The Victorian government has legislated a "pledging model" in the Victorian *Climate Change Act 2017* that allows Ministers, government departments and emitting entities to work together to establish an appropriate pledge to reduce sector-wide emissions over five -year periods between 2020 and 2045.

Under the Victorian Act, five-year sectoral emissions reduction pledges are required from the Ministers responsible for the following sectors:

1. Energy, including stationary energy, transport and fugitive emissions
2. Industrial processes and product use
3. Agriculture
4. Waste
5. Land use, land use change and forestry

The Victorian Act also establishes that Victoria's Adaptation Plan must be addressed on a sector-by-sector, or 'systems', basis. As with Victoria's mitigation pledges, Ministers must consult with stakeholders to develop plans/targets that are operational for five years after which time they are reviewed and re-operationalised, between 2021 and 2046. Five-year adaptation plans/ targets are required form Ministers responsible for the following sectors:

- the health and human services system
- the natural environment system
- the primary production system
- the built environment system
- the transport system
- the education and training system
- the water cycle system

Victoria's *Adaptation Plan* describes its 'sector or systems approach to adaptation as international best practice'.

In support of its claim to national or even world leadership in climate change mitigation, Tasmania should build on, and extend, Victoria's approach by legislating sectoral targets.

Table 2.1: State and Territory climate change targets and commitments

Jurisdiction	Legislated targets and commitments	Non-legislated policies/ commitments	Sectoral targets	Other
New South Wales	No legislated emissions reduction commitments	Net zero emissions by 2050, with an interim target of 30% reduction by 2030. "Aspirational" target of 10% hydrogen in NSW's gas network by 2030.	No sectoral targets	NSW has a $450 million fund supporting businesses who adopt low emissions processes or technology
Queensland	No legislated emissions reduction commitments	Net zero by 2050, interim target of 30% reduction by 2030. QLD also set (and met) a target of 3000MW of rooftop solar generation by 2020 (about 1 million rooftop systems).	No sectoral targets	QLD has established a $15 million hydrogen industry development fund.
Victoria	Net zero by 2050, with five-yearly interim targets	The 2019 Independent Expert Panel report recommended interim targets of 32-39% below 2005 levels by 2025, and 40-50% below 2005 levels by 2030	5-yearly ministerial 'pledges' outline sectoral emissions reduction strategies	Victoria has legislated 'systems-based' adaptation targets alongside mitigation/ abatement targets
South Australia	60% below 1990 emissions by 2050	SA targets include net zero by 2050, and a 50% reduction on 2005 levels by 2030	Voluntary sectoral agreements	Legislated adaptation targets
Western Australia	No legislated emissions reduction commitments	Net zero by 2050, interim target of 50% reduction by 2030	No sectoral targets	Proponents of major projects must outline how proposed developments fit within emissions reduction targets..
Northern Territory	No legislated emissions reduction commitments.	Net zero by 2050, with periodic reviews of progress. Target of 50% renewable energy by 2030.	No sectoral targets	Only 3% of total Australian emissions, but highest gross emissions per capita
Australian Capital Territory	ACT has committed to net zero by 2045, structured according to 5 interim targets	Target of 100% renewable energy by 2020, with 36MW of energy storage by 2020. Both these initial targets have been met. Target of zero emissions bus fleet by 2040	Like SA, the ACT act has voluntary sectoral agreements, though none have yet been made	The ACT Act provides for monitoring and periodic reporting on progress towards targets

2.3 Key elements of the next Tasmanian Climate Change Act

Reflecting Tasmania's existing emissions profile, established climate action policies and practices, and national best practice the next *Climate Change Act* should include the following elements:

- Establish clear principles which inform Tasmania's Climate Change strategy
- Establish legislated sectoral emissions targets for 2030 (from a 2005 baseline) to maintain Tasmania's climate positive status and position as an international leader on climate action.
- Prepare and implement detailed sector/system-level adaptation plans to reduce the impacts of unavoidable climate change.
- Commit to increased disclosure of sectoral and industry-level emissions and implement a system of carbon budgeting.
- Commit to 'mainstreaming' climate action across all government activities and continue to promote and support whole-of-community climate action among individuals, communities, organisations and businesses.

2.3.1 PRINCIPLES INFORMING THE TASMANIAN CLIMATE CHANGE ACT

Comprehensive climate change acts are underpinned by sets of principles to help guide decision-makers. For instance, the Victorian *Climate Change Act* requires Ministers to consider the principles of their *Climate Change Act* (as well as the science of climate change and policy objectives), when preparing a mitigation 'pledge' or adaptation plan. The new iteration of the Tasmanian *Climate Change Act* should incorporate the following guiding principles:

1. No harm

Where possible, new policies should not exacerbate emissions or exposure to climate impacts. Decisions regarding climate action should be made in the wider public interest and should be based on the best available science, adopting a precautionary approach in circumstances of scientific uncertainty (noting that most climate modelling to date has either been correct or under-estimated climate impacts).

2. Equity

Inter-generational and distributive equity should be paramount. This includes ensuring that natural, economic and social conditions enable future generations to meet their needs and fulfil their aspirations. Where there are short-term financial burdens associated with emissions reduction, policy should ensure that the impact on low-income households and communities is minimised.

3. Leadership and collaboration

Tasmania should provide leadership in national and Australian climate policy and action both through providing an example to other jurisdictions and through contributing to innovation and emissions reduction across Australia and beyond.

4. Accountability

The outcomes of decisions and actions should be measurable and should be reported, and - where deficient – addressed. Communities should be active and ongoing partners in climate action.

5. Integrity in carbon accounting

The global carbon offset market is expanding rapidly, and various forms of carbon sequestration are important elements in emissions reduction and climate action. However, many offset products are problematic and any carbon offsets and credits used in Tasmania's Climate action must be consistent with the principles of additionality (removing carbon from the atmosphere which wouldn't have otherwise been the case) and permanency (carbon removal must be on a permanent basis).

2.3.2 ESTABLISHING NATION-LEADING SECTORAL EMISSIONS TARGETS FOR 2030

South Australia has actively and aggressively developed polices and legislation to reduce emissions across its economy, including a nation-leading economy-wide emissions reduction target of 50% below 2005 levels by 2030. Tasmania can become a credible national leader on climate action by combining Victoria's approach to sectoral pledges with South Australia's targets.

Victoria's approach to reporting progress and establishing new plans on a five-yearly basis can provide guidance for Tasmania. To provide further confidence that successive state governments will continue to reduce emissions,

binding sectoral targets should be accompanied by independent monitoring and accountability mechanisms.

Tasmania should develop legislation that requires the State's five gross emitting sectors (transport, agriculture, energy, industry and waste) to each reduce their emissions by 50% below 2005 levels by 2030. Analysis of specific sectoral emissions targets is presented below while sectoral strategies that should be considered as part of the *Climate Action Plan* for achieving these sectoral targets are presented in Part 3.

2.3.3 ESTABLISHING SECTORAL ADAPTATION STRATEGIES

In addition to establishing sectoral emissions targets, Tasmania should follow the Victorian approach and develop sectoral adaptation plans and targets designed to enhance resilience and minimise the impacts of unavoidable climate change. Part 4 of this submission outlines adaptation strategies which should be developed and implemented in relation to five broad and interrelated social and environmental systems.

- Health and emergency management
- Ecosystems and habitat
- Agriculture and aquaculture
- Infrastructure and the built environment
- Communities and climate education and literacy

2.3.4 MAINSTREAMING CLIMATE CHANGE ACTION

Given the scale and complexity of the climate challenge there is growing recognition of the need to 'mainstream' climate change strategy by integrating climate adaptation and mitigation considerations across all the Tasmanian Government's policy domains and objectives, including budgeting. Where possible, decision makers in government, in collaboration with stakeholders, should consider both the climate-related risks and opportunities in all major decisions.

The Tasmanian Government could pursue a climate mainstreaming strategy through the existing State Policies framework under the *State Policies and Projects Act 1993*, which determines the Government's strategic policy direction on matters of state significance. This would acknowledge the importance of this issue, and the wide range of agencies involved in implementing effective climate action.

The Victorian Government has adopted a slightly different approach by legislating that 'decision makers must have regard to climate change' (*Climate Change Act* (Vic)). In Tasmania, one of the five recommendations from the second review of the *Climate Change Act* in 2016 was to require 'state government agencies to consider the contents of the Act in relevant decision making' and that specifically decisions should consider risks from climate change and implications for emissions and potential to achieve the target.[49] This recommendation was accepted in principle by the Tasmanian Government.[50]

Further, in terms of adaptation, there should be a legal obligation to include a climate impact assessment requiring agencies and decision-makers to assess the implications of significant new actions and decisions on emissions targets and the capacity to adapt to the impacts of climate change/exposure to impacts.

Many state government policies already acknowledge that current and future climate change will have a heavy impact on Tasmanian biodiversity, and recognise the need to facilitate adaptation and promote resilience.[51] However, conservation laws in Tasmania make no mention of climate change and provide no guidance (through objectives or principles) or substantive legal mechanisms (such as legal protection for climate refugia) to facilitate biodiversity adaptation as the climate changes, nor is there any coordination monitoring to serve as early warning of changes.

The Act provides a promising vehicle for integrating climate considerations across conservation laws, without the need for detailed, instrument-by-instrument reforms. This means it could become a tool for guiding government decision makers to anticipate and prepare for climate change and its impact on the Tasmanian environment.

2.3.5 DISCLOSURE AND REPORTING OBLIGATIONS

The ability of citizens, researchers, and policy makers alike to access clear, transparent and easy to interpret data will be critical to assessing the performance of Tasmania's *Climate Action Plan* and the *Climate Change Act* and ensuring public confidence in the process. Currently, however, some emissions data from energy and industrial processes are either not recorded in the relevant State and Territory Greenhouse Gas Inventory category or are recorded in the wrong category. This creates considerable difficulties interpreting Tasmania's emissions profile and may even lead to challenges implementing and reporting on the proposed sectoral reduction targets.

While commercial confidentially in emissions reporting is an undeniably important objective, it must be balanced against the public's right to know about

the environmental impacts of Tasmanian industry. If large firms with industrial facilities do not have their emissions reported in an accessible, easy-to-interpret way, it becomes difficult for citizens to assess emissions reduction progress and ultimately to make informed decisions on an issue of profound public importance.

Given the significant improvement in relation to carbon disclosure by governments and businesses alike in recent years, the Tasmanian government should work with industry to increase transparency in relation to greenhouse gas emissions as part of the next Tasmanian *Climate Action Plan*. Many successful sub-national disclosure and reporting schemes for industrial emitters have been established in the United States and Europe.

2.4 Analysis of Tasmania's emissions profile (and the challenge of staying below net-zero emissions)

Tasmania has been a net-negative carbon emitter since 2016 (net-zero carbon sonce 2015), but, as noted above, the state's ability to maintain this status will depend on reducing gross emissions across the entire economy over time. This net-negative profile also masks the fact that Tasmania's gross emissions are growing. A 190% reduction in emissions attributed to land use change from 2005 to 2018 (from 11,572 kt CO2-e emissions to –10,391) conceals the fact that Tasmanian emissions per capita from transport, agriculture, industrial processes, bushfire, and fossil-fuel combustion have been rising steadily for the past 30 years and in some sectors are above the national average (Figure 2.4 below).

We now have an important opportunity to reduce emissions across the entire Tasmanian economy and consolidate the state's claim to leading the transition towards a climate-positive economy. We have the opportunity, the resources, and the expertise to meaningfully address this pressing challenge and are well-placed to capture the benefits of being a first mover.

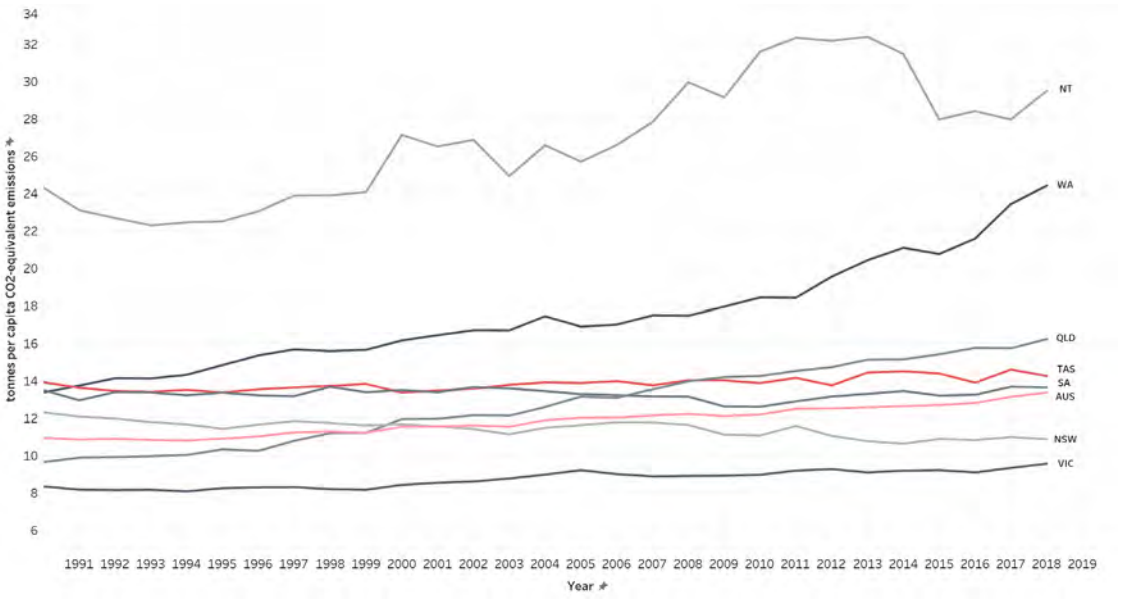


Figure 2.4: Tasmania's emissions per capita excluding LULUCF emissions

2.5 The role of land-use credits in Tasmania's emissions profile

As illustrated in Figures 2.2 and 2.3, Tasmania's recent swift transition to a net-negative emissions status is almost entirely attributable to changes in land use associated with the decline of the state's forestry industry. In the wake of the 'forest peace deal', large parcels of managed plantation and native forest that had been earmarked for logging were converted into reserves. Many of these parcels, which had either been partially or fully deforested or were scheduled to be deforested in the near future, were able to be recorded as offsets against gross CO2-e emissions from other sectors of the Tasmanian economy. To be clear, offsets from carbon sequestration in forests or credits from land use change are a central part of any emissions strategy. Growing forests to sequester carbon from the atmosphere is an important and even essential emissions reduction approach.

However, the long-term carbon sequestration productivity of old-growth versus plantation forests remains subject to debate,[52] and accounting methodologies for measuring their impact are imperfect. The Full Carbon Accounting Model (FullCAM) used to calculate emissions for the Australian State and Territory Greenhouse Gas Inventory assumes that while young forests sequester large amounts of carbon, their productivity as carbon sinks plateaus over time. Once these growing forests reach maturity, the model assumes that they become carbon neutral. As a result, while the conversion of former forestry parcels (especially those with young plantation forests) into reserves is currently drawing down large amounts of carbon from the atmosphere each year, the volume sequestered will decline over time as these forests reach maturity and their biomass stabilises.

This gradual decline in plantations' ability to store additional carbon could be offset by planting more forests – reforesting degraded agricultural land, for example – but the area available for further land-use change is finite. Furthermore, rewilding or carbon offsetting must be carefully balanced against other vitally important land uses, notably agriculture. Moreover, even if many of the areas converted to agricultural land since European settlement (particularly in the Tasmanian Midlands) were to be restored to their pre-colonial condition, carbon stored in the ecosystems natural to those areas would be relatively modest.[53] Finally, and as noted above, the increasing severity and incidence of bushfires risks turning these important carbon sinks into carbon emission sources, given that large areas of Tasmanian forest are not fire-adapted ecosystems and may therefore not regenerate following a sufficiently intense fire event. Research suggests that even those ecosystems that have evolved to regenerate following bushfires are doing so more slowly due to changing weather and rainfall patterns associated with climate change, undermining their ability to effectively recover or sequester carbon emitted during fires.[54]

Over the long term, therefore, total reliance on offsets from carbon sequestration in forests will become unsustainable, and Tasmania will gradually move towards net-positive CO2-e emissions once again. This means that while LULUCF will continue to be a key pillar of Tasmania's climate strategy for the foreseeable future, emissions reduction across the entire Tasmanian economy will be required. For this reason, and in response to the questions posed the *Discussion Paper on Tasmania's Climate Change Act: Independent review of the Climate Change (State Action) Act 2008*, the next section advocates for the adoption of uniform, sector-specific abatement targets.

2.6 Establishing sectoral emissions targets to maintain a climate-positive Tasmania

Tasmania's ability to claim leadership on climate change mitigation in the future will require broad-based and ongoing climate action. Point Advisory's modelling conducted for the Review of Tasmania's *Climate Action Plan* of various 'business as usual' scenarios for the state's emissions in 2050 suggests that Tasmania's net CO2-e emissions could return to levels as high as 7500kt without more ambitious, sector specific strategies. Reflecting the challenges associated with its distinctive emissions profile, as well targets being adopted nationally and internationally, Tasmania should seek to enact firm, legislated 10-year emissions reduction targets at the sectoral level.

This approach will ensure that the work of emissions reduction is shared across the Tasmanian economy rather than relying on one industry sector to offset or mitigate business-as-usual practices in others. Reflecting the ambitious targets adopted internationally and in other states, and considering the mitigation strategies available to Tasmanian government and industry, a target of 50% reduction in sectoral emissions on 2005 levels by 2030 should be adopted. A system of annual reporting, monitoring, and five-yearly reviews of progress will ensure that industry-level strategies incorporate emerging best practice approaches to sectoral emissions mitigation. While a sector-based target of 50% on 2005 emissions will pose challenges, it is not unachievable and would be consistent with targets from climate change mitigation being established by leading jurisdictions on climate action around the world.

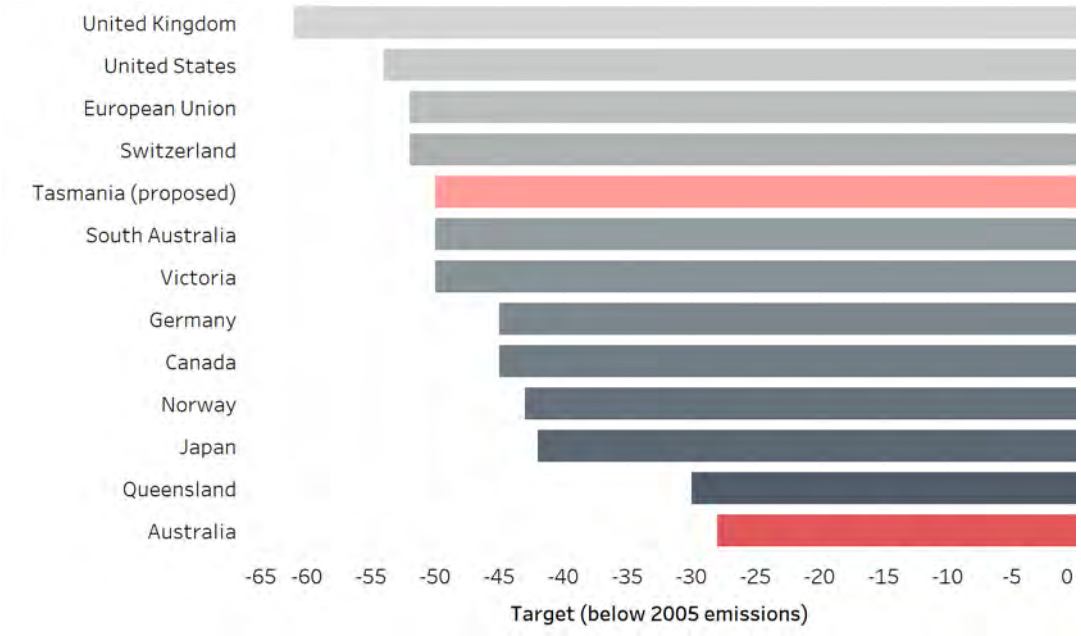


***Figure 2.5: Tasmania's proposed target compared against other existing interstate and international 2030 targets**: 50% by 2030 would bring Tasmania into line with other leading jurisdictions around the world*

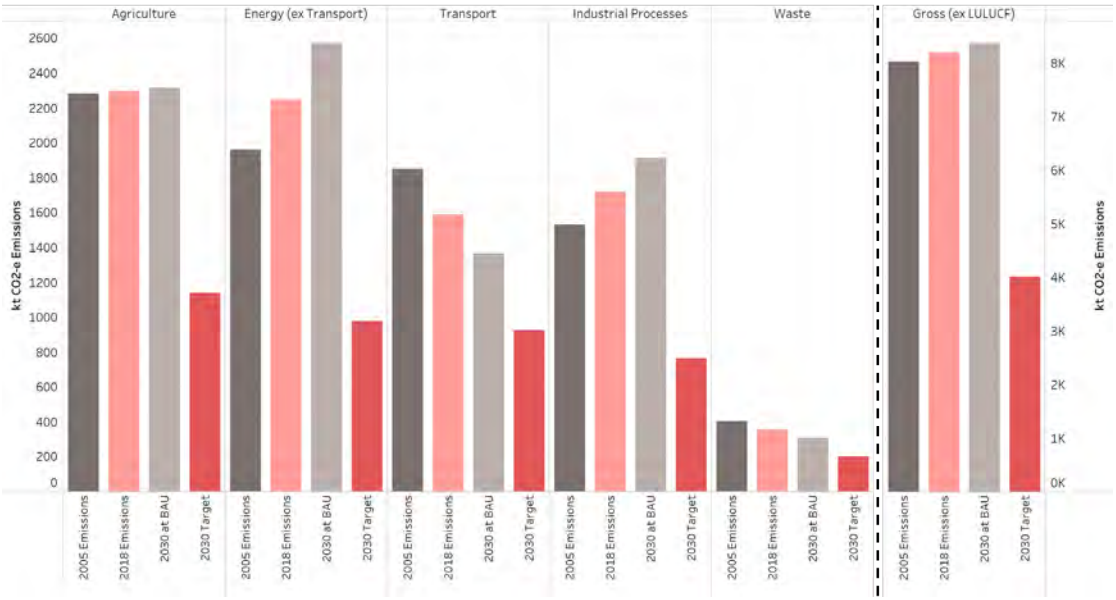


Figure 2.6: Tasmania's sectoral emissions and 2030 targets

A key objective of the *Climate Action Plan* should be to maintain Tasmania's net-negative emissions profile over the medium term. Reducing gross emissions by 50% (4010 kt) by 2030 would provide Tasmania with a 'buffer' whereby LULUCF emissions could rise by 6200 kt (from -10,391 in 2018) and Tasmania would still retain its net-negative status.

2.7 Sectoral targets and relative abatement cost in major emitting sectors

There is an active debate as to whether uniform sectoral commitments impose disproportionate or inequitable costs on sectors whose abatement pathways are more challenging.[55] However, we believe that uniform sectoral targets of 50% reduction on 2005 levels by 2030 provide the most appropriate and achievable pathway to long-term maintenance of Tasmania's net-negative emissions profile and would solidify the state's position as a climate-positive economy. In the context of dangerous and imminent climate change, challenges to reducing emissions must urgently be reframed as opportunities in a new low-carbon economy.

The remainder of this section analyses the ability of the state's four major gross emitting sectors to meet the proposed 50% reduction. Waste is not discussed i due to its relatively small net contribution. It is argued here that sufficient abatement opportunities exist for each major sector to reach a 50% emissions reduction, and that a uniform sectoral target should therefore be adopted in the legislation. A more in-depth review of specific, evidence-based mitigation strategies that should be considered as pathways to achieving these targets is presented in Part 3. Finally, it should be noted that while the categories used in the STGGI have been adopted here, Transport has been separated from the Energy sector due to its different emissions profile and abatement needs. The five gross emitting sectors to which targets should be applied, therefore, are Agriculture, Transport, Energy (excluding Transport), Industrial Processes, and Waste as illustrated in Figure 2.7 below.

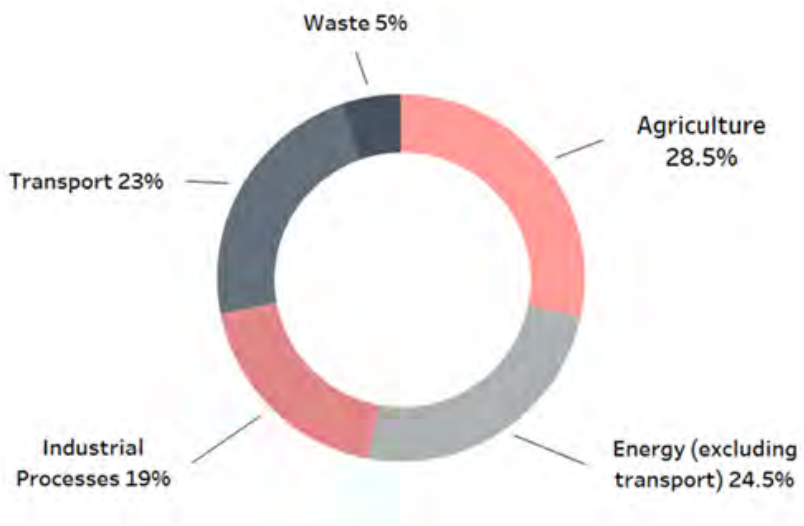


Figure 2.7: Sectoral contributions to Tasmania's gross emissions, 2018

2.7.1 AGRICULTURE

The agriculture sector accounts for 28% of Tasmania's gross CO2-equivalent emissions (Figure 2.7), with 71% of these agricultural emissions attributable to enteric fermentation (Figure 2.8). The high proportion of methane emissions from ruminating livestock in Tasmania's agricultural emissions profile presents a considerable opportunity for emissions mitigation but has been identified in the past as a barrier to the agriculture sector meeting mitigation targets.[56] Carbon sequestration in soils and trees, together with improved practises for environmental stewardship and landscape restoration (discussed further below) also provide an opportunity for emissions mitigation in the agricultural sector. However, in the absence of significant innovation, Tasmanian agricultural emissions may increase given likely growth in the sector over the coming decades - especially in light of the Tasmanian Government's AgriVision plan to increase the value of Tasmanian agricultural production to $10 billion by 2050. While future agricultural growth will extend beyond livestock, emissions from enteric fermentation in beef and dairy cattle are likely to dominate the agriculture sector's emissions profile for the foreseeable future, making it the obvious priority area to target with action and innovation (see Part 3 for further discussion).

While economic and technological barriers to reducing methane emissions from livestock have been high in the past, more recent advances suggest improved scope for the agriculture sector to meet the targets proposed here without making cuts to production. Several of these new technology options, notably anti-methanogenic livestock treatments and feed supplements utilising Asparagopsis seaweed derivatives, are discussed in depth in Part 3. Moreover, marginal abatement cost modelling conducted in 2016 identified agriculture as the sector with by far the greatest cumulative abatement potential – much of it achievable at net-negative cost.[57] Carbon sequestration in soils and vegetation is another significant opportunity for restoring environmental stewardship, sustainably driving economic growth and reducing emissions at the same time.

The aspirational target of net-zero emissions by 2030 from Meat & Livestock Australia (MLA) suggests that the agriculture sector itself recognises the importance of enacting ambitious emissions reduction targets.[60]

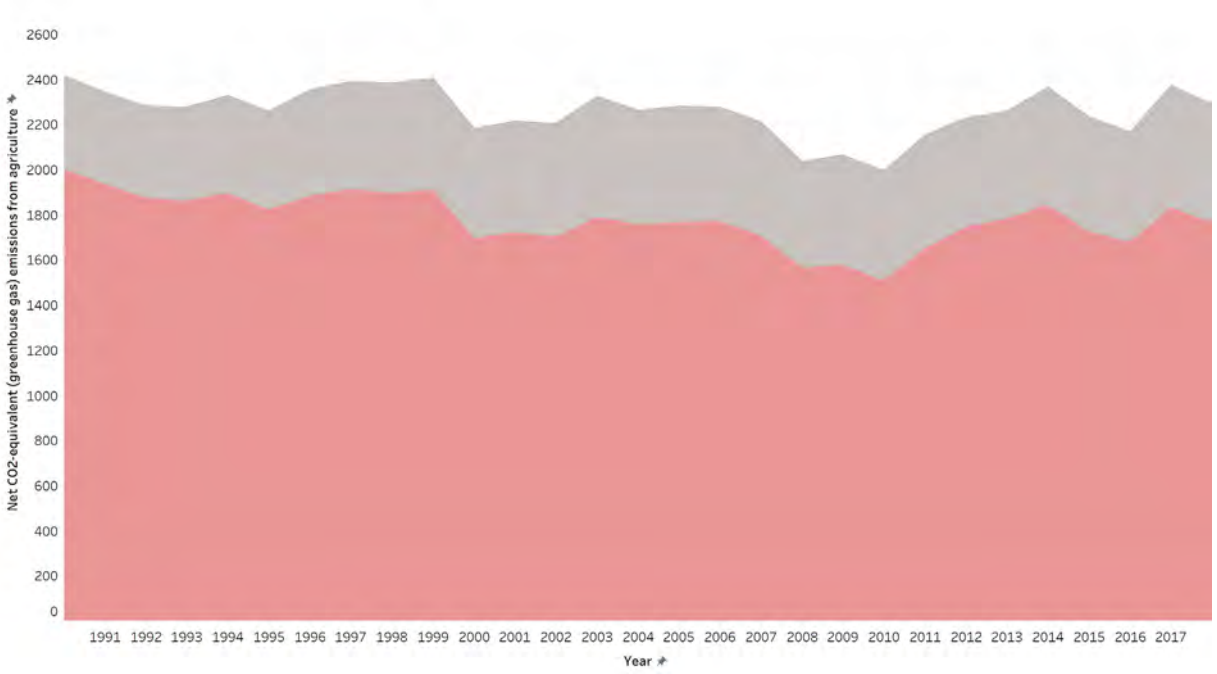


Figure 2.8: Proportion of agricultural emissions attributable to enteric fermentation, 1990-2018
(source: State and Territory Greenhouse Gas Inventories 2020)

2.7.2 TRANSPORT

Transport emissions in Tasmania are recorded under the 'Energy' category of the State and Territory Greenhouse Gas Inventories, capturing emissions from fuel combustion in private vehicles, public transport, freight, railways, intra-state aviation, and domestic marine transport. Transport accounts for 23% of Tasmania's gross emissions, the vast bulk of which (94%) are from road transport. While emissions in this category fell by 14% from 2005-2018 (see Table 2.1), further abatement will require both a reduction in Tasmania's high dependence on and use of private vehicles and the rapid uptake of zero- and low-emissions vehicles (see Part 3.2 below).

Notwithstanding challenges identified in Part 3.2, transport emissions have been identified in existing analysis as one the country's most significant cumulative abatement opportunities, with the rapid development of zero-emissions transport options and the phasing out of internal combustion engines. 2016 abatement cost curve analysis from Energetics (the most recent such analysis publicly available in Australia) found that low-carbon transport and improved farming and land management practices accounted for over 50% of Australia's cumulative emissions abatement potential. Importantly, the average abatement cost per metric tonne of CO2-equivalent greenhouse gases was found to be net-negative across a wide range of studied transport initiatives, suggesting that considerable gains could be made in this sector whose energy efficiency dividends would far outweigh their cost.[59] These abatement opportunities, as well as analysis on supporting battery electric vehicle (BEV) uptake and low emissions public and active transport, are discussed at greater length in Part 3.

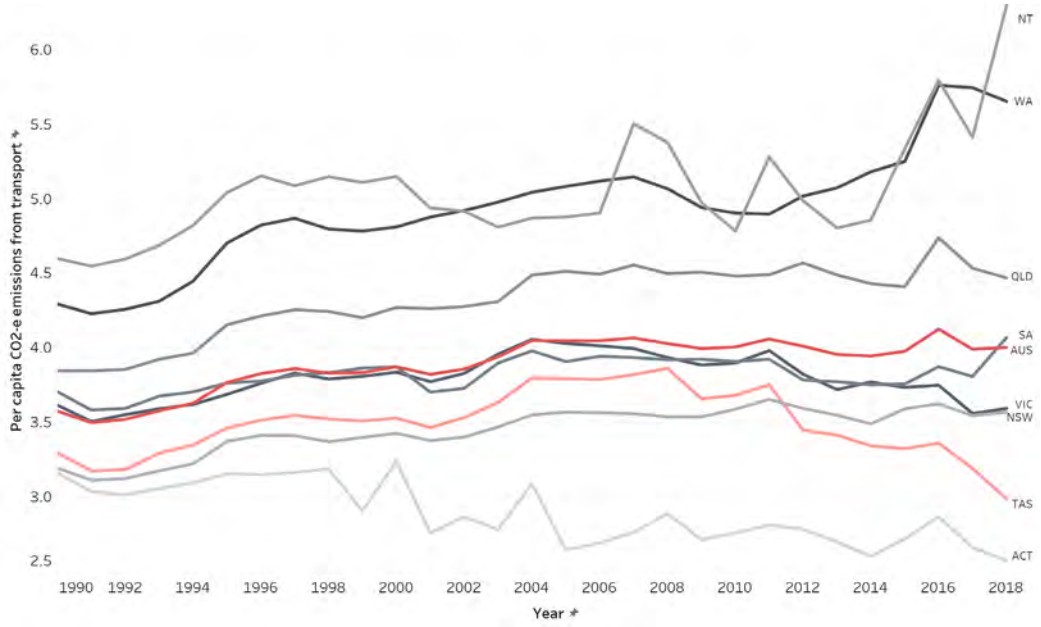


Figure 2.9: Emissions per capita from transport by state, 1990-2018
(source: State and Territory Greenhouse Gas Inventory 2020)

2.7.3 ENERGY (NON-TRANSPORT)

While the majority of Tasmania's energy emissions come from the transport sub-sector, other sources also contribute. The remainder are from fuel combustion in energy industries, manufacturing, and construction. These non-transport energy emissions account for 24.5% of Tasmania's gross emissions. As discussed in greater depth in Part 3, the state's self-sufficiency in renewable electricity generation means that a large proportion of these emissions are from other fossil fuel combustion in a combination of residential and industrial applications, including liquified natural gas (Figure 2.5).

While reducing LNG use in both domestic and industrial applications presents challenges, as described in greater detail in section 3.1, emerging green hydrogen technology may offer considerable abatement opportunities in this sector.

Finally, the high proportion of wood combustion in Tasmania's residential heating mix (some 30% of households - as reported in the Department of Health's *Report on the Tasmanian Population Health Survey 2019*) presents further significant abatement opportunities, not to mention considerable health co-benefits. Replacing inefficient older wood heaters with slow-burning pellet fires or electrical heating solutions would significantly reduce emissions from this source and could be achieved through regulations on the sale of new or existing residential property. However, a lack of sufficiently-detailed data and research means that the greenhouse impact of inefficient wood stoves is under-stated in the state and territory inventories – particularly in Tasmania where they are a very common residential heating method. Further research is necessary to properly account for the CO2-e impact of wood-heating and better understand their long-term climate impact, not to mention their adverse respiratory and cardiovascular health implications.

2.7.4 INDUSTRIAL PROCESSES

Emissions from industrial processes have been Tasmania's fastest-growing sectoral emissions category, increasing by 12% over the period 2005-2018. This increase is primarily due to the steady rise in emissions from the state's minerals industry and product uses as substitutes for ozone depleting substances (ODS). Overall, emissions from industrial processes make up 19% of Tasmania's gross emissions.

Despite Tasmania's renewable electricity generation capacity, stubbornly high and rising industrial emissions continue to present a considerable abatement challenge. The fact that manufacturing and heavy industrial operations employ a large number of Tasmanians, many in rural and regional areas of the state, further compounds the difficulty of pursuing large, ambitious emissions reduction targets in this sector. Moreover, modelling by Energetics suggests that abatement costs for emissions from industrial processes are for the most part relatively high. An advantage enjoyed in Tasmania in this regard, however, is the fact that a significant proportion of emissions from industrial processes in the state come from a small handful of large emitters. As a result, large gains could be achieved through vehicles similar to the Federal or NSW emissions reduction funds, which allocate investment and grants-based funding to firms or facilities seeking technological solutions to lower their emissions intensity.

Figure 2.10: Growth in emissions from industrial processes in Tasmania, 2005-2018
(source: State and Territory Greenhouse Gas Inventory 2020)

PART 3: REDUCING TASMANIA'S GREENHOUSE GAS EMISSIONS

Tasmania's carbon dioxide-equivalent greenhouse gas emissions are overwhelmingly produced by four sectors of our economy: energy, transport, agriculture and industrial processes (waste only contributes 5% of total emissions – see Figure 2.6).

To credibly claim national climate leadership, the Tasmanian government will need to make a clear commitment to reduce emissions from these sectors. Given the ambitions of other states, and considering the mitigation strategies available to Tasmanian government and industry, a target of 50% reduction in sectoral emissions on 2005 levels by 2030 should be adopted (Part 2.3).

These 50% targets should be designed using a method that is consistent with the sectoral breakdowns adopted in the State and Territory Greenhouse Gas Inventories. As discussed in the previous section, this would mean that each gross emitting sector would need to meet a 50% reduction target, with the 'Energy' category in the STGGI split into Transport and Energy (excluding Transport – see Table 3.1 below). As LULUCF emissions are unlikely to be net-positive between now and 2030, they are excluded from the 50% target. The advantages of such an approach include the availability of a ready framework for reporting on progress, an existing shared methodology for calculating emissions, and a platform for comparing Tasmania against other states and territories. One disadvantage, however, is the fact that these categories do not always clearly reflect economic activity at an industrial level, making policy development of specific industrial initiatives more difficult. Part 3 therefore proposes a mix of abatement opportunities: some targeting specific STGGI emissions categories and others targeting individual industries, recognising that these latter recommendations may lead to reductions across more than one sectoral emissions category.

Part 3 presents a number of policies and approaches consistent with a sector-based approach that would help drive Tasmania towards achieving a target of 50% below 2005 levels by 2030.

In addition, this Part is guided by and responds to the three mitigation questions contained in the TCCO's Opportunities Paper.

- What do you think are the key opportunities to reduce Tasmania's emissions? Please choose your top three.
- What do you think are the key gaps in Tasmania's current efforts to reduce emissions?
- What do you think are the main opportunities for Tasmania to transition to a low-carbon economy?

Table 3.1: Tasmanian emitting sectors and proposed 2030 targets (kt Co2-e)
(source: State and Territory Greenhouse Gas Inventory 2020)

Sector*	2005 emissions	2018 emissions	2030 target	% reduction on 2018
Energy	1960	2245	980	56%
Transport	1852	1587	926	42%
Industrial processes	1531	1719	766	55%
Agriculture	2281	2294	1141	50%
Waste	405	354	203	43%

Given they are already net negative, and will likely remain so in the short-term, LULUCF emissions have been excluded from this table

3.1 Energy emissions (not including transport)

Electricity generation and the use of liquified natural gas and other fossil fuels in residential and industrial applications are a major source of CO2-e greenhouse gas emissions. Fortunately, Tasmanian electricity generation has been almost %100 renewable since the closure of the Bell Bay power station in 2009. Due to our renewable energy generation assets, energy-related emissions (excluding transport) are significantly below the national average.) (Figure 3.1).

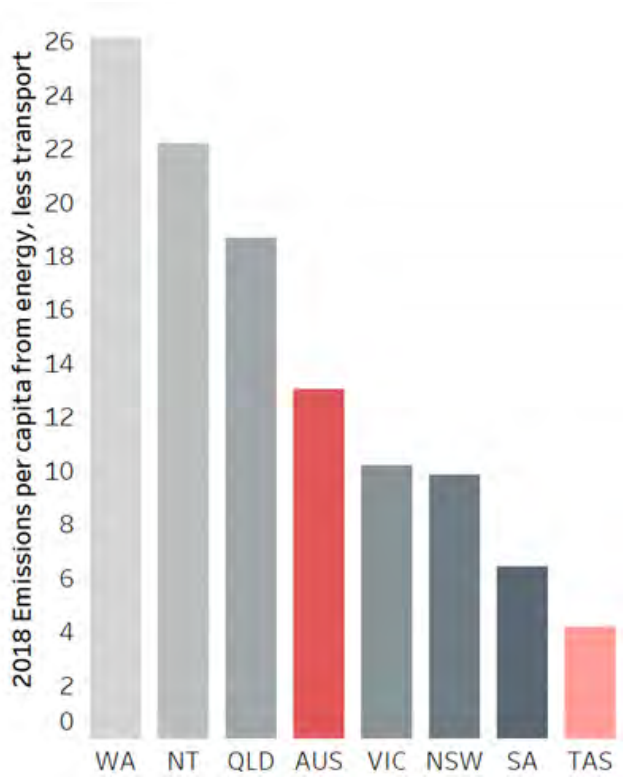


Figure 3.1: : Non-transport energy emissions per capita (t CO2-e) by state and territory, 2018
(data source: State and Territory Greenhouse Gas Inventory 2020)

However, effective self-reliance in renewable energy generation notwithstanding, Tasmanian energy emissions excluding transport contribute 2245 kt of CO2-e greenhouse gases to the state's gross emissions – an increase of 14.5% since 2005. This accounts for roughly a quarter of the state's total (gross) CO2-e emissions. A major source of these non-transport energy emissions is liquified natural gas (LNG), which has been imported via the Basslink pipeline since 2002. This LNG services some 12,000 residential customers (heating and cooking) and is used in a variety of industrial applications and stationary engines.

Fortunately, there are a number of abatement technologies that could be used to reduce on-island energy emissions. Many promising opportunities relate to the development or application of technologies that use locally produced green hydrogen or biogas either as a natural gas substitute or as part of a blend.

Among these more promising LNG emissions abatement opportunities are:

- Blending h2 into liquified natural gas at a ratio of 1-1.5 parts in 10, which would reduce CO2-e emissions by the same amount (10-15%). A number of projects around the world have demonstrated the possibility of using blends comprising up to 20% hydrogen. Research suggests that blending hydrogen with LNG at concentrations of between 10-20% is feasible without major investment in modifying existing gas delivery infrastructure.[60]
- Transitioning to 100% hydrogen in the network. Our network is small and modern enough to be used for H2. While the conversion of appliances poses a logistical challenge, a trial using 100% hydrogen for heating and cooking in 300 homes is currently underway in Fife, Scotland.[61] Tasmania could become the first jurisdiction to undertake a similar transition at scale through a joint venture.
- Bespoke industrial applications. The Tasmanian Government could partner with industry on customised solutions for converting from LNG to hydrogen. Grange Resources is currently examining opportunities for increasing use of hydrogen in industrial processes, and other large facilities should follow suit with appropriate government support.
- Improving the energy efficiency and insulation of all homes and other buildings, especially those that use natural gas or wood for heating.

Utilising these and other abatement opportunities, Tasmania's emerging green hydrogen industry could prove a key resource in the reduction of non-transport energy sector emissions. In addition, Tasmania would be well-placed to explore a number of non-hydrogen energy emissions abatement pathways. As discussed in Part 3.3, subsidising/investing in solar or other renewable energy generation on farms or agricultural properties to encourage energy self-sufficiency (or even feeding excess power back into the grid) would help to reduce reliance on diesel, petrol, LNG, and other combustion to power agricultural machinery and processes.

Figure 3.2: LNG imports and non-transport energy emissions in Tasmania, 2003-2021
(source: State and Territory Greenhouse Gas Inventory 2020)

Health industry emissions

Research shows that the provision of health care accounted for 7% of Australia's entire CO2-e emissions. Hospitals had a carbon footprint of about half of the total for health care; pharmaceuticals contributed 20%; while specialist medical services contributed 6% and general practice 4%. Direct CO2-e emissions from the use of fuel (specifically gas for hot water from hospital boilers) contributed to 10% of total CO2-e emissions (Malik et al 2018). Solutions to reduce emissions include substituting non-renewal energy sources such as gas for renewable energy sources, building energy efficient buildings (and retrofitting existing buildings), and developing alternative models of care, such as telehealth.

3.2 Transport emissions

Tasmania's transport sector is almost entirely dependent on imported fossil fuels and accounts for approximately 19% of total state emissions, having declined only marginally since peaking in 2011. The state's 100% renewable electricity system, combined with the rapid development of battery and hydrogen fuel-cell powered vehicles, provides an opportunity for Tasmania to lead the transition to a low-or zero emissions transport system. In the medium term our goal should be to reduce transport-related emissions to 926 kt 2030 (50% of the 2030 level) from 1587 kt in 2018. Increasing the uptake of zero-emissions vehicles in Tasmania has the potential to deliver greater emissions-reduction dividends that in other Australia states given that the source of electricity could be 100% renewable when combined with Tasmania's plans to double renewable energy generation by 2040

State-level transport emissions are determined by two factors: demand for transport and the dependence on private vehicles, and the carbon intensity of available transport options.

The demand for transport and the dependence on private vehicles in Tasmania is the highest in Australia on a per capita basis and is influenced by a range of factors including:

- The availability of public or active transport and ridesharing options
- Planning and urban design and the extent to which residents are forced to drive to access employment and services
- Relative cost of private vehicle use
- The impact of technology on work and commuting
- Cultural and social factors

The primary focus of reducing transport-related emissions is to promote a transition from internal combustion engine (ICE) powered vehicles to battery electric and fuel cell powered alternatives. However, it is also important to recognise that reducing the demand for travel – especially in private vehicles – can make a significant short-term contribution to reducing transport emissions. This is especially relevant to Tasmania, which has the highest rates of private vehicle ownership in Australia at 0.94 registered vehicles per capita (the national average is just 0.77) with more than 90% of homes in Tasmania having two registered vehicles, and 84% of Greater Hobart residents taking a private vehicle to work each day. Our high dependence on private vehicle transport is also reflected in the fact that cars and light commercial vehicles combined constitute 68% of Tasmania's total transport related emissions: the highest proportion in the country.

Increasing the rate of active and public transport in Tasmania, along with smart development and urban planning, will be key to reducing emissions from transport. In addition to the emissions dividends, the promotion of active transport and more liveable communities also has significant health and lifestyle benefits. The rapid uptake of digital and online platforms for work and other forms of communication during the COVID-19 pandemic likewise has the potential to reduce personal travel and associated emissions.

The second key factor contributing to transport emissions is the carbon intensity of available transport options.

3.2.1 ZERO-EMISSIONS VEHICLES

In addition to being heavily reliant on private vehicles, Tasmanians also drive the oldest and least efficient cars in the country, highlighting the need to modernise Tasmania's vehicle fleet.

Over the medium and longer term, the greatest reduction in transport-related emissions will come from a combination of increasing the fuel efficiency of ICE powered vehicles on Tasmanian roads and promoting the transition to zero-emission battery electric vehicles (BEVs) and hydrogen fuel cell (H2) vehicles.

The modelling presented above (Table 3.2) and below (Figure 3.3) calculates Tasmania's transport-related emissions for three uptake scenarios of zero-emissions vehicles prepared by AEMO and Energeia.[62] This analysis assumes continued steady growth in the number of vehicles on Tasmanian roads,

		2020	2025	2030	2035	2040	2050
Low uptake	**Sales**	387	859	2209	4128	5430	16416
	Market share	0.16%	0.73%	2.45%	5.73%	10.8%	26.89%
Neutral uptake	**Sales**	437	1074	4353	9242	16611	33215
	Market share	0.17%	0.94%	4.04%	10.88%	23.09%	68.42%
High uptake	**Sales**	644	3121	12069	30477	37398	54931
	Market share	0.23%	1.78%	9.36%	28.69%	54.69%	98.08%

Table 3.2: Tasmania's transport-related emissions for three zero-emissions vehicle uptake scenarios *(data source: AEMO/Energeia 2017)*

and that the rate of increase in energy efficiency of ICEs seen over the past 15 years will continue for the life of the model. Given the likelihood of diminishing returns on technological investment in ICE fuel efficiency, this is an optimistic assumption.

As can be seen from Figure 3.3 below, Tasmania would have to significantly outpace even the high uptake scenario of 12,069 sales in 2030 to meet the state's transport emissions target, a goal which will require a concerted policy response in the next Tasmanian *Climate Action Plan.*

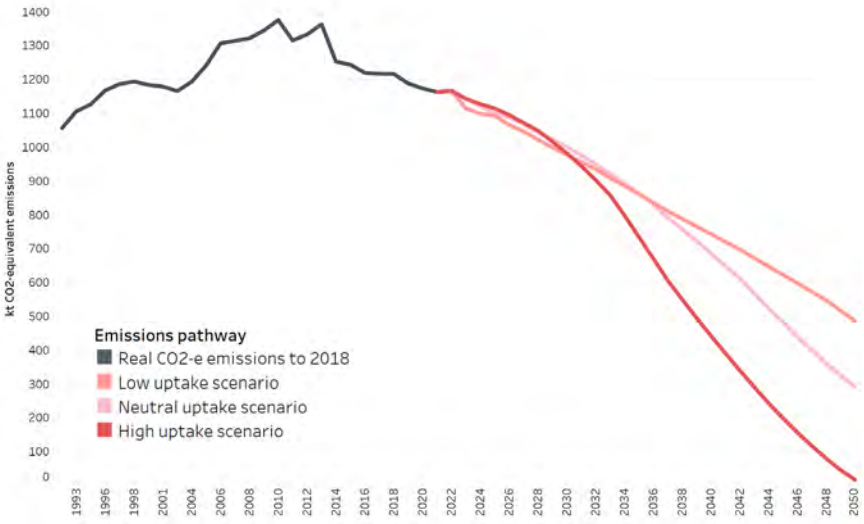


Figure 3.3: Tasmania's transport-related emissions for three zero-emissions uptake scenarios
(data sources: AEMO/Energeia 2017; State and Territiry Greenhouse Gas Inventory 2020)

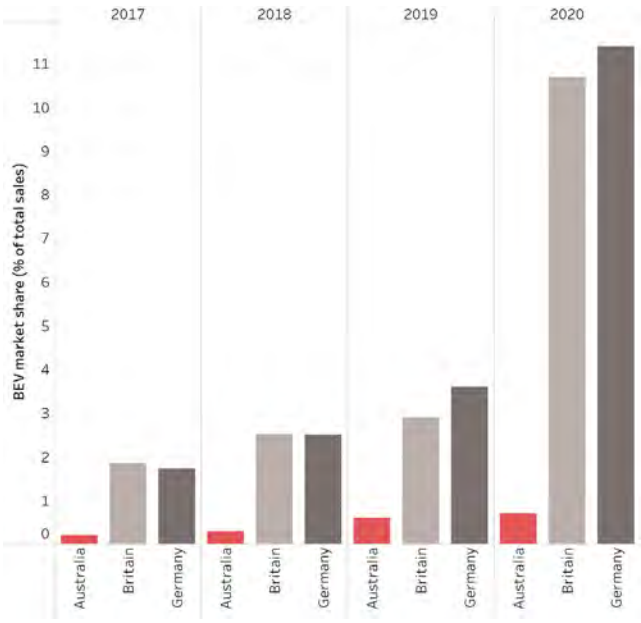


Figure 3.4: Share of BEVs in new car sales in Australia, the UK, and Germany, 2017-2020
(data source: Purtill 2021)

Emissions from transport and electricity: carefully linking closely-coupled sectors

The electrification of Tasmania's transport fleet offers the potential for reduced emissions or even zero-emissions transport. The tailpipe emissions normally produced when combusting petrol or diesel in conventional engines can be replaced by emissions produced at the point of generation, associated with the additional electricity that an electrified transport system requires. Although Tasmania currently produces all of our electricity, on average, from renewable energy sources, the electrification of transport in Tasmania would require additional electricity to be sourced. This additional electricity would in effect be supplied, in absence of any linked, new on-island renewable generation, from mainland Australia and would be produced at the prevailing marginal emissions intensity (typically now Victorian brown coal or natural gas). This would be true even if Tasmania was a net exporter of renewable electricity, because of the interconnected nature of the Australian electricity system. To achieve genuine zero-emissions transport in Tasmania will require the careful and deliberate planning and development of the transport system alongside the electrical power system, ensuring that the conversion to an electric vehicle fleet is coupled with new renewable generation (either in Tasmania or elsewhere) that would not otherwise have been produced.

The challenge is compounded by the existence of several barriers to higher uptake of BEV and H2 vehicles in Australia, including a lack of supply, high sticker prices relative to ICEs, tax and regulatory uncertainty, and a lack of charging stations and associated infrastructure. According to the Australian Electric Vehicle Council, around 50% of Australian motorists are interested in buying a BEV (a similar level of demand to European countries in which BEV ownership and sales are far higher than in Australia) but are prevented from doing so by these barriers. As a result, while some 10% of new car sales in Germany in 2020 were BEVs, the comparable figure in Australia was just 0.7% (see Figure 3.4).[63]

Analysis from a range of jurisdictions has identified four key barriers to increased uptake of zero-emissions vehicles (see below). While some of these barriers would require a national response, many are able to be addressed through a state-level emissions plan. These challenges, and solutions or responses to them, are addressed in greater detail below.

Increasing the supply zero emissions vehicles

The absence of specific emissions standards on new cars sold in Australia is limiting the availability of zero-emissions cars in the Australian market and is a major barrier to increased BEV uptake. Approximately 70% of new cars sold globally are subject to some form of emissions target. The most common approach worldwide is to average or 'pool' emissions from models sold by a specific manufacturer in a given jurisdiction per year, and if a manufacturer exceeds the emissions target they are subject to a penalty. For example, the current emissions target per vehicle in the EU is 95g of CO2-e per km and if a manufacturer exceeds this threshold they will be subject to a penalty, such as the $150 million fine imposed on Volkswagen in 2020.[64] Under this regime, zero emissions vehicles effectively provide manufacturers with a credit allowing them to sell cars that exceed the cap without attracting fines. Emissions targets also provide a strong disincentive for global manufacturers to export BEVs and hydrogen vehicles to markets such as

Table 3.3: Tasmania's transport-related emissions for three zero-emissions vehicle uptake scenarios

Barrier	National strategies	State strategies	Local strategies
Vehicle supply and choice	National CO2 targets on new sales	Procurement policies Lobby Commonwealth on CO2 targets	Procurement policies (public and private sector)
Vehicle costs	Luxury car tax Price on carbon FBT 'Cash for clunkers' buyback scheme	Registration concessions Direct subsidies	Parking concessions
Infrastructure and range	Charging infrastructure	Charging infrastructure Home charging and smart grids	Charging infrastructure Planning rules
Awareness and education	Promote solutions to barriers	Promote solutions to barriers Dealer education Distinguishable EV numberplates	Try and Drive EV days Prominent EV free parking

Australia, where zero emissions vehicles are not similarly incentivised through emissions policy. According to some car industry executives this is creating a scenario where Australia risks becoming a dumping ground for inefficient vehicles that no longer pass muster in jurisdictions with more rigorous standards.[65]

While an emissions standards regime should be implemented at a national level, states should collectively lobby the federal government to implement vehicle emissions standards to incentivise the importation of zero-emissions vehicles into Australia and increase choice available to Australian motorists.

Another way in which federal, state, and local governments, as well as corporates and other large organisations, can increase the supply of zero-emissions vehicles over time isthrough procurement. Given the relatively high cost of BEVs currently, promoting uptake in commercial fleets will be an important early way to increase their market share until prices approach parity with ICE vehicles. The Tasmanian Government's commitment to establish a 100% electric vehicle fleet by 2030 is an important step towards reducing transport emissions.

Reducing the cost of zero-emissions vehicles

The purchase price of BEVs remains significantly higher than for ICE vehicles although running costs are generally lower. Until BEV uptake becomes more widespread, and advances in technology and production make prices more competitive, some level of subsidy may be required to incentivise the purchase of BEVs to achieve transport-related emissions targets. A number of direct subsidies and concessions have been used in other jurisdictions to promote BEV uptake with varying degrees of success. Perhaps the most effective option for a state government (which would complement federal initiatives) would be to exempt zero emissions vehicles from sales duties for the short to medium term (until they reached price parity) which would reduce the purchase price of a BEV by 4% in Tasmania. The cost of this exemption could be offset by increasing the duty on ICE vehicles, further reducing the relative price difference between BEV and ICE vehicles.

South Australian and Victorian electric vehicle taxes

South Australia and Victoria have recently announced systems of distance-based road user charges for electric vehicles ("EV Taxes"), the first of their kind anywhere in the world. Singling out EV's (and hybrids) with a new tax in the absence of broader transport tax reform based on road wear and tear will likely dampen EV uptake in these states and make Australia less attractive for EVs in general.

Key points:

- Fuel excise on petrol and diesel is levied at approximately 43c per litre with the revenue being used to fund roads and transport infrastructure and are a de facto road user charge.
- An EY report calculated that over a 10-year period a BEV vehicle owner would save approximately $14,500 in fuel excises and fuel-related GST creating a potential longer term shortfall in road funding (EY 2020).
- Some states have proposed a road user charge for EVs but given the need to reduce transport emissions the introduction of a road user charge should be delayed until price parity is achieved, which is expected to be reached in 2025-26.

Improving infrastructure and range

Tasmania's size relative to other states and the generally shorter commutes relative to larger and more congested cities mean that the range of BEVs should be less of a barrier in Tasmania than elsewhere. Nevertheless, it remains true that currently-available electric cars are not capable of travelling as far as fossil-fuelled equivalents on a single charge. This means that the Tasmanian government should continue to invest in strategically located charging stations to ensure state-wide travel is practical. The promotion of smartphone apps like PlugShare, which shows a state-wide map of EV charging stations, would also help to alleviate this problem.

While establishing a state-wide network of public fast-charging stations is important, it should be noted that over 90% of private vehicle charging takes place either at home or a workplace. Where possible, the Tasmanian *Climate Action Plan* should encourage the uptake of domestic charging infrastructure to help promote BEV uptake. Initiatives include:

- Ensuring that tenants in rental properties are allowed to install electric vehicle chargers or adapters if required.
- Mandating electric vehicle readiness in new buildings and residential properties, for example by ensuring that new houses and apartment buildings contain BEV charging plugs.

Lastly, Tasmania should continue to promote the use of residential smart meters and grids to enable BEV owners to connect car-based batteries to household electricity systems, further increasing the benefits of BEV ownership.

Awareness and education

EV awareness and acceptance of the advantages of zero emissions vehicles in Tasmania is already high and has increased over time. A recent survey of Tasmanian attitudes towards EVs found that more than 81% would consider purchasing an EV if the upfront cost declined and availability of models increased. Try and drive EV days, public charging and government fleet transition have assisted in this regard. Keeping the Tasmanian public informed about local EV market changes - new models, lower costs - and increased infrastructure will build community knowledge and confidence in low- and zero-emission vehicles.

3.2.2 HEAVY TRANSPORT

Emissions from heavy transport applications such as trucks and buses represent 32% of Tasmania's transport emissions (7% of total emissions). Whereas BEV vehicles are likely to become the dominant technology for light vehicles (especially in a state with 100% renewable electricity), hydrogen fuel cell technology has numerous advantages for most heavy transport applications although metropolitan bus services can be provided by either battery- or hydrogen-fuelled buses depending on the specific application. Moreover, the development of hydrogen solutions to reduce heavy transport emissions will complement Tasmania's emerging renewable hydrogen industry and is a focus of the Tasmanian Renewable Hydrogen Strategy.

The Tasmanian Government should continue to work with heavy transport operators to develop cost-effective strategies for converting diesel-powered vehicles to hydrogen. Where possible, hydrogen conversion and vehicle manufacturing work should be conducted in Tasmania. For example, Elphinstone currently manufactures Bustech designed diesel buses in Tasmania and Bustech are currently developing hydrogen models.

While intrastate maritime emissions are modest, Tasmania also has an opportunity to be an innovator in the development and construction of low emissions marine transport options including hydrogen- and ammonia-fuelled ferries.

3.2.3 ACTIVE TRANSPORT

As noted above, another important strategy that will yield environmental and health benefits is to promote active transport and design in our cities and towns to encourage Tasmanians to become less vehicle dependent. This could include developing and fast-tracking plans and approvals to establish designated active mobility networks of safe and accessible bike lanes, with appropriate charging and end-of-trip infrastructure for E-bikes and scooters – if done effectively this would generate significant branding opportunities similar to prominent commuter bike-friendly European cities.

In addition to investing in active transport infrastructure, a broader planning and liveability strategy to reduce Tasmania's high dependence on private vehicle transport will reduce emissions and deliver strong co-benefits in improving health outcomes, with further benefits in cost savings.

3.3 Agricultural emissions

In a median rainfall year, agriculture accounts for around 28% of state-wide emissions. In drought years, however, agricultural emissions can be much higher due to loss of existing soil carbon and surface vegetation. The majority of Tasmanian agricultural emissions are derived from enteric fermentation, followed by soils, as shown in Figure 3.5. Enteric fermentation is the process by which methane (a greenhouse gas some 30 times more potent that CO2) is produced by the breakdown of cellulosic materials, such as grasses, in the digestive tracts of ruminating livestock. Emissions from soils include nitrous oxides produced mainly by the addition of nitrogenous fertilisers, and carbon dioxide, caused by loss of soil carbon or carbon cycling.

Innovation in the agricultural sector will be required to meet the necessary emissions reduction targets without reducing production or curtailing the sector's considerable potential to expand. Agriculture will continue to be an important sector in the Tasmanian economy with the state's Agri-Vision 2050 plan hoping to achieve growth in annual agricultural production from $1.6 billion in 2020 to $10 billion by 2050. Ensuring that this rapid growth can proceed alongside significant emissions reductions will require comprehensive, innovative solutions designed to sustainably intensify agricultural production (outlined further below). Significantly reducing the emissions intensity of farming in Tasmania will be challenging considering that Tasmania's agricultural emissions have changed very little over the past 30 years (Figure 3.6) but can be achieved through technological innovation and appropriate levels of strategic investment.

An agricultural emissions reduction strategy for Tasmania will need to combine both emissions avoidance and emissions offset strategies if the sector is to achieve a 50% reduction in CO2-equivalent emissions on 2005 levels by 2030.

'Emissions avoidance' technologies are those that reduce emissions at their source (e.g. enteric fermentation reduction) while 'emissions offset' strategies offset or compensate for emissions per unit of land area (such as planting trees on farms to reduce net farm emissions) and can be much greater than total emissions produced. Given that livestock and enteric methane comprise the largest (current and projected) source of emissions in the agricultural sector, it follows that the livestock sector holds the greatest promise for profitable, sustainable and socially responsible emissions mitigation.

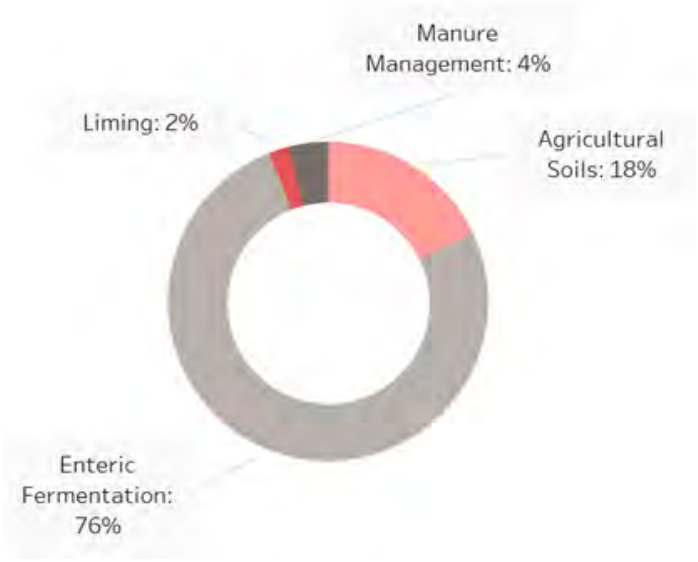


Figure 3.5: Tasmania's agricultural emissions *(data source: State and Territory Greenhouse Gas Inventory 2020)*

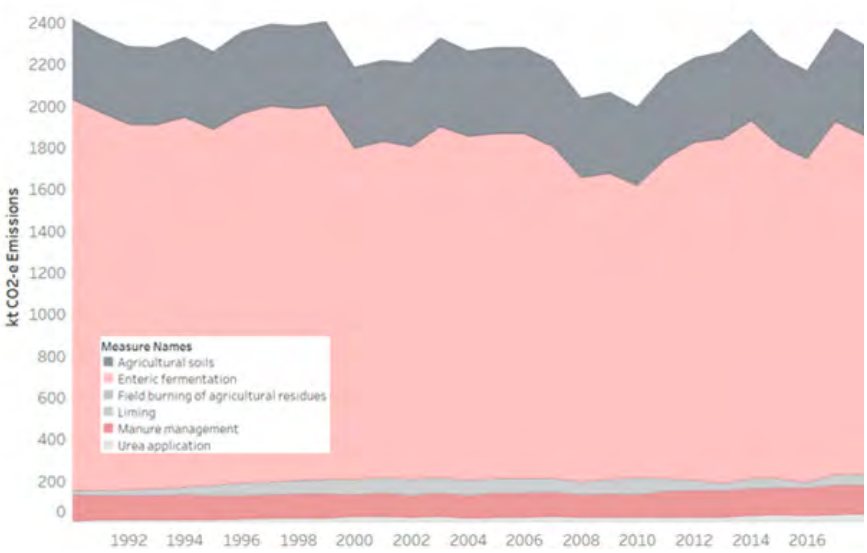


Figure 3.6: Disaggregated Tasmanian agricultural sector CO2-e emissions, 1990-2018

3.3.1 EMISSIONS MITIGATION AND ABATEMENT OPPORTUNITIES FOR THE LIVESTOCK INDUSTRY

The Tasmanian agricultural economy is dominated by income derived from animal products, particularly dairy and beef. With large-scale implementation of irrigation infrastructure across the State and with increasing global demand for animal products (especially dairy and red meat), intensive pasture-based industries such as dairy and beef cattle will continue to grow in future. These sectors must be prioritised in agricultural emissions mitigation initiatives.

Past agricultural research has largely focused on improving productivity in isolation. To move the agenda forward, progress in multiple sustainability indicators is required: productivity gains must be concurrently assessed alongside carbon sequestration, emissions mitigation, environmental stewardship, economic growth and social responsibility. A more holistic 'sustainable intensification' approach will provide a clearer understanding of the impacts and externalities associated with different technological or growth pathways.

Multi-disciplinary sustainable intensification measures are at the forefront of global sustainability thinking and, if implemented and scaled appropriately, would position Tasmania to become a global leader in sustainable agricultural production. Sustainable intensification increases agricultural production without adverse environmental impact[66] and is currently being tested through participatory processes with multiple stakeholders as part of the Tasmanian Institute of Agriculture's NEXUS project.

Some of the most promising opportunities for sustainable intensification of Tasmanian agricultural production include:

1. ***Carbon sequestration in vegetation***

Tasmania enjoys several advantages over mainland Australia in this area. In addition to storing or drawing down atmospheric carbon pollution, planting trees provides important co-benefits to livestock (including shade, wind breaks and reduced heat stress) and to the environment (enhanced biodiversity, habitat for wildlife). Planting trees and vegetation offers the largest opportunity for both emissions avoidance and emissions offsets on Tasmanian farms.

2. ***Carbon sequestration in soils***

Tasmania's cool temperate climate is conducive to relatively high rates of soil carbon sequestration compared with mainland Australia. Large gains in soil carbon stocks could be made by planting of deep-rooted legumes and perennials. These pastures increase productivity, increase soil carbon at depth, improve water-use efficiency, provide drought resilience and reduce emissions. Adding biochar to agricultural soils is another opportunity for storing carbon while optimising soil health and productivity.

Global Hub for Regenerative Farming Practices

The Tasmanian Government's Opportunities Paper explains that 'emissions from agriculture can be reduced by improving soil carbon through regenerative farming practices'. Providing government support to facilitate new entrants into the agricultural sector that plan to use regenerative techniques on marginal and degraded land, or those seeking farm conversion, can contribute to the state's food production and emission reduction goals, as well as deliver significant co-benefits for 'brand Tasmania'. Tasmania has a rich history of global leadership on organic, restorative and low pollution food production systems, and has the reputational pedigree to become a global hub for regenerative farming practices.

3. Landscape restoration

Unproductive arable agricultural landscapes have large potential for raising profitability, restoring environmental stewardship, protecting land health and improving social licence of the agriculture sector. Preventing livestock from grazing on native endangered pastures while increasing grazing in more productive, fertile regions is a clear opportunity for landscape management, raising productivity at the regional level while also protecting more vulnerable areas and fragile soils. Strategic land restoration and natural resource management programs can also support on-farm water conservation, harvesting and rehabilitation. Landscape management of this type requires government action.

4. Supplement livestock feeds

Livestock feed supplements and additives offer wide and potentially profound opportunities for reducing emissions from enteric fermentation. The use of additives or supplements derived from endemic seaweeds (see Box 1) or brewers' grain, as well as enteric methane vaccines such as 3-Nitrooxypropanol ("3-NOP"), have the potential to considerably reduce methane emissions from enteric fermentation in ruminating livestock. Developing plans, processes, and timelines to fast-track implementation and upscaling of EF technologies will be an important emissions reduction pathway for this sector.

5. Supporting income diversification

This opportunity provides a significant opportunity for climate change adaptation. In a drought year, when income from crops or pastures is low, income from alternative sources such as carbon provide a form of financial resilience for farmers. Despite this, uptake of agricultural Emissions Reduction Fund (ERF) projects in Tasmania remains discouragingly low, primarily due to cost and complexity associated with enrolment in current ERFs.[67] Avenues for increasing uptake of income diversification measures – ERF and otherwise – would be one of the greatest opportunities for emissions mitigation and sustainable intensification of the agricultural sector (Harrison et al. 2021). 'ERF stacking' (or combining multiple ERFs on farm using appropriately contextualised socio-economic bundles) also provides another opportunity for sustainable intensification.

Asparagopsis Seaweed

Supplementing livestock feed at very low volumes (less than 1%) with additives derived from Asparagopsis Taxiformis seaweed can reduce methane emissions from cattle by over 90%. The digestion of Asparagopsis seaweed species by ruminating livestock produces a compound called bromoform, which inhibits the digestive enzyme responsible for producing methane during enteric fermentation (CSIRO 2021). The more efficient digestion enabled by these seaweed additives also limits energy waste and enables livestock to grow faster, as metabolic conversion of methane consumes up to 15% of feed energy (FutureFeed 2021). This means that upscaling the use of seaweed additives in livestock feed can potentially reduce methane emissions while simultaneously lowering farmers' feed expenses and livestock energy waste.

Sea Forest, based in Triabunna, is the first enterprise in the world to cultivate Asparagopsis at a commercial scale through both marine and land-based aquaculture. Growing seaweeds helps to clean and de-acidify our oceans through absorbing nutrients and CO2 via photosynthesis. Sea Forest's Asparagopsis feed supplement contains bioactive compounds which prevent methane production in ruminant livestock. The University of Tasmania is working with industry, research and government partners to further develop Asparagopsis production and supply with a view to reducing enteric emissions from livestock in Tasmania and beyond.

3.4 Industrial emissions

Tasmania's industrial sector – namely, manufacturing and minerals processing – makes a significant contribution to the Tasmanian economy, but is also a substantial CO2 emitter accounting for 36% of total emissions in 2018 (Table 3.4). Given the size of industrial emissions, achieving nation-leading emissions target of 50% below 2005 levels by 2030 will require a clear strategy to reduce emissions over the next decade.

While facility-specific emissions data is not available (unlike, for example, in the US), Tasmania's highest emitters are likely to be major operators in minerals processing, cement, pulp and paper and manufacturing.

While these businesses benefit from access to renewable electricity, many still use significant quantities of natural gas and other fossil fuels. One general strategy to reduce industrial emissions, drawing on the renewable hydrogen strategy, is to promote the use of renewable hydrogen (or perhaps biofuel) in industrial processes where possible. Our strategy should be to capitalise on our renewable energy assets and expertise to deliver solutions which will secure Tasmania's low-emissions future.

3.4.1 DEVELOPMENT OF FACILITY-SPECIFIC STRATEGIES TO REDUCE EMISSIONS

Tasmania's industrial sector is characterised by a small number of relatively carbon-intensive operations which presents an opportunity to develop tailored facility-specific emissions reduction plans and timetables.

Cost-effective bespoke emissions reduction solutions to production processes can be developed through collaborations with government and research partners and can draw on the approaches and technologies that the owners/parent companies of many Tasmanian operations are developing and implementing to significantly reduce emissions.

Figure 3.5: Total emissions of Tasmania's industries *(combining relevant sections of direct emissions and industrial processes)*

Category	2018 % of total Tas emissions less LULUCF
Direct combustion (industrial)	15%
Metal and chemical	9%
Ozone subtitute	3%
Minerals industries	9%
Total	36%

The University of Tasmania's climate change action

This submission's primary concern is with the state government's climate strategy. However, effective climate action also requires active contributions from organisations across the Tasmanian community – including the University of Tasmania. The University is committed to minimising its greenhouse gas emissions and was certified as a carbon neutral organisation in 2017 in accordance with the Commonwealth Climate Active Carbon Neutral Standard. To achieve this carbon neutral certification entities must: measure and reduce emissions where possible; offset remaining emissions; publicly report on their carbon neutrality, and; undertake independent validation at least once every three years. The University of Tasmania is one of only two universities in Australia to achieve this carbon neutral certification.

Emissions reduction initiatives

The University is adopting a climate-positive approach across various operational domains. In addition to reducing emissions these changes have several important co-benefits for the University.

Some of the key initiatives include:

- Fuel source replacement and building upgrades to limit reliance on diesel, LPG, and LNG.
- Increased photovoltaic energy generation across several University facilities.
- Sustainable transport initiatives, including the acquisition of several BEVs for the University fleet while continuing to promote active transport.
- Migration to digital and cloud-based work platforms across most areas of University business, reducing paper use. For applications that still require printed office paper, the University has switched to certified carbon-neutral paper.
- A variety of waste management/reduction programs, including bins for organic waste and 'recycling walls' for depositing e-waste, batteries, various types of plastics, phones, and other recyclable waste.
- Reducing embodied carbon and optimising energy efficiency in new buildings. At the Inveresk Precinct, for example, the University targeted a minimum 25% reduction in embodied carbon for the site's two newest buildings.
- For difficult-to-address emissions, the University takes a portfolio approach to acquiring certified local and international carbon offsets, including from reforestation, renewable energy, biogas, and biodiversity protection projects in Australia, China, Indonesia, Vietnam, and Kenya.

PART 4: CLIMATE RISK, ADAPTATION AND RESILIENCE

Even as Tasmania takes concerted action to mitigate climate change (Parts 2 and 3), as a community we also need to develop a comprehensive adaptation strategy to prepare for the inevitable consequences of unavoidable climate change.

Developing and implementing detailed adaptation plans to build resilience and minimize climate impacts is a central element of a climate-positive strategy and a key feature of leading climate action plans such as Victoria's Climate Adaptation Plan.

Because the impacts of climate change vary considerably between communities and regions, state governments, working in collaboration with communities, must play a central role in preparing for, and adapting to, climate impacts.

Just as climate change mitigation should be addressed at a sectoral level, specific adaptation strategies should also be developed in this way. As argued in Part 1, and reflecting world-leading practice, adaptation plans should be required under the Tasmanian *Climate Change Act*. Connections with diverse stakeholders, communication across and between sectors, data and reporting, research and evaluation, and strong leadership in every sector will be necessary in these adaptation efforts.

Adaptation plans which identify and respond to growing climate risks can reduce the impact of global warming on communities, the environment and the economy but it is also important to recognise the limits of pursuing adaptation strategies. For example, in some circumstances there will be a need to implement a managed retreat from climate impact zones such as heavily forested and low-lying coastal residential areas. And as was highlighted in Part 1.2, some of Tasmania's natural systems, such as our ancient forests and kelp forests, will not be able to adapt to rapidly warming conditions and once lost may never return.

This Part (4) outlines the key elements of a sectoral, or systems-based, adaptation plan which should be incorporated in the next iteration of the Tasmanian *Climate Change Act* and the associated *Climate Action Plan*. The ensuing analysis follows the lead of the Victorian *Climate Change Act* and the Victorian Adaptation Plan and outlines adaptation strategies for human health and emergency services; ecosystems and habitats; agriculture and aquaculture; the built environment and transport; and education and training.

The role of government in climate adaptation

Governments, and state and local governments in particular, have a key role in identifying and managing future risks associated with climate change. There is broad consensus that government is best placed manage (in partnership with others) the future risks facing communities, especially when the timing, scale and distribution of costs associated with climate change is highly uncertain. In this sense effective climate adaptation is a collective action problem that cannot be addressed effectively through individual action or market-based approaches alone.

There is also a temporal challenge associated with climate adaptation in that the slower we are to mitigate, the greater the impacts will be and the harder it will be to adapt to them – in other words: the adaptation gap will grow. Some impacts are inevitable.

Reflecting these challenges, the main roles for government in terms of adaptation include:

- Protecting vulnerable human communities and groups that are not able to protect themselves, even with the provision of suitable information and incentives. This will involve close collaboration with those groups and associated service organisations
- Taking positive action to protect public goods (natural assets) that will not be protected through private action – including by reducing non-climate stressors and, where necessary, actively intervening to promote adaptation and reverse degradation.
- Developing and providing information about climate risks and adaptation options that are not otherwise available to the community/sectors. This will enable people to undertake their own risk assessments and drive individual adaptation.

- Ensuring that other policies and economic incentives are aligned and promote adaptive behaviour while not promoting maladaptation (especially with respect to land-use planning such as planting forests in the wrong places or developing urban or other infrastructure which will be vulnerable to climate risks such as fire and sea-level rise.
- Where possible, providing active support for adaptation initiatives for the wider community.
- Valuing ecosystem services (such as air and water) differently. Cost-benefit analyses should include social and environmental costs over the immediate and longer term.

In short, state governments need to play an active role to protect communities, our economy, and our environmental assets from climate change. State governments in Australia have admirably demonstrated their ability to mobilise and protect communities during the COVID-19 pandemic, and while climate change represents a different challenge, the adaptation effort will require a similar commitment to evidence-based action.

4.1 Addressing the impacts on human health and emergency management

4.1.1 HEALTH

Given the many climate change impacts on human health a number of adaptation strategies will be required to minimise long-term health impacts. Significantly, many of the strategies outlined below will also help mitigate climate impacts and deliver cost savings and other long-term wellbeing dividends.

- Develop enforceable planning regulations to prevent new developments in identified high-risk flood/ bushfire/coastal inundation areas.
- Increase vegetation cover in cities to reduce the urban heat island effect.
- Prioritise programs to increase energy efficiency of existing housing stock, while addressing indoor air quality.
- Introduce home energy auditing for all homes to be leased or sold.
- Increase minimum Nationwide House Energy Rating Scheme requirements for all new homes, with ratings to be based on 'as built', as opposed to ratings of architectural specifications only. Concurrently introduce minimum indoor air quality standards.
- Introduce regulation/legislation on the installation of wood heaters in new builds. This could include providing incentives to homeowners to replace wood heaters with heating technology with reduced emissions (e.g. electric heating, pellet fires) and/ or mandate installation of wood heaters with low particle emissions ratings such as in New Zealand.
- Prioritise and accelerate a reduction in smoking prevalence – smoking is significantly associated with a number of chronic conditions that are exacerbated in extreme events (e.g. respiratory illness and cardiovascular disease).
- Support distributed and community-owned renewable energy generation, as compared to nationally/internationally owned. Centralised renewable generation continues to favour those with more money.

Increased climate-related risks to human health will add to the pressure on Tasmania's health system. Scenario planning and building health system capacity will be critically important to minimise the impacts of large one-off, or multi-staged events (those occurring simultaneously such as the bushfires and floods of 2016), that overwhelm Tasmania's health system and impose a heavy financial and social burden on the state and community.

4.1.2 EMERGENCY MANAGEMENT

Impacts from climate change will increasingly pose serious risks to community safety, and will heighten the pressure on the Tasmanian emergency services. As discussed in Part 1, Tasmania is already experiencing more frequent and severe extreme weather events, a trend which is likely to continue in future. The cost to the Government and the community of responding to these natural disasters is rapidly increasing.

Tasmania has flood and bushfire management strategies in place. These strategies provide advice to communities about taking personal responsibility in preparing for and responding to a climate-related hazard. They also set out the role, responsibilities, capacities and functions of Tasmania's emergency services in preparing for and responding to environmental emergencies. However, Tasmanian communities and households continue to face elevated risks in a number of areas including access to affordable insurance. Research has demonstrated that low-income households are often under-insured against bushfire risk and this problem will become more acute as the cost of insurance against climate-related risks increases over time.[69]

Government can focus on enhanced planning for climate-related emergencies, rather than focusing on developing its reactive capacity (although this is also important). This will save lives and money. Scenario planning is critically important as it is the link between future thinking and strategic action. In addition, Government can:

- Mainstream climate change in all aspects of Tasmania's emergency management plans and actions
- Develop a specific climate change emergency management program
- Enhance and coordinate community-based climate risk and emergency management and planning

- Include climate change projections into government budgeting at the state and local level. This will help prevent financial shocks and manage the immediate and long-term financial costs of a major environmental emergency
- Investigate enhanced delivery of vital information to the Tasmanian community. For example, delivery of the Tasmanian Bushfire App (similar to the effective NSW Fires Near Me app) to the community will save lives.

As Figure 1.5 (Part 1) shows, Tasmania has experienced a strong increase in bushfire damage in recent decades - a trend that is likely to continue. In terms of adaptation to increasing climate, induced fire events (as well as contributing to a lower decline of carbon stocks) conducting sustained low intensity controlled burning that restores Aboriginal fire management regimes as well as thinning of forests may be warranted. However, this would unequivocally need to involve long-term experimental and observational studies that link fire severity effects on forest structure, dynamics and carbon pools.[70]

Equipping community with knowledge, plans and technologies to protect their families and livelihoods is one of the main responsibilities of governments. Education and emergency management forums and building connection-rich communities can save lives. Scenario planning and responses to catastrophic damage to essential services and infrastructure such as electricity networks can enhance community resilience.

Developing climate adaptation plans and, where possible, targets that can be measured and verified for Tasmania's health and emergency services sector, or 'system', will make Tasmanians safer, protect their livelihoods, and make communities more resilient.

4.2 Managing impacts on ecosystems and habitat

As discussed in Part 1.2, climate change is having and will increasingly have an effect on ecosystems and the flora and fauna within them. Tasmania is literally the 'last stop' for many species – there is nowhere further south for them to go. Some Tasmanian Government policies acknowledge the likely impact of current and future climate change on biodiversity, and the need to facilitate adaptation and promote resilience,[72] including in the Tasmanian Wilderness World Heritage Area. These resources demonstrate that Tasmania's biodiversity will be heavily impacted by a changing climate, including as a result of warming and drying trends and more extreme weather events such as bushfires and heatwaves. However, there is a need for a more proactive approach to supporting the resilience of our ecosystems.

The next Tasmanian *Climate Change Act* provides an important opportunity to integrate climate considerations across conservation laws, without the need for detailed, instrument-by-instrument reforms.[71] *The Act* should become a tool for guiding government decision makers to anticipate and prepare for climate change in their interpretation and implementation of conservation laws in Tasmania. Furthermore, coordinated monitoring needs to be implemented to provide information on early warning of changes and to underpin decision-making.

It will be crucial to identify and protect vulnerable areas from land clearing, development or overfishing as well as managing existing reserves, so that wildlife can take refuge in them.[72] A first and vital step involves explicit protection of climate refuge areas in Tasmanian law to prevent unlawful actions such as clearing and damaging habitats, such as occurs in the legislation of other states.[73]

Emergency interventions for conservation purposes will be required in some contexts. Such interventions should be anticipated in legal instruments such as threatened species recovery plans and protected area management plans.[74]

Ecological restoration is a crucial requirement for adaptation-oriented conservation but is all but absent from existing policy and laws (except in response to environmental harm such as a pollution event). Policies and legal provisions that require, support and prioritise ecological restoration could promote adaptive approaches, including by requiring reference to up-to-date climate information rather than a reliance on historical information.[75]

Some species will migrate to stay within tolerable climatic conditions, and Tasmanian decision makers will need guidance about whether those species should be protected in their new environments or whether they should be managed and/or removed. Human-driven species translocations will also be necessary in some cases to avoid species extinctions and to supplement ecosystem functions.[76] A clear legal and policy framework for climate adaptation should include explicit principles about when such interventions will be justified in a changing climate.[77]

4.3 Climate adaptation for agriculture and aquaculture

The increasing frequency of climate extremes, the changing direction, magnitude and seasonal variability of Tasmania's rainfall patterns, the likelihood of protracted periods of drought in Tasmania's farming regions, and the reduction in soil moisture over time (see Part 1.2) all have the potential to reshape Tasmania's agricultural industry over the coming decades. Productive regions and/or crops in 2020 may not be productive, or may have to be used in different ways, in 2050 and beyond.

Sustaining and growing the agricultural economy, particularly in relation to livestock production, while sustaining the natural resource base (soil, water, air, and biodiversity), is one of the foremost adaptation challenges posed by a changing climate. In addition, the agricultural industry is central to Tasmania's economy and identity.

It is therefore vital that the Government continues to plays a strong role in developing and implementing strategies that assist communities and businesses that rely on our agricultural system to adapt to climate change or else transition to new industries, products, or locations. While profitable farming businesses will have greater capacity to adapt and innovate to a changing Tasmanian climate, enterprises with marginal profitability may require government support to transition to new endeavours.

Income diversification (also discussed at Part 3.3.1) for farms should be encouraged as a key adaptation strategy amid increasing climate variability. In drought years, when income from crops or pastures is low, income from alternative sources (such as carbon, biodiversity or tourism) provide financial resilience for farmers.

Key to the resilience of farms and farming communities will be access to good quality data on the changing climate and seasonal forecasting to underpin their decision-making. Further, supporting on-farm climate and digital literacy will also be critical.

Similarly, Tasmania's aquaculture industry requires adaptation strategies. As discussed in Part 1, the warming of Tasmanian waters has seen the incursion of non-native species impacting ecosystems, including species valued by the industry. In addition, farm-reared fish in marine settings are adversely affected by warming waters and concomitant acidification. Tasmanian aquaculture operators desire longer seasonal forecasts and higher resolution spatial information allowing a better sense of future risks. Such knowledge will aid business planning and adaptation.[78]

4.3.1 WATER SUPPLY IN TASMANIA'S REGIONS

Water is a major asset for Tasmania linked to livelihoods, energy production, irrigated and rainfed agriculture, environmental management and conservation. Competing demands for water intensify during droughts. Indices of meteorological and agricultural drought generated through fine-scaled climate projections indicate that the episodic and regional nature of drought events in Tasmania will continue (see Part 1 for more information on climate impacts of global warming).[81] It is predicted that by 2070-99, rainfall in autumn and summer in western Tasmania will have reduced by 10-20%, with the east coast of Tasmania becoming especially drought-prone.

The *White Paper on the Competitiveness of Tasmanian Agriculture 2050* highlighted the need to focus on supporting the development of long-term resilience and preparedness initiatives in rural communities, rather than reactively providing recovery assistance during, or following extreme events such as droughts.[80] Many farmers, especially on the east coast of Tasmania, wonder about the future of their enterprises without irrigation especially in relation to pasture and livestock management. Proactive investment in irrigation to provide high-surety water will be an important support for adaptation and resilience in the Tasmanian agriculture sector.

Tasmania has already invested heavily in irrigation which has underpinned significant growth in the sector over the last decade. Since 2010, 15 irrigation schemes have been constructed with a total capital cost of $418 million, funded by the Tasmanian and Australian Governments and the private sector, providing an additional 100,000 ML of reliable water supply to support growth in agriculture. Tasmanian Irrigation's Pipeline to Prosperity, the third tranche of public-private irrigation schemes, will deliver 10 proposed irrigation schemes with the potential to provide another 78,000 ML of high security water.

However, adapting to climate-related water scarcity through irrigation expansion is complex. Irrigation in the wrong place and/or poor irrigation practices can have a negative impact on fragile soils and soil carbon. Potential benefits can also be offset by increasing exposure to financial risk as farming businesses become locked in a cycle of increasing investment in irrigation infrastructure and technologies associated with higher revenue,

higher operating costs, higher debt, and higher land values. Irrigation expansion is attracting investment by corporations and/or leading to expansion in size of farms. The University of Tasmania is establishing a 'Tasmanian Drought Resilience Adoption and Innovation Hub' following the announcement of $8 million in funding from Commonwealth Government's Drought and Resilience Research and Adoption program. The hub, one of eight across Australia, is set to transform the way that Tasmanian farmers and communities prepare for and respond to drought.

The hubs form the centrepiece of the Commonwealth's Future Drought Fund program and the following high-level goals:

- An innovative and profitable farming sector
- A sustainable natural environment, and improved functioning of farming landscapes
- Adaptable and resourceful rural, regional and remote communities.

The Tasmanian hub will create an engagement, learning and innovation platform to integrate the work of farmers, researchers, local entrepreneurs, traditional custodians, natural resource managers, industry and community developers. Stakeholders will be brought together to share and exchange knowledge, define problems, co-design relevant solutions for where they are needed and evaluate outcomes based on the criteria of those impacted by drought. The Hub will facilitate and harness research and development as well as playing a key role in translating existing research. The development and uptake of solutions will be accelerated by catalysing and supporting extension activities, innovation processes and commercialisation activities.

Effective drought resilience across a regional landscape is more likely when the 'community' of diverse stakeholders work collaboratively so that solutions draw upon diverse sources of knowledge and expertise. Understanding enablers for collaboration is crucial for developing regional resilience. Also critical to success are activities and actions that help to build a shared understanding of the problem domain and those that improve trust in relationships. Development and uptake of creative solutions can accelerate when action and research occur concurrently. When potential beneficiaries are involved in the research, they tend to take notice of the evidence emerging and can foster learning among their peers. Sustaining and enhancing drought resilience in future generations will depend on involving those who can shape and enable the future workforce, including rural women and educators.

4.4 Improving resilience of our built environment (including transport)

Tasmania's cities and towns, regardless of their location, will feel the impacts of climate change in some way. Extreme weather events such as storm surges and associated inundation can damage or even destroy low-lying coastal buildings and properties, while higher maximum temperatures and more frequent heatwaves pose an extremely worrying bushfire risk to peri-urban and rural homes, schools, hospitals, businesses, and communities across our state. Incremental impacts such as sea-level rise pose serious challenges to infrastructure such as ports, roads, sidewalks, stormwater systems, and bridges, as well as, in some locations, their ongoing habitability.

Government decisions cannot be based on observations of the past but must be firmed based on what climate change projections tell us. For example, past flooding, coastal inundation, or bushfire patterns cannot inform decision about development approvals or infrastructure rollouts, these decisions must be informed by accurate downscale models and up-to-date information and data.

The cost of addressing these challenges will be significant, but pales in comparison to the costs of taking no action. Conservative estimates indicate that US$1 invested today in disaster preparedness of the built environment can avoid US$4 in post-disaster reconstruction.[81] In other words, the Tasmanian state government can save considerable sums of money by integrating climate adaptation into their planning and policy approaches to our built environment.

More active consideration of the impacts of climate change on future urban planning, development, and transport infrastructure will be essential to addressing these challenges.

4.4.1 URBAN PLANNING AND DEVELOPMENT

Urban planning and development have major implications for climate change adaptation (and emissions reduction). This is because continued urban sprawl into sparsely populated areas increases the vulnerability of new communities to bushfire risks (a risk remediable only by large-scale land clearing, releasing stored carbon dioxide). It also adds to the challenges of planning for, and ultimately providing, timely emergency management.

While a wide range of housing types is necessary to meet community needs and market demand, increasing infill development in Tasmania's urban centres is the most sustainable path to accommodating the state's growing population both in terms of minimising climate risk and reducing transport emissions.

Tasmania's current development patterns are unsustainable. For example, the Southern Tasmanian Regional Land Use Strategy 2010-2035, launched in 2011 and amended in 2020, targeted a 50/50 breakdown between greenfield and infill development.[82] Most major metropolitan areas across the country have infill development targets set at 60-70% of all new housing. Even with a less ambitious target, recent estimates suggest that very little progress has been made towards achieving a 50/50 development split in Tasmania's major population centre.

More effective planning to address sprawl and peri-urban development would support climate adaptation as well as providing far-reaching benefits for energy efficiency, provision of public transport and transport infrastructure, emergency management, and access to healthcare and essential services while lowering the carbon intensity of Tasmania's urban centres.

Key elements of a climate change adaptation approach for urban planning and development (including existing buildings) are listed below. As noted at 4.1 many of these adaptation strategies would also deliver health and wellbeing co-benefits:

- Locate government infrastructure, settlements, assets and services in less hazard-prone areas.
- Rethink planning and zoning regulations to expand soft land cover and green infrastructure in the built environment.
- Develop building codes and architectural guidelines that promote climate-responsive buildings and prioritise the use of low-emissions materials and processes.
- Retrofit existing government buildings and infrastructure to improve energy efficiency and ensure compliance with best-practice bushfire ratings and standards.
- Prioritise programs to increase energy efficiency of existing housing stock, while addressing indoor air quality.

- Increase minimum Nationwide House Energy Rating Scheme requirements for all new homes, with ratings to be based on 'as built', as opposed to rating of architectural specifications only.
- Implement wood heater standards and incentivise the uptake of efficient wood heaters. This would not only lower the carbon footprint of household heating, but also reduce hazardous woodsmoke pollution.
- Develop and encourage stringent household, school and business water-use plans.
- Deeply engage local governments into adaptation plans, processes, and laws – they are on the frontline of climate impacts and intimately know their communities.
- Incentivise private sector adaptation and remove barriers.

4.4.2 TRANSPORT SYSTEMS

The design of new transport projects, and the management and maintenance of existing ones, should be conducted through a policy framework that integrates broader climate change adaptation themes. In addition to road and public transport infrastructure, consideration must also be given to the adequacy and maintenance of fire trails and other similar networks of emergency response and management transport infrastructure. Examples of transport system adaptations applicable to Tasmania include:

- Road redevelopments in low-lying areas to accommodate for increased risk from flooding and other extreme weather.
- Updates and adaptation of road-adjacent stormwater infrastructure to manage a likely increase in storm surges, high tides, and extreme rainfall events that would disrupt transport and stress, damage, or degrade existing transport infrastructure assets.
- Assessing the likely impacts of sea-level rise on port infrastructure and update or retrofit as necessary. Given Tasmania's reliance on marine freight to and from the Australian mainland, ensuring that existing port infrastructure can tolerate increased storm surges and rising seas will be particularly important.
- Updating road and transport infrastructure in preparation for increased uptake of electric vehicles and broader electrification of the transport network, and depots, consistent with projected climate change impacts.

Nature-based solutions for adapting to climate change

Nature-based Solutions address climate change impacts (and greenhouse gas emissions) through the protection, restoration and sustainable management of natural ecosystems; compared to the deployment of artificial infrastructure and strategies. For example, restoration of endemic coastal vegetation such as dune grasses, trees and mangroves can strengthen coastal defences against storm surge (as well as sequester carbon dioxide) and protect coastal communities; compared to building a concrete seawall (with a high-level of embedded carbon dioxide emissions). Nature-based adaptation projects can assist with flood and pest control, urban heat, access to water, coastal, river, and inland/hillslope erosion, and wind and fire breaks. They can be deployed to support and protect food production and water systems through to the built environment. Research has demonstrated that such interventions can be two to five times cheaper than the erection of artificial barriers (Lawrence and Vandecar, 2015). Reforestation and afforestation projects, and re-planting infant corals into reefs (blue-carbon projects) for example, can generate their own revenue streams though carbon credits. Nature-based Solutions are being increasingly recognised by governments, NGOs, businesses and communities as the best way to tackle the challenges of climate change, protect human populations and create new habitats for wildlife.

4.5 Climate education and literacy

Climate education and literacy are important elements in any comprehensive plan to strengthen the Tasmanian community's capacity to adapt to and plan for the impacts of climate change. Where possible climate education should provide both information on the climate facing communities alongside actions individuals can take to respond to the climate challenge. Informing and empowering individuals and communities is an important driver of effective climate action.

Research and polling have consistently shown a strong correlation between the level of concern about climate change and climate change literacy. Climate literacy includes informing the whole of society on the anthropogenic nature of climate change, the changes that are needed to mitigate climate change, the timeframe for those changes (in line with the Paris Agreement goals to keep temperature rise below 1.5 degrees above pre-industrial levels) and the projected consequences of not doing so. Community members should be aware of how their own actions impact on climate change, and how reducing household carbon footprints has a significant, tangible impact on climate change. In these ways, climate literacy can empower individuals, households and communities to take action.

Engaging community members about climate change means increasing the understanding of how extreme weather events are associated with climate change, to enable better preparation for risks like bushfire and flood. Individuals involved in specific industries, for example, agriculture and aquaculture, need tailored climate information, while a wide range of the most climate-vulnerable activities (including forestry, hydroelectricity, emergency management) need detailed climate information also. Climate literacy instruction in schools should also consider the mental health impacts of climate change, which are increasingly impacting on young people in particular.

Government has a role in supporting climate literacy and education. In schools there are currently no specific mandated curriculum on climate change across all year groups at a national or state level, despite Australia agreeing to comprehensive climate change education as a signatory to the Paris Agreement (of which Article 12 covers climate literacy). Students may leave Tasmanian schools having had little specific instruction on climate change, depending on their school, teachers or subject choices. In a study of young Tasmanians aged 18 to 24, many reported feelings of frustration due to a 'fragmented' approach to issues connected to climate change.[83] The Tasmanian Government could consider the best way to incorporate climate change education and literacy into the curricula of Tasmanian schools.

University of Tasmania and climate change engagement and education

A research partnership between the University of Tasmania, Elsevier and Ipsos in 2020 found that the University of Tasmania was the most trusted source in Tasmania for climate change information (59% of respondents agreed). The University teaches climate change across a variety of disciplines, and in 2020/21 has launched a series of two 13-week study units specifically on climate change. The 'Curious Climate Tasmania' project was another University initiative (in partnership with the Tasmanian Government, CSIRO and the ABC) where the public were invited to submit questions. Over 200 members of the Tasmanian public asked 300 climate-change related questions of academic experts. (https://curiousclimate.org.au/).

PART 5: CONCLUSION AND RECOMMENDATIONS

Climate change represents a profound challenge which demands a comprehensive and coordinated response from individuals, communities, business and governments. Despite the clear costs and risks of global warming an ambitious and proactive climate action strategy would enable Tasmania to capitalise on its climate-positive status and assets to attract investment, industries and people seeking to contribute to a low-carbon world.

The current review of Tasmania *Climate Change Act* and the associated *Climate Action Plan* represents an important and timely opportunity to consolidate and capitalise on Tasmania's world-leading carbon emissions profile and renewable electricity assets.

However, Tasmania cannot be complacent. This submission argues that Tasmania's climate action strategy must include more ambitious sectoral emissions reduction targets and comprehensive, sector-specific climate adaptation strategies to establish a resilient, competitive and prosperous climate-positive economy.

Recommendations relating to the policy question raised in the Issues and Options papers published as part of the Review porcess were presented throughout the submission and are summarised below.

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Part 1 - The climate challenge

1.1: Commissioning updated 'downscale' modelling of likely impacts of global warming on the Tasmanian climate to inform community-level adaptation strategies (Section 1.2).

1.2: Tasmania's next *Climate Change Act* should include:

- A commitment to establishing and promoting Tasmania as a world-leading 'climate-positive' jurisdiction (Section 2.1).
- A statement of the principles which will guide future climate action (Section 2.3.1)
- Establish sectoral emissions targets for energy, transport, agriculture, industry and waste. Reflecting international best practice, the target should be a 50% reduction in sectoral emissions by 2030 from a 2005 baseline (Part 2).
- A commitment to develop a collaborative and coordinated 'mainstreaming' approach to climate action encompassing all levels and agencies of government and partnerships with communities and business (Section 2.3.4)

2030 sectoral emissions targets – Tasmania (kt CO2-e)

Sector*	2005 emissions	2018 emissions	2030 target	% reduction on 2018
Energy	1960	2245	980	56%
Transport	1852	1587	926	42%
Industrial processes	1531	1719	766	55%
Agriculture	2281	2294	1141	50%
Waste	405	354	203	43%

Part 2 - Sectoral emissions targets

Part 2 of the submission analyses the latest data from the State and Territory Greenhouse Gas Inventory to calculate sectoral 2030 emissions targets which would ensure that Tasmania maintained its world-leading emissions profile.

Part 3 – Sectoral mitigation strategies

Part 3 of the submission proposes evidence-based strategies for reducing sectoral emissions which should be developed during the implementation of the next *Tasmanian Climate Action Plan*. Specific recommendations include:

ENERGY (PART 3.1)

- Continuing the work under the *Tasmanian Renewable Hydrogen Action Plan* to increase the replacement of natural gas with renewable H2 in residential and industrial applications.
- Partner with specific industries to reduce non-electricity energy emissions.

TRANSPORT (PART 3.2)

- Establish targets for sales of zero-emissions vehicles
- Work with other states to promote national emissions standards for new vehicle sales to promote supply of zero-emissions vehicles
- Abolish duties on sales of zero emissions vehicles (funded by increasing duties in ICE vehicles) until price parity is achieved
- Continue to promote public and active transport
- Continue to develop and promote options for using green hydrogen for heavy transport.

AGRICULTURE (PART 3.3)

- Promote research, development and production of feed supplements for livestock to reduce enteric emissions. Tasmania is well placed to play a leading role in this globally significant innovation.
- Continue to develop and promote 'sustainable intensification' strategies including maximising soil carbon and vegetation-based sequestration

INDUSTRY (PART 3.4)

- Establish firm-specific partnerships to reduce the emissions intensity of key Tasmanian industries
- Where possible, support conversion from natural gas to green hydrogen in industrial processes.
- Continue to provide zero-interest loans to Tasmanian businesses investing in technologies and processes which will reduce emissions.

Climate change and our response to it will fundamentally transform our economy over the next generation. It will be disruptive and will require investment but will also create opportunities which Tasmania can capitalise on. Indeed, modelling commissioned by the Tasmanian Government and published in the discussion paper prepared for the *Independent Review of the Climate Change Act* found that 'the transition to a net zero carbon economy could deliver economic benefits across most sectors including agriculture, forestry and aquaculture and manufacturing' in addition to 'broader economic co-benefits'.[84]

Part 4 – Sectoral adaptation strategies

Reflecting international best practice and the strategy adopted by the Victorian Government, the Tasmanian *Climate Action Plan* should develop and implement climate adaptation plans for five key sectors and systems in order to reduce the impact of unavoidable climate change. Specific sectoral adaptation plans which should be considered are described in Part 4 of the submission:

HEALTH AND EMERGENCY MANAGEMENT (PART 4.1)

- Develop enforceable planning regulations to prevent new development in identified high risk flood, bushfire, or coastal inundation areas.
- Ensure minimum vegetation cover in urban environments to minimise the urban heat island effect.
- Develop programs to increase the energy efficiency of existing housing stock and commercial/ government buildings.
- Further develop a specific climate change emergency management program, as well as a bushfire response smartphone app similar to those available in NSW or Victoria.
- Encourage and coordinate community-level emergency response planning.

ECOSYSTEMS AND HABITAT (PART 4.2)

- Increase protections for habitats which are home to vulnerable or protected species impacted by climate change. These protection may include legal instruments such as threatened species and protected area management plans.
- Restore and rehabilitate degraded ecosystems to ensure existing habitat for flora and fauna likely to be impacted by climate change is protected or expanded.
- Ensure the use of the most recent, relevant, and reliable climate data in the assessment of development or land use planning.
- Develop plans for responding to inevitable species relocation. Existing strategies should be updated to recognise species translocation and migration as the climate changes.

AGRICULTURE AND AQUACULTURE (PART 4.3)

- Encourage income diversification as a buffer for primary producers against increasingly unpredictable climatic conditions.
- Support climate and digital literacy for primary producers through education initiatives.
- Prepare rural and regional communities for the likelihood that changing rainfall patterns, increased bushfire risk, and increased extreme weather events will threaten the viability of certain crops or productions processes in many areas of the state.
- Invest proactively in irrigation, and support producers to develop efficient and up-to-date irrigation infrastructure to manage increased unpredictability of rainfall and more intense, prolonged drought events.

INFRASTRUCTURE AND THE BUILT ENVIRONMENT (PART 4.4)

- Review planning and zoning regulation to expand soft land cover and increase vegetation in cities to reduce the urban heat island effect.
- Increase efforts to promote infill development in Tasmania's urban centres as opposed to peri-urban development exposed to bushfire risk.
- Consider likely climate change impacts in decisions about the placement/development of government assets, infrastructure and services.
- Ensure that building codes promote energy efficiency and climate responsive buildings, as well as ensuring the use of low-emissions materials and processes.
- Retrofit existing buildings and infrastructure to increase energy efficiency and protect against heatwaves.
- Assess the ability of existing and future port infrastructure to withstand sea-level rise and increased extreme weather events.
- Prepare road infrastructure for increased uptake of electric vehicles, including with the strategic provisions of fast charging infrastructure.
- Undertake assessment and improvement of existing and new stormwater infrastructure to ensure existing assets will be sufficient for increased extreme rainfall and flood events.

COMMUNITIES AND CLIMATE EDUCATION AND LITERACY (PART 4.5)

- Incorporate greater climate education and climate impact awareness in school curricula to ensure students are prepared for a world in which climate change adaptation will be a defining generational challenge.
- Develop education and awareness programs to increase climate change literacy in the community.
- Develop industry-specific climate change adaptation and awareness education programs to ensure that all sectors of the economy are equipped with up-to-date knowledge that will aid adaptation and resilience in the face of unavoidable climate change impacts.

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