Climate change in Western Australia

Issues paper – September 2019

Department of Water and Environmental Regulation

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Minister's foreword

The McGowan Government acknowledges the challenge that climate change poses to the State and we want to have an informed discussion with the Western Australian community and determine how we move forward to address the risks and seize the opportunities that climate change poses. The proposed State Climate Policy is envisaged to be a roadmap for the long term that assists with the careful planning and investment required to ensure the continued prosperity of our State.

As a State, we can improve our strategies to invest in and support new industries and technologies like the energy sources of the future, such as hydrogen and renewables. This will help ensure that our State assets are positioned to support a growing population and our industrial needs for decades to come.

We need to ensure that our water resources are secure and can support our growing population.

We have the opportunity to invest in the conservation estate to shore up our biodiversity values and participate in the growing carbon market to deliver homegrown solutions to emissions reduction imperatives.

In August this year, the government announced its commitment to working with all sectors of the economy to achieve net zero emissions for our State by 2050. We have also set ambitious targets to improve our waste management strategies and improve the way we use our resources.

The expansion of the State's public transport system through METRONET will enhance the efficient movement of our community and deliver direct reductions in transport emissions along with emerging technologies such as electric vehicles.

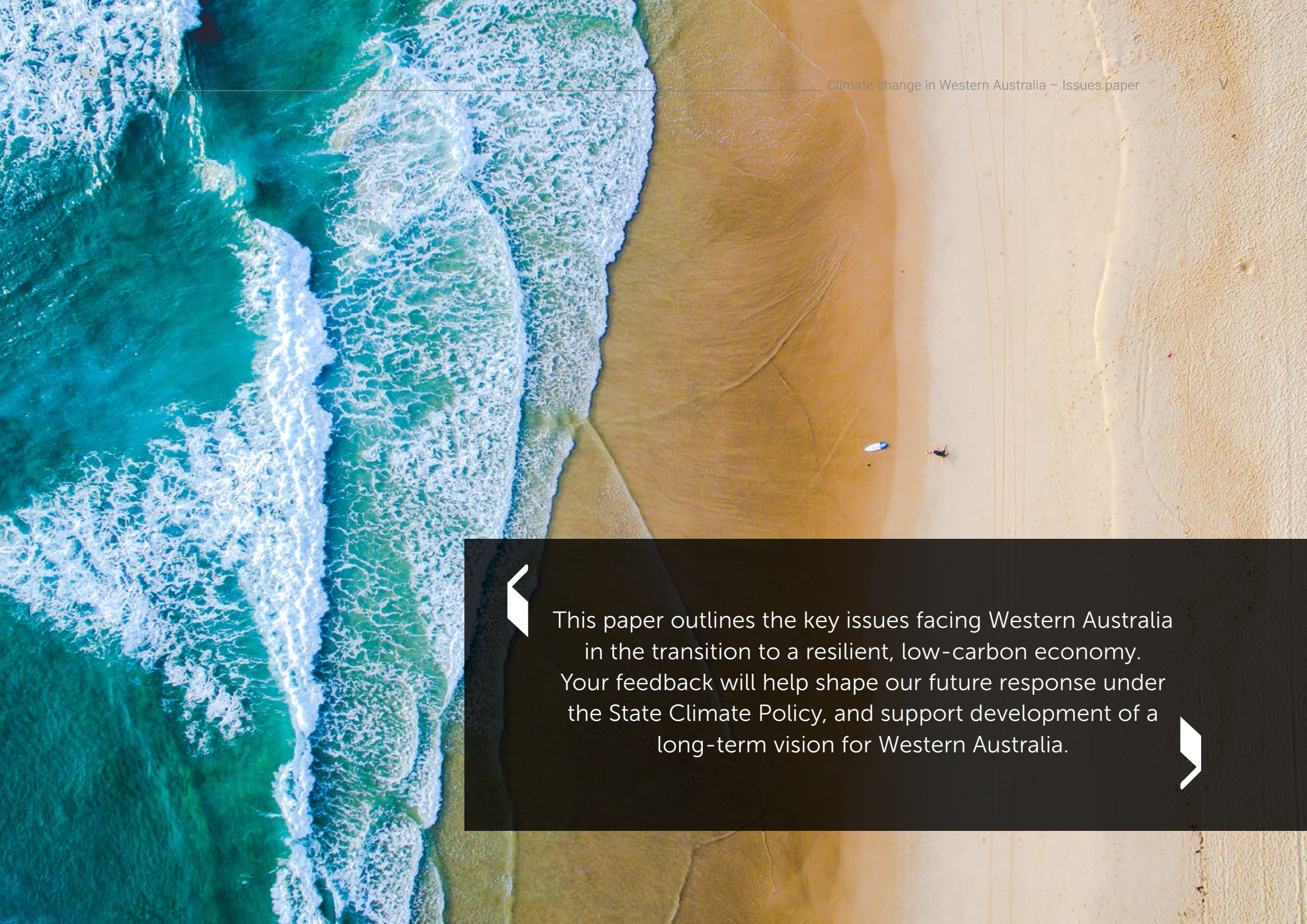
Western Australia's assets are plentiful – we have world-class renewable energy, a wealth of mineral resources, abundant land and a skilled workforce, which reinforce the exciting opportunities for developing new industries and services, and diversifying our economy. The McGowan Government is working to take advantage of these job-creating opportunities, for example through its Future Battery Industry Strategy, Renewable Hydrogen Council, LNG Jobs Taskforce and the development of a State-based carbon supply market.

While a nationally consistent policy framework which we can rely on to deliver the commitments of the Paris Agreement is urgently needed, Western Australia won't wait on the Australian Government. A clear State Government policy and roadmap for action will ensure we manage the low-carbon transition in a considered way. It is also critical that we seize the opportunities presented by new technologies, emerging markets and changing consumer preferences. A coordinated approach to climate change will enhance the reliability of important services and the resilience of our communities, infrastructure and environment in the face of the unavoidable impacts of climate change.

We need to do more to safeguard a prosperous future for our State. This paper outlines the key issues facing Western Australia in the transition to a resilient, low-carbon economy, and sets out opportunities to build on actions already underway. Your feedback will help shape our future response under the State Climate Policy, and support development of a long-term vision for Western Australia.

I invite all Western Australians to have their say.

Hon Stephen Dawson MLC
Minister for Environment



This paper outlines the key issues facing Western Australia in the transition to a resilient, low-carbon economy. Your feedback will help shape our future response under the State Climate Policy, and support development of a long-term vision for Western Australia.

Have your say

Western Australia's response to climate change is important and you are encouraged to have your say.

We invite you to have your say in shaping Western Australia's future.

By working together, we can ensure our State is well positioned for the low-carbon transition and resilient to the unavoidable impacts of climate change. Developing a complementary, integrated policy response in consultation with business and the community is the best way to achieve this goal.

Your feedback on the issues and questions outlined in this paper will help inform the development of Western Australia's new Climate Policy. It will also support the whole-of-government aim of sharing prosperity, and realising our State's economic, social and environmental potential.

You are invited to share your views by making a submission to the Department of Water and Environmental Regulation.

Your legal rights and responsibilities

If you make a submission, please be aware that in doing so, you are consenting to it being treated as a part of a public document. Your name will be published; however, your contact address will be withheld for privacy. If you do not consent to your submission being treated as part of a public document, you should either mark it as confidential, or specifically identify what information you consider to be confidential, and include an explanation.

Please note that even if your submission is treated as confidential by the department, it may still be disclosed in accordance with the requirements of the *Freedom of Information Act 1992*, or any other applicable written law. The department reserves the right before publishing a submission to delete any content that could be regarded as racially vilifying, derogatory or defamatory to an individual or an organisation.

How to make a submission

Submissions can be made online:

https://consult.dwer.wa.gov.au/climatechange/issues-paper

You can also send hardcopy submissions to:

Climate Change Consultation
Department of Water
and Environmental Regulation
Locked Bag 10, Joondalup DC
WA 6919

Introduction

Western Australia's climate has changed during the past century, with our State's South West region impacted by climate change more than almost any other place on the planet. We have seen higher average temperatures, and an increase in the annual number of days in Perth over 35 ℃. There has also been a steady decline in rainfall, with a 60 per cent reduction of inflow to metropolitan dams since the 1970s.[1]

Already one of the most fire-prone regions in the world, Western Australia's fire risk has increased over the past four decades, and fire seasons have lengthened due to warming, drying conditions. There have also been observed changes in sea levels, with the rate of sea level rise on the west coast almost three times the global average.[2]

In the future, climate change will drive increased average and maximum temperatures, time spent in drought and lead to more extreme weather events.[3] In the south-west, the prolonged period of drying will continue, affecting primary industries, water security and natural ecosystems.

These changes will potentially have broad impacts across our communities, industries and ecosystems. Warming trends and extreme events will affect our natural assets, such as Ningaloo Reef, and our global biodiversity hotspot in the south-west, which will have implications for how these iconic regions are managed.

Climate change will see a need for greater emphasis on disaster preparedness, and increase the challenge of protecting infrastructure and vulnerable communities. Some agricultural areas in Western Australia may become marginal[4] and our cities and towns will be exposed to rising sea levels. Meanwhile, more severe heatwaves and changing patterns of disease have the potential to affect the health and wellbeing of Western Australians, particularly the vulnerable.

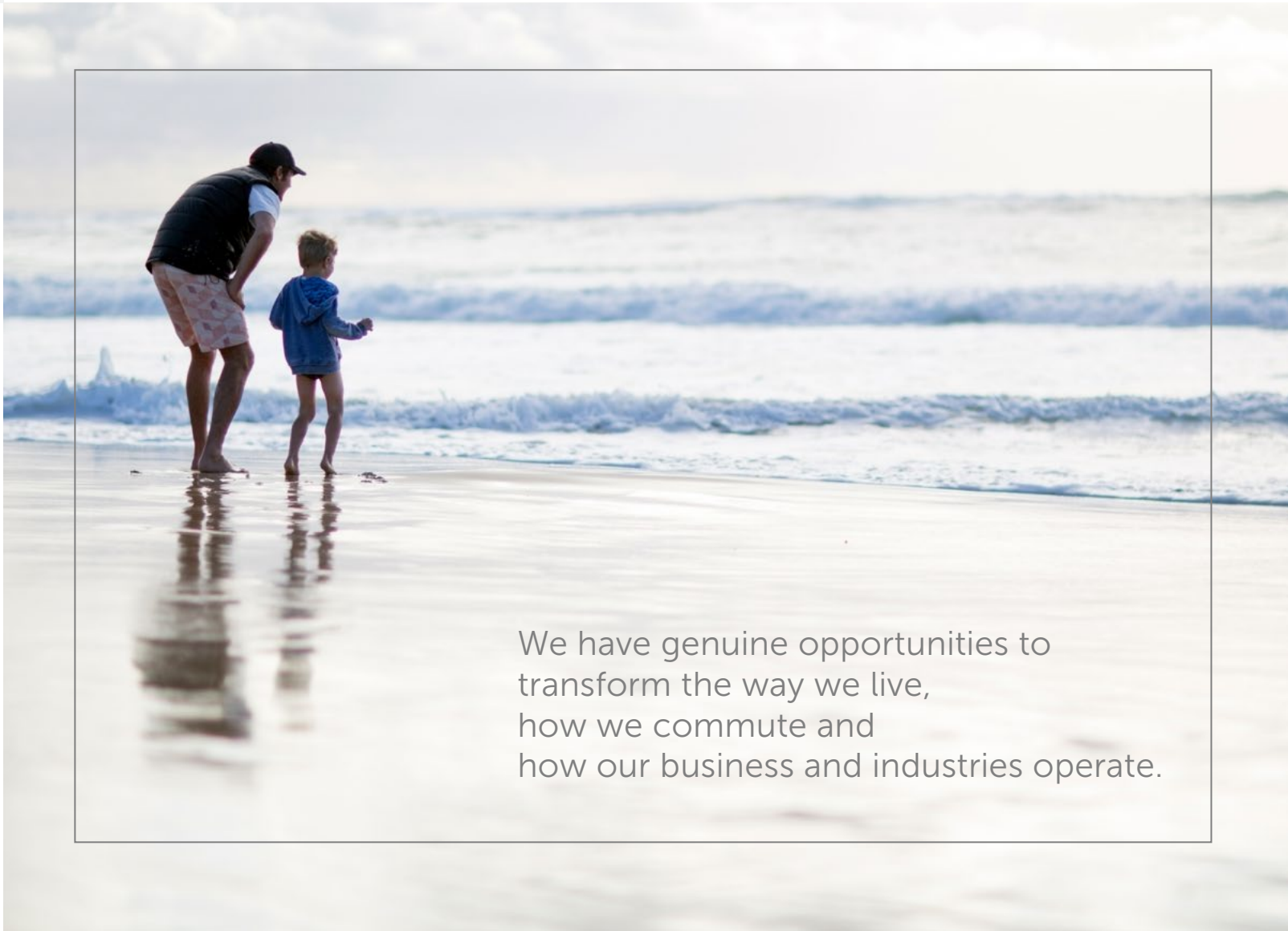
As a resource-based economy, Western Australia is significantly exposed to carbon transition risks as the world moves to cleaner production processes and low-carbon products and services. The State's emissions-intensive extractive industries contribute 30 per cent of our gross state product, with more than 90 per cent of Western Australia's merchandise exports coming from minerals and petroleum.

Western Australia contributes around 17 per cent of Australia's total greenhouse gas emissions.[5] While the emissions intensity of our economy has declined by 30 per cent from 2005, our State's emissions have increased by almost one quarter. The growth in emissions is primarily a result of the resources boom, which has led to a doubling of the size of our economy between 2000 and 2016.

Responding to climate change in Western Australia presents complex and challenging issues for government, business and the community. How we respond to those challenges – and how we manage the unprecedented rate of change in technology and global

markets – will determine the scale of those impacts and our future prosperity.

However, we don't need to choose between reducing emissions and protecting our State's economy and industries. Right now, we have genuine opportunities to transform the way we live, how we commute and how our business and industries operate. By embracing those opportunities, we can shift to a cleaner, more sustainable economy while continuing to enjoy all the things that make Western Australia a great place to live.



International and national context

Australia ratified the United Nations Framework Convention on Climate Change Paris Agreement on 10 November 2016 and has committed to reducing greenhouse gas emissions by 26 to 28 per cent below 2005 levels by 2030. Parties to the Paris Agreement aim to limit warming to well below 2 ℃ above pre-industrial levels, acknowledging that emissions will need to reach net zero in the second half of this century.

The Paris Agreement also commits Australia to actions to enhance adaptive capacity, strengthen resilience and reduce vulnerability to climate change, acknowledging that all levels of government, business and the community have a role to play.

> A stable national policy framework for climate change and energy has, however, proved difficult to achieve over the last decade.

It is broadly accepted that nationally consistent, economy-wide market mechanisms are better able to reduce our greenhouse gas emissions at least cost to the economy. A stable national policy framework for climate change and energy has, however, proved difficult to achieve over the last decade.

The key Australian Government climate change policies are currently the Emissions Reduction Fund (ERF) – recently renamed the Climate Solutions Fund – which provides for crediting and purchasing of abatement by the Clean Energy Regulator, and the ERF 'safeguard mechanism', which requires relevant facilities to keep greenhouse gas emissions at or below business as usual levels. In recent years, Australia's greenhouse gas emissions have been rising, and almost one third of safeguard mechanism facilities have applied to increase their baselines.

The Government of Western Australia has committed to working with all sectors of the economy to achieve net zero emissions by 2050. The government's aspiration creates the overarching framework for the State Climate Policy, ensuring that Western Australia captures the emerging opportunities of the low-carbon transition and secures a competitive economy into the future.

Issues and opportunities for Western Australia

With the development of a new State Climate Policy, we have the opportunity to minimise physical impacts and safeguard Western Australia's economy in the face of global mega-trends and the low carbon transition. Our State can benefit from emerging opportunities and, in the process, diversify our economy and ensure our energy-intensive industries remain competitive into the future.

The State Government has a pivotal role in supporting resilience through its responsibility for land use and transport planning, and provision of public infrastructure, emergency management and relevant information on impacts and vulnerability.

A clear State Climate Policy will provide much-needed clarity for private and public sector investment, ensuring planners and businesses in Western Australia are able to make timely and efficient investment decisions. This is particularly important for future investment in resource and energy projects, energy networks, low-carbon technologies and the built environment. We are seeking input from business, industry, local government and the community on the issues and opportunities in a number of key areas.

1. Transforming energy generation

2. Industry innovation

3. Future mobility

4. Regional prosperity

5. Waste reduction

6. Safe and healthy communities

7. Water security

8. Liveable towns and cities

9. Resilient infrastructure and business

10. Protecting biodiversity

11. Strengthening adaptive capacity

1 | Transforming energy generation

While transformation in the power system promises lower-cost and lower-emissions energy for Western Australian households and businesses, there are technical and regulatory issues to be managed.

Western Australia's energy transformation is already underway. In the State's main electricity grid – the South West Interconnected System (SWIS) – renewable energy supplied by large-scale renewable generators has doubled since 2007. More than a quarter of Western Australian households have now installed a solar photovoltaic (PV) system. Collectively, large- and small-scale renewable generation is supplying 16 per cent of our annual energy needs in the State's south-west.[6]

While transformation in the power system promises lower-cost and lower-emissions energy for Western Australian households and businesses, there are technical and regulatory issues to be managed.

Your thoughts?

- What are the main challenges for decarbonising Western Australia's electricity supply while ensuring adequate generation capacity, security and reliability?
- What are the most effective ways to overcome these challenges by 2030?
- Should the electricity sector make a pro-rata (or greater) contribution to Australia's national greenhouse gas emission targets?
- How fast do you think the transition of the electricity sector should occur?

Issues for energy transformation

- Emissions in the SWIS have increased by around 16 per cent since 2005. A 26 per cent 'pro-rata' reduction for the SWIS, consistent with Australia's Paris Agreement commitments, would require us to cut emissions by 36 per cent from current levels. This is a significantly larger task for Western Australia compared to emissions reductions in the National Electricity Market (NEM), Australia's main electricity grid, where emissions have declined by around one fifth since 2005 due to reduced economic activity.
- Greater levels of large-scale renewables generation and distributed energy sources will create challenges for security and reliability, and for how electricity grids are operated. As renewables, including solar PV, increasingly displace traditional thermal generation, the critical security services these forms of generation supply to the network are also displaced.
- If Western Australia is to make a contribution to national emissions reduction, it is estimated that over $10 billion of investment is required in infrastructure, storage and large-scale generation.[7] The Australian Government has made substantial funding commitments to enhance energy storage and support integration of renewable electricity in the NEM. These initiatives include Snowy Hydro 2.0 and a second interconnector between Victoria and Tasmania. Western Australia needs to receive its share of Commonwealth funding to support the low-carbon transition.

Opportunities for the energy transformation

- The State Government is installing innovative solutions for fringe-of-grid and remote off-grid locations, including integrated solar-battery microgrids and micropower systems. Making better use of these distributed options for electricity supply can make energy both cleaner and more affordable, but needs to be carefully managed.
- Declining technology costs may soon put battery storage combined with renewable sources such as wind and solar PV on a par with conventional energy sources. Decarbonising our electricity sector at reasonable cost will soon be within reach. Devices which use, generate or store electricity (including electric vehicles) will increasingly form part of our power system.
- Reducing emissions from electricity supply has the potential to catalyse emissions reductions in other sectors, for example through electrification of transport.

Did you know...

Energy Transformation Strategy

On 6 March 2019, the McGowan Government launched the Energy Transformation Strategy, including a whole-of-system plan for the south-west, and a Distributed Energy Resource Roadmap to guide the integration of distributed energy sources. These initiatives will support the transition to a lower-emissions power system by guiding the efficient integration of renewable generation and identifying opportunities for energy storage.

2 | Industry innovation

Western Australia's energy, mining and manufacturing industries are key drivers of the State's economy, with the resources sector contributing almost one third of our gross state product.[8] These industries are also significant sources of energy demand and greenhouse gases, contributing around half of Western Australia's total emissions.

New resource sector proposals are likely to drive increases to Western Australia's emissions in the short term. Western Australia's liquefied natural gas (LNG) export capacity will reach almost 50 million tonnes per year in 2019, with emissions from State-based operations increasing as a result. The government's *Greenhouse Gas Emissions Policy for Major Projects* sets out the broad approach that will be taken in consideration of new proposals and project expansions with significant greenhouse gas emissions. The policy aims to ensure that new proposals make an appropriate contribution to the State's aspiration of net zero emissions by 2050.

Your thoughts?

- What measures have been implemented by your business to lower energy use or emissions?
- What are the barriers to decoupling energy use and emissions in the resources sector?
- Have you assessed the implications of the low-carbon transition for your business or sector? How are these risks disclosed to stakeholders?
- What exemptions should apply to trade-exposed sectors in reducing our emissions?
- How can the Government of Western Australia foster clean industries and technologies?

Did you know...

Renewable Hydrogen Strategy

The McGowan Government launched its Renewable Hydrogen Strategy in July 2019 to position Western Australia as a frontrunner in the burgeoning global renewable hydrogen industry and has committed $10 million to a Renewable Hydrogen Fund.

Issues for energy industry innovation

- Emissions from electricity generation outside the State's main grid have almost doubled since 2005 due to the rapid growth in the resources sector, including off-grid sites and LNG facilities.
- Western Australia's fugitive emissions have increased significantly in recent years, and now contribute 14 per cent to the State's total greenhouse gas emissions.
- Deployment of renewable energy solutions may be limited in some areas by existing network infrastructure. Matching energy supply with load can also be challenging, and land requirements for renewable energy generation – typically greater than those for conventional energy sources – can present barriers to greater adoption.

Did you know...

Future Battery Industry Strategy and Future Battery Industries Cooperative Research Centre

The McGowan Government's Future Battery Industry Strategy was launched in January 2019 to grow Western Australia's future battery industry and transform it into a significant source of economic development, diversification, jobs and skills. The government has also committed $6 million in funding to the new Future Battery Industries Cooperative Research Centre to be headquartered in Perth.

Opportunities for industry innovation

- Harnessing our world-class renewable resources to break the link between energy and emissions can put Western Australia's energy intensive businesses at the forefront of cleaner production trends and provide a competitive advantage in a low-carbon world.
- Many mining and energy projects are located in areas with abundant, high-quality renewable energy resources such as solar. Integrating renewables into a project's energy mix can offset fuel costs, enhance energy security and help manage the risks of fuel price volatility and future carbon pricing.
- LNG can displace higher emissions fuels in shipping, reducing greenhouse gas emissions from the export of fuels and minerals.
- Opportunities to lower the carbon footprint of LNG production and minimise emissions across the energy value chain include improved leak detection and remediation, changes to venting and flaring practices, and greater adoption of industrial-scale renewables.
- The global trend to decarbonisation will increase demand for low-carbon energy carriers such as hydrogen produced from renewable fuels. Western Australia is well positioned as a future producer of renewable hydrogen, which would facilitate export of the State's renewable energy resources to Asian markets.
- Global demand for lithium-ion batteries and the shift to electrification of transport present exciting opportunities to develop a sustainable, value-adding battery industry. Investment and leadership is required to ensure we move beyond the processing of precursor materials into the manufacture of battery components and battery cells, and development of service technologies and expertise.

3 | Future mobility

Transport emissions contribute 17 per cent of Western Australia's total greenhouse gas emissions, and have increased steadily in recent years – rising 53 per cent between 2005 and 2017. Most of Western Australia's transport emissions come from passenger vehicles with emissions linked to population growth and increasing vehicle kilometres travelled.

The transport sector is likely to undergo a significant transformation in the coming years, as the cost of electric vehicles (EVs) approaches price parity with petrol and diesel vehicles, and other technological advances and potential disruptions (such as automation and ride-sharing) emerge further. These developments are likely to transform the nature of transport and may significantly improve its environmental impact.

Your thoughts?

- What are the barriers to purchasing a low-emissions vehicle for your household or business?
- What can be done to facilitate the uptake of electric and other low-emission vehicles in Western Australia?
- How can we further encourage use of public transport and active transport, such as walking and cycling?
- How can we ensure that Western Australia isn't left behind in the transition to cleaner transportation?

Did you know...

Electric Vehicle Strategy for Western Australia

The Western Australian government is investigating options to accelerate the uptake of electric vehicles in the State and deliver a strategy that will support a transition to cleaner electrified transportation.

Issues for future mobility

- Western Australia has one of the highest rates of car use per person in the world and our vehicles emit relatively high levels of greenhouse gas emissions per kilometre travelled by international standards.[9]
- Reducing transport emissions in Western Australia can be challenging given our commodities-based economy, the large distances between regional communities and current patterns of low-density development on the urban fringes.
- Freight demand continues to grow in Western Australia, with implications for future emissions depending in part on the choice of transport mode (e.g. road vs rail).
- Australia is one of the few countries within the Organisation for Economic Co-operation and Development (OECD) without mandatory fuel efficiency standards. Without national carbon emission standards there is a risk that our region could become a destination for high-polluting vehicles while other nations progress towards cleaner transportation.
- EVs are becoming increasingly popular around the world, driven by rapid technological advances and declining battery costs. However, Western Australia is well behind the global average uptake of EVs.[10]

Opportunities for future mobility

- We can lower our emissions through multiple opportunities, including integrated land use and transport planning, mode shift (encouraging people to use more public transport and replacing car trips with 'active transport' options such as walking and cycling), improving freight management and using more fuel-efficient or low-and zero-emission vehicles.
- The electrification of transport, combined with decarbonisation of our electricity grid, will significantly reduce greenhouse gas emissions as well as provide air quality and fuel security benefits.
- Hydrogen fuel cell vehicles are continuing to develop and may present opportunities to decarbonise particular applications such as long-haul heavy transport.

Did you know...

METRONET

METRONET is Perth's most ambitious public transport program. It brings together transport and land use planning to create a framework for sustainable growth of the city that will reduce car-dependency and create train station precincts that limit urban sprawl and connect communities.

Blueprint for future Perth and Peel cycling network

The McGowan Government is investing $146 million in cycling over four years and has commenced development of a blueprint for future cycling infrastructure across the Perth and Peel regions.

4 | Regional prosperity

Western Australia's agriculture and food sector is the cornerstone of our rural and regional communities. Our State is the nation's largest grain-producing region, and a significant producer of meat and livestock, dairy, wool and horticulture products. Climate change presents our regional communities with both impacts to be managed and new economic opportunities.

Your thoughts?

- How will climate change affect your regional community?
- What steps can we take to further enhance the resilience of our regions and our primary industries?
- How can we support the agricultural sector to participate in the low-carbon transition?
- What opportunities do carbon offset markets present for Western Australian land managers, including Aboriginal groups?
- What matters should the State Government take into account in developing a strategy for carbon farming in Western Australia?

Did you know...

Collie Futures Fund

The McGowan Government has provided $20 million over five years to drive economic diversity and create jobs in the Collie region. The funding is delivered through a small grants program and industry development fund to support long-term economic growth and stimulate jobs for Collie.

Issues for regional prosperity

- Ongoing drying across the south-west may significantly reduce wheat yields in some areas, while increased temperatures and changes to rainfall and fire risk will have implications for livestock and pasture management across the State. Extreme weather events may exacerbate land degradation, cause plant and animal deaths, and increase infrastructure and insurance costs.
- The State's lower west coast is a global hotspot for increasing sea temperature which is having a major impact on fish stocks.[11]
- Agriculture is the fourth most energy-intensive industry in Australia, and the only industry to experience an increase in energy intensity since 2008-09.[12]
- Regional communities where the energy sector is a major employer (particularly coal mining and coal-fired power generation) are vulnerable to changes to the way electricity is supplied. Falling demand for coal-fired generation is likely to result in the retirement of some of the State's coal-fired power stations over time, with significant flow-on effects for workers and regions.
- While carbon farming presents opportunities for land holders, there are complex legal and policy issues to be considered and competing interests to be balanced. Native title has been determined to exist or is claimed over a large portion of Western Australia's rangelands, and areas of interest for carbon farming – including the Mid West, Gascoyne and Goldfields regions – are also prospective for future gold, nickel, base metals, iron ore and petroleum operations.

Opportunities for regional prosperity

- Western Australia's primary producers are at the forefront of technological innovation, driven by the need to adapt to drying conditions. Advances in technology, supported by investment in crop breeding, agronomy, stock breeding and husbandry will create opportunities to maintain, develop and diversify new business models and services.
- Improved seasonal forecasting and regional climate projections will enhance the resilience of our agriculture, fisheries and aquaculture sectors.
- New industries such as carbon farming and bioenergy production are emerging, unlocking new income streams in regional and remote areas, supporting regional prosperity and delivering environmental co-benefits.
- Investments in renewable energy and energy efficiency can reduce emissions, lower operating costs and improve the profitability of the agricultural sector.
- Aboriginal people, as traditional owners, landholders and land managers, are playing an active role in developing Western Australia's carbon farming industry and improving methods of land management and burning practices. Continued development of this work and other land-based initiatives has the potential to generate significant long-term environmental, economic and cultural benefits for regional and remote Aboriginal communities.
- A research and agronomy focus on the development of soil carbon to restore water retention capability in our farming and pastoral soils is critical to protecting the productivity of Western Australian agriculture.
- The development of carbon credit rules under Article 6 of the Paris Agreement is likely to increase demand for carbon offsets, and revenue for carbon farming activities. Additional funding for the Australian Government's Emissions Reduction Fund will also present opportunities for carbon farming in Western Australia.

Western Australia's agriculture and food sector is the cornerstone of our rural and regional communities.

Government targets for a more sustainable, cleaner environment require at least 75 per cent of waste generated in Western Australia to be reused or recycled by 2030.

5 | Waste reduction

Waste accounts for a relatively minor proportion of Western Australia's greenhouse gas emissions. However, waste generation and disposal has a significant impact on the environment and public health through pollution, biodiversity loss and resource depletion.

In February 2019, the Premier and Minister for Environment launched the Waste Avoidance and Resource Recovery Strategy 2030 to improve our State's waste management. The Waste Strategy's vision is for Western Australia to become a sustainable, low-waste circular economy in which human health and the environment are protected from the impacts of waste.

The government is reducing the generation of waste through its ban on lightweight, single-use plastic bags and the introduction of a container deposit scheme. Government targets for a more sustainable, cleaner environment require at least 75 per cent of waste generated in Western Australia to be reused or recycled by 2030. Additional measures to avoid and reduce single-use plastics are being investigated.

Your thoughts?

- What areas can we target to further reduce greenhouse gas emissions from waste?
- What can households, businesses and government do to reduce their waste and compost more?

Did you know...

Three-bin FOGO system for Perth and Peel households

The three-bin kerbside collection system includes the separation of food organics and garden organics (FOGO) from other waste categories. The State Government has set a target to ensure the three-bin system is provided by all local governments in the Perth and Peel regions by 2025.

A liveable environment

The State Government's priority for a liveable environment includes ambitious targets for waste reduction with the goal that 75 per cent of waste generated in Western Australia is reused or recycled by 2030.

Issues for waste reduction

- Waste accounts for 2 per cent of our State's greenhouse gas emissions. While this is a small contribution to our State's total, these emissions have increased 20 per cent between 2005 and 2016.
- Western Australia produces almost 20 per cent more waste annually than the national average. A typical Western Australian household creates about 28 kilograms of waste each week, of which only around one third is recycled and the rest sent to landfill.[13]
- Greenhouse gas emissions are generated from waste when organic matter (such as kitchen and garden waste, agricultural and forestry residue, manure, and solids from treated sewage) breaks down in the absence of oxygen and produces methane – a greenhouse gas which is 26 times more potent than carbon dioxide.

Opportunities for waste reduction

- A circular economy presents opportunities for increased local recycling activity and local solutions, which, in turn, create local jobs, and minimise the costs and environmental impacts of unnecessary transport.
- Several landfill sites in Western Australia capture methane generated from waste to produce energy. Methane emissions from the decomposition of organic matter can also be reduced by composting waste instead of stockpiling it or sending it to landfill.
- Carbon farming methods are available for avoiding methane production and composting organic waste under the Australian Government's Emissions Reduction Fund (now Climate Solutions Fund). This has the potential to provide income opportunities for land managers and alternative waste treatment providers.
- Western Australia has a hierarchy that ranks waste management options in terms of their general environmental desirability, with waste avoidance being the preferred option. After opportunities for avoidance, reuse, reprocessing and recycling have been exhausted, energy recovery from waste is preferred to landfill disposal. Australia's first large-scale, waste-to-energy plant is being constructed in Western Australia and will have the potential to save up to 400 000 tonnes of carbon dioxide equivalent emissions per year.

6 | Safe and healthy communities

Impacts of climate change such as heatwaves and extreme weather events, an increase in pollutants and allergens, and changing patterns of disease have the capacity to affect the health of all West Australians, particularly the vulnerable. Western Australia's 2017 *Sustainable Health Review* noted that 'heatwaves are responsible for more deaths in Australia than any other natural disaster and will likely worsen with climate change'.[14]

Climate change also has significant implications for emergency management and other social services delivery with the potential for climate-related hazards such as fire to place a strain on disaster response services.

Photo: Department of Fire and Emergency Services

Your thoughts?

- What are the main climate risks for your household or your community? What can be done to manage these risks?
- What are your biggest concerns about Western Australia's future climate?
- What could be done to ensure your community is better prepared for possible climate impacts?

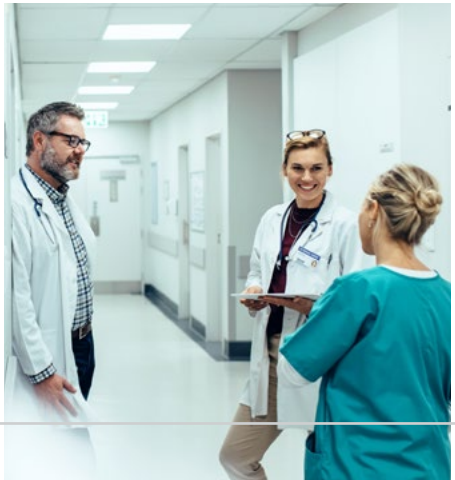
Did you know...

State Risk Project

Since 2013, the State Emergency Management Committee (SEMC) has run the State Risk Project to gain a comprehensive understanding of the risks faced at the state, district and local levels. Risk assessments completed to date take into account seven priority hazards including bushfires, heatwaves and floods.

Inquiry into the impact of climate change on health in WA

In March 2019, the McGowan Government announced a Chief Health Officer's inquiry into the impact of climate change on health services and how health services can reduce their environmental footprint.



Issues for healthy communities

- Climate change will exacerbate existing health burdens by increasing injury, physical and mental illness, and the frequency of extreme weather events (floods, droughts, heatwaves and storms). Climate change will also lead to alterations in the distribution of vector-, water- and food-borne infectious diseases, and air pollution patterns.[15]
- The fire season in Western Australia's south-west is expected to lengthen, placing more demands on personnel and equipment.[16] A longer fire season will also narrow the seasonal window for prescribed burning and hazard reduction measures, and exacerbate the risk of severe fire.
- Our current infrastructure, along with our health, social and emergency services, have been planned on the basis of historic climate patterns and needs. The future volatility of our climate and the increasing prevalence of extreme weather events may strain or exceed the capacity of our existing health system and emergency management frameworks, and disrupt essential services and programs.
- Emergency services are on the frontline of our changing climate, and improved national firefighting assets are likely to be required to manage the escalating threat of bushfire from a warming and drying climate.[17] Recent Western Australian bushfires, including the 2011 Roleystone-Kelmscott fire and the 2014 Perth Hills fire, have caused significant damage to property and hardship in communities, foreshadowing the need for a new approach to bushfire prevention.
- While initiatives to enhance preparedness are considered more efficient than rebuilding after a natural disaster, only 3 per cent of national disaster funding is spent on disaster mitigation and preparedness.[18]

Photo: Department of Fire and Emergency Services

Opportunities for healthy communities

- We can enhance the resilience of our communities by preparing for the increased demand on services, while building longer-term resilience into infrastructure design and investment. We can also ensure land use planning reduces exposure to climate-related hazards, particularly fire, flood, storms (including cyclones) and coastal erosion and inundation.
- Embedding climate considerations into long-term investment and management decisions through enhanced coordination across government and communities can improve resilience to natural disasters.
- Research into changing patterns of disease and other health consequences of climate change can lessen the impacts of these changes. Communication targeted to medical practitioners and the community (in particular vulnerable groups) regarding prevention and treatment of health impacts, such as reducing exposure to vector-borne diseases or managing heat-related illness, can significantly improve public health outcomes.

7 | Water security

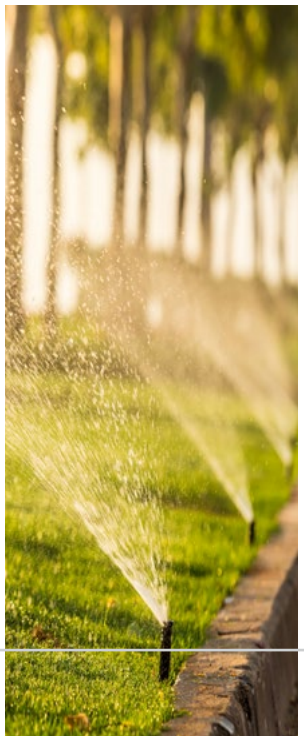
One of the State Government's priorities is creating a more sustainable and liveable environment. Our economic, social and environmental future is dependent on securing our water resources in the context of climate change.

Adapting to climate change requires the Western Australian community, including individuals and industry, to use water more efficiently. Improved water literacy and enhanced community engagement are critical to creating a sustainable, productive and resilient community for the long term.

Your thoughts?

- What can we do to encourage Western Australians to use water more efficiently and adapt to a drying climate?
- Are there policies adopted in other jurisdictions we should consider for Western Australia?
- What are the best management options to deal with the water security implications of climate change for our agricultural sector?

Did you know...



Water Corporation – groundwater replenishment

Australia's first full-scale Groundwater Replenishment Scheme is located at Craigie, in Perth's northern suburbs. It started recharging recycled water to Perth's deep aquifers in 2017. The Water Corporation's Advanced Water Recycling Plant will have the capacity to recycle up to 28 billion litres a year, with half of this water recharging the Leederville and Yarragadee aquifers onsite and the remaining volume of water being transferred to recharge bores drilled in Wanneroo and Neerabup.

Issues for water security

- Perth is located on one of Australia's best groundwater resources – the Gnangara groundwater system – which supplies about 40 per cent of the drinking water used in the metropolitan region each year. With ongoing warming and drying of our climate, our groundwater system has shifted out of balance. Rainfall has reduced faster than changes to groundwater use, and our once-healthy system is under strain.
- Further reductions in groundwater use across the region will be required within a decade, along with significant investments in water infrastructure to manage bottlenecks in water supply.
- The drying trend, in particular reduced winter and spring rainfall, has impacted towns and farms in the Wheatbelt region, challenging productivity, driving innovation and prompting investigation of measures to enhance rainfall harvesting catchments and provide off-scheme farm potable supplies.
- In addition, ongoing investment is required to deliver reliable and safe water supplies to remote communities, supporting health and wellbeing in Aboriginal communities across the State.

Opportunities for water security

- The State Government and the Water Corporation, along with the community and local governments, have been collectively managing the effects of our drying climate since around 2001. Key management strategies include using groundwater more sustainably through increased recharge and reduced abstraction, improving water efficiency through better technologies and urban design, and developing alternative water sources.
- At present, desalination supplies almost half of Perth's drinking water supply, and the Water Corporation is exploring the feasibility of new desalination plants north and south of the Swan River, as well as increased groundwater replenishment.
- Enhancing water efficiency will avoid or defer the need for new water sources, and reduce the total energy use (and greenhouse gas emissions) associated with desalination. Between 2001 and 2018, water efficiency initiatives have supported reductions in water use by consumers in Perth from 191 000 litres to 123 000 litres. Demand management initiatives for Perth have saved 109 billion litres of scheme water since 2001, which is more than the entire annual capacity of the Southern Seawater Desalination Plant.
- Securing a sustainable water future will require a mix of innovative water projects, adopting water sensitive urban design, building capacity in water efficiency, sharing research and exploring new water supply options.

Did you know...

Gnangara groundwater allocation plan

Work has begun on the next Gnangara groundwater allocation plan, including consultation with the Water Corporation and water users, to find practical pathways to bring the system back into balance by 2030. The plan will involve new limits on groundwater availability, and changes to how we license groundwater.

8 | Liveable towns and cities

The design and construction of our cities and towns has long-term implications for both sustainability and quality of life. Our built environment, particularly our homes and offices, and fixed equipment such as heating and cooling systems, are long-lived assets. Decisions made today can lock in energy savings – or, conversely, lock in higher energy use and emissions – for many years to come.

Your thoughts?

- What are the key barriers to improved energy efficiency for our built environment?
- What information or tools do you require to improve energy efficiency in your household or workplace?
- What energy efficiency standards or disclosure measures do you support for our homes and offices and the appliances we use in them?
- How do you think climate change will affect the liveability of your neighbourhood or region?
- How can we improve the retention of vegetation, particularly tree canopy, in our cities and suburbs?

Did you know...

Trajectory for Low Energy Buildings

A trajectory for low-energy buildings has been developed cooperatively between Commonwealth, state and territory governments to identify cost effective opportunities for energy efficiency improvements throughout the building system from thermal performance to appliance energy usage and renewable energy generation.

Better urban forest planning

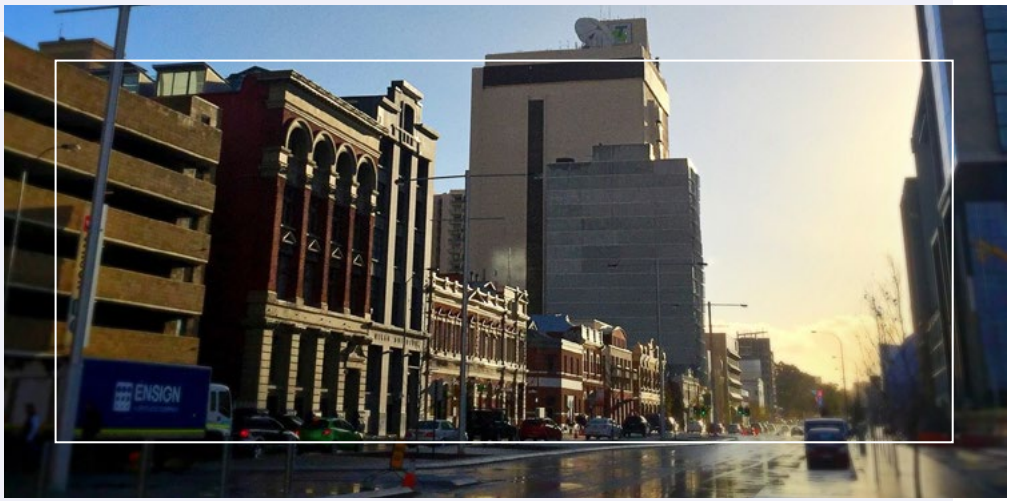
The Department of Planning, Lands and Heritage (DPLH) in partnership with the Western Australian Local Government Association (WALGA) has released a planning guide for urban forest to improve the consistency of local government urban forest strategies.

Issues for liveable towns and cities

- Buildings currently account for almost one fifth of Australia's greenhouse gas emissions[19] and, by international standards, our existing housing stock is relatively inefficient.[20]
- Despite the cost savings from energy efficiency improvements, there are recognised barriers to their adoption. These include information gaps (around costs and benefits, for example); lack of skills to implement energy efficiency opportunities; high initial costs (understanding investment payback to make informed decisions can be difficult and time consuming); and split incentives (where those paying for measures are not the beneficiaries of the measures).
- Our built environment is not just a contributor to global climate change, but also susceptible to the effects of a warming climate. Some urban areas are experiencing temperature increases at twice the rate of the planet as a whole[21] due to loss of natural vegetation and its replacement with paved surfaces, buildings and infrastructure.
- Perth is expected to be up to 2.7 ℃ hotter by 2030. In eastern suburbs, where vegetation and tree canopy is lower, warming will be even greater. The heat island effect has significant implications for human health, local ecosystems, and the water cycle, and can increase energy demands for heating and cooling.

Opportunities for liveable towns and cities

- Intelligent urban planning, higher construction standards and energy-efficient equipment (coupled with renewable energy) can significantly reduce emissions from our built environment, while reducing utility costs and enhancing health and comfort for building occupants. The Government of Western Australia collaborates with other states and territories as well as the Australian Government to design and deliver a range of cost-effective housing, appliance and equipment energy efficiency measures across the country. The sooner cost-effective energy efficiency measures can be adopted, the earlier energy and cost savings will be locked-in.
- Linking transport corridors with places of employment, housing and recreation can reduce the need for private vehicle travel. A new initiative, Design WA, outlines key considerations for energy efficiency and climate resilience and aims to ensure good design is the centre of all development in Western Australia.



- Urban development has contributed to a decline in established vegetation, particularly tree canopy, across the Perth and Peel regions since 2009. While vegetation can minimise the urban heat island effect, maintaining and reinvigorating our urban forests is challenging alongside targets for higher-density development and declining rainfall.

9 | Resilient infrastructure and businesses

Resilient infrastructure is critical for Western Australia's productivity and economic prosperity, and the interconnection of our communities with the essential services on which they rely. Infrastructure is generally capital-intensive and has a long life span. It is therefore important that infrastructure is designed, built and maintained to be resilient in the face of climate change.

Coastal development and ports, inland road networks, as well as energy, water and communications infrastructure face risks from rising sea levels, increasing temperatures and more frequent storms and bushfires. These changes will impact Western Australia's resources and primary industry sectors, as well as communities.

Your thoughts?

- What are the key climate risks for the primary industry or resources sectors?
- Do you currently assess the impact of physical climate risks on your business, assets or infrastructure?
- Is there information which would assist you to do this better?
- What are the best ways to enhance the resilience of public and private infrastructure?

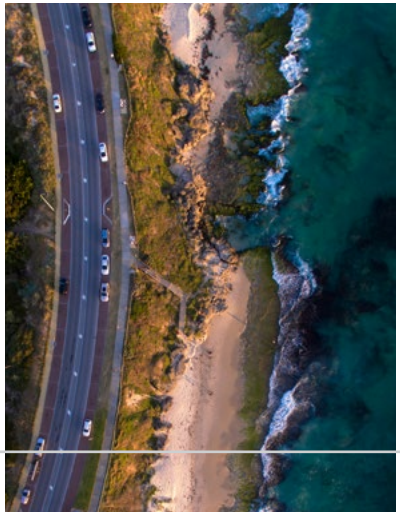
Did you know...

State planning policy 2.6 – coastal planning

The State coastal planning policy provides a planning framework for the long-term sustainability of the Western Australian coast. It also provides guidance for the incorporation of coastal hazards including sea-level rise in the determination of land use and development in the coastal zone.

Coastal planning and management grants

On 21 February 2019, the State Government announced $1.6 million in funding for projects to manage Western Australia's coastline through the Department of Transport's Coastal Adaptation and Protection grants, and the Western Australian Planning Commission's Coastwest and Coastal Management Plan Assistance Program grants.



Issues for resilient infrastructure and businesses

- Ongoing warming and changes to rainfall across the State have the capacity to reduce the productivity of our primary industries, increasing infrastructure and insurance costs. The sector also faces business risks associated with volatile fuel costs and emissions policy.
- Projected sea level rise will lead to significant areas of flooding in vulnerable cities and towns, with coastal erosion and damage to low-lying coastal infrastructure. Infrastructure and settlements along Western Australia's coasts, in particular Mandurah, Bunbury, Busselton and Rockingham, are vulnerable to climate change.[22] Up to 28 900 residential buildings, 2100 commercial buildings and 9100 km of Western Australia's roads will be at risk towards the end of this century.[23]
- Most local coastal managers are local government authorities. In recent years, the Productivity Commission has noted the lack of clarity around the roles and responsibilities of local government in adaptation,[24] including where risks and potential adaptation measures span multiple institutional land owners.
- While future coastal developments will incorporate a coastal foreshore reserve, providing a buffer against coastal hazards, in some cases active management of coastal areas will also be needed. Examples include where infrastructure requires a coastal location (e.g. ports and harbours), where existing coastal protection structures are deteriorating or in the case of extreme weather events.
- Businesses are typically best placed to manage risks to their own private assets, operations and infrastructure. However business relies on accurate and regionally relevant science and information to support risk assessment and decision making.

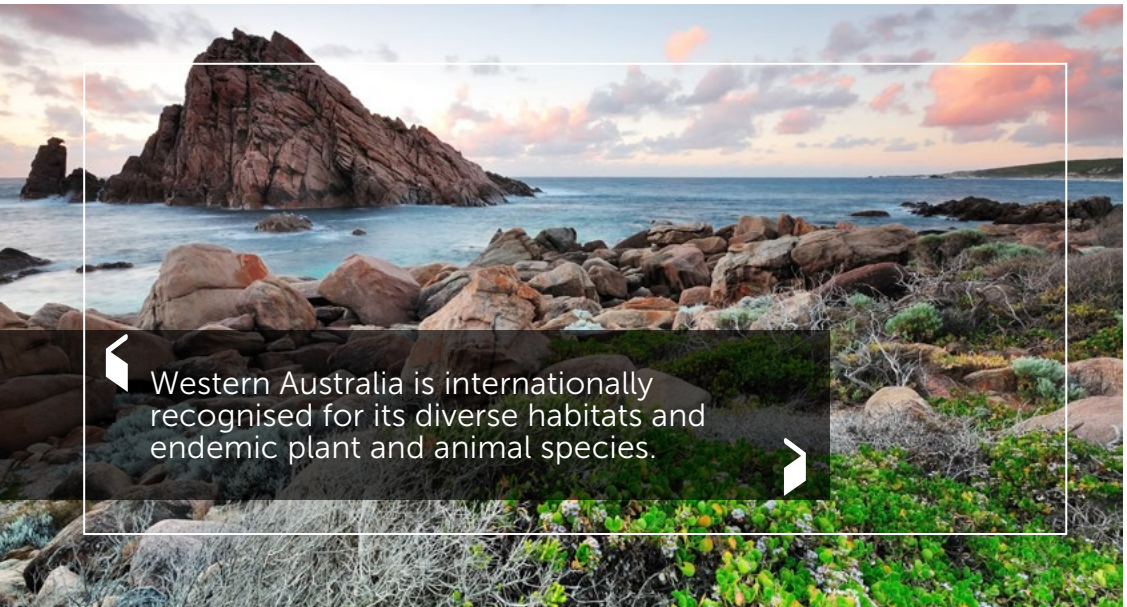
Opportunities for resilient infrastructure and businesses

- Government is well placed to support resilient business and infrastructure through levers such as planning policies that support effective adaptation, appropriate regulatory and fiscal structures, and provision of high-quality information and tools to support proper planning.
- Embedding consideration of climate change into agricultural practices and land sector development can enhance resilience, while integration of large-scale renewable energy projects into agricultural enterprises can minimise exposure to future carbon pricing. Targeted investment in resilience measures is estimated to reduce government expenditure on disaster relief and recovery.
- Support in relation to coastal hazard management, particularly in areas where science and engineering expertise is required, can assist local coastal managers to manage hazards and improve resilience. There is no specific statute for coastal hazard management in Western Australia; however, the State Government provides statutory guidance on sustainable coastal development through the Western Australian Planning Commission's *State planning policy 2.6 – coastal planning*.

10 | Protecting biodiversity

Western Australia is internationally recognised for its diverse habitats and endemic plant and animal species. The State's south-west is one of only 34 global biodiversity hotspots. Our biodiversity is under threat from a range of processes, including land clearing, reduced rainfall, changed fire regimes, invasive species, disease, grazing and salinity.

Climate change has already impacted our biodiversity and is predicted to cause widespread changes to the health of marine and terrestrial ecosystems. The *Global Assessment Report on Biodiversity*[25] identified climate change as one of the significant drivers of change in nature and declines in biodiversity values.



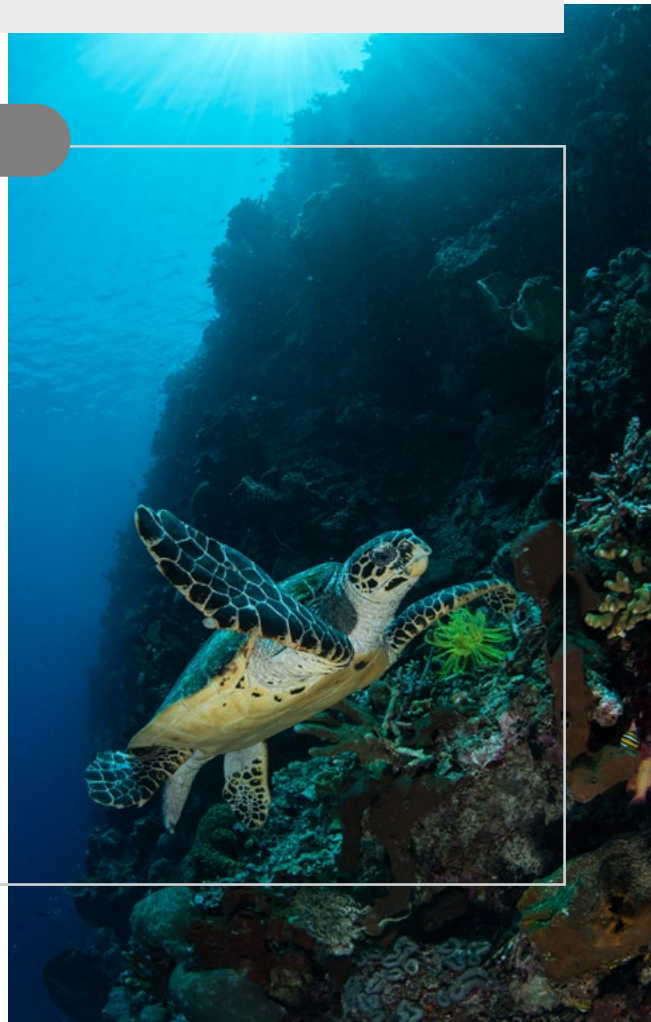
Your thoughts?

- Can existing land use and biodiversity management practices be modified to reduce vulnerability and improve resilience?
- Are there opportunities for new collaborations with landholders or communities to address climate risks and improve biodiversity outcomes?

Did you know...

Increasing conservation for future generations

The McGowan Government has set a target for increasing Western Australia's conservation estate by 5 million hectares, or 20 per cent, by 2023–24. Expanding conservation in areas of high biodiversity will help protect our unique wildlife, and support jobs and economic diversification in regional and remote areas.



Issues for protecting biodiversity

- Climate change is anticipated to reduce biodiversity, including causing potential extinctions of species unable to cope with the rate of change or impacted by habitat loss. Warming temperatures will increase the risks of algal blooms, anoxia and fish kills in Western Australia's aquatic ecosystems.
- Sea level rise and coastal hazards will affect coastal and estuarine environments, with changes in the salinity of coastal wetlands and groundwater. Reduced water flows in rivers, combined with increased tidal influence, have significant implications for estuaries, including those of the Swan and Peel.
- Climate change will alter the seasonal lifecycle response and distribution of aquatic species. Increased tidal height in estuaries is also problematic for migratory shorebirds as it increases water levels in nearshore areas and can make areas that were previously important foraging habitat unavailable.
- Ocean warming and acidification has the potential to impact Western Australia's coral reefs – the most diverse of all marine systems. Ningaloo Reef is a significant aggregation site for the endangered whale shark, and the world's only extensive coral reef that fringes the west coast of a continent.
- Integrating landscape restoration and biodiversity protection into an active agricultural landscape is challenging. In addition, the complexity and diversity of some ecosystems, along with altered soil properties and hydrology, present additional hurdles to effective restoration.[26] Some local governments in Western Australia's south-west retain less than 5 per cent of their original vegetation due to land clearing from agriculture, along with urban and industrial development.

Opportunities for protecting biodiversity

- Steps can be taken to improve the resilience of our precious biodiversity. Actions include identifying and prioritising systems for conservation, restoring remnant ecological communities and urban forest, and maintaining ecological connectivity between habitats.
- Other measures to improve resilience involve addressing existing stressors, such as groundwater depletion, pests and salinity.
- There has been significant government investment in ecosystem restoration across agricultural lands. Expanding the conservation estate by declaring national and marine parks in areas of high biodiversity will help to protect Western Australia's biodiversity.

11 | Strengthening adaptive capacity

Adaptive capacity is the ability of a sector, community or system to adapt or adjust to climate change in order to minimise harm or manage the consequences. Government can support adaptive capacity by providing tools, guidance and accurate information about the impacts of climate change and adaptation options for stakeholders.

The government publishes a diverse range of information on climate-related impacts, from guidance on livestock production, broadacre cropping and horticulture, to information about managing risks of bushfire, heatwaves, sea level rise and coastal hazards (such as erosion and inundation).

State and local governments have closely aligned responsibilities in the areas of land use planning, health, emergency management and infrastructure. Building strong State and local government partnerships and supporting the adaptive capacity of local governments will be key to Western Australia's future resilience.

Your thoughts?

- Are there gaps in the availability of adaptation knowledge, climate information or skills for your community, organisation or sector? How can these be addressed?
- What are the main barriers to the adoption of effective climate change adaptation?

Did you know...

Funding to secure future of Western Australia's agriculture

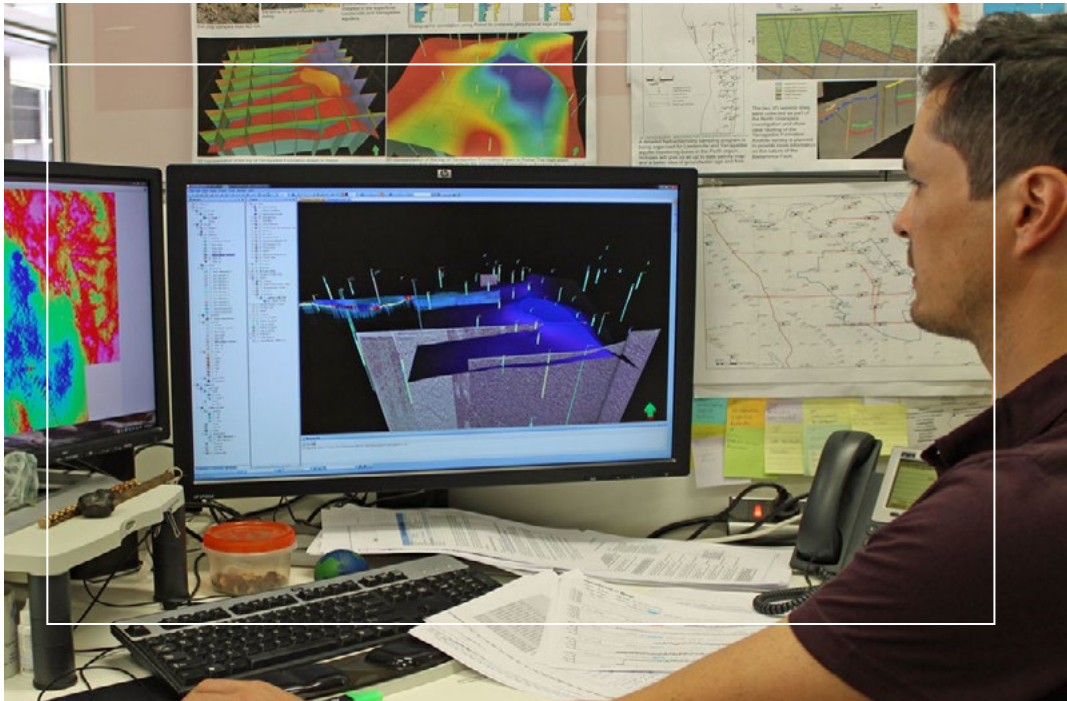
The Government of Western Australia has announced increased funding for the Department of Primary Industries and Regional Development (DPIRD) to support primary producers and rebuild scientific capability. Additional expenditure of $131.5 million will ensure Western Australia's agricultural sector remains at the forefront of international competition.

Issues for strengthening adaptive capacity

- While individuals and communities may be highly motivated to manage their own risks, they rely on up-to-date and relevant information in order to do so. Climate science is constantly evolving, so it needs to be regularly updated to inform our adaptation responses. The government invests in significant research programs, such as the Western Australian Marine Science Initiative, and regularly collaborates with research institutions and the Commonwealth Scientific and Industrial Research Organisation (CSIRO).
- Climate risks are generally not spread evenly across the community, but are greater for vulnerable groups including Aboriginal communities, the elderly and the homeless.
- Local governments are on the frontline of climate change adaptation. They are actively engaged in managing climate risks, assessing coastal hazards and coastal erosion, managing the implications of climate change for emergency services and considering how adaptation costs may be equitably shared. Local governments are best placed to identify the adaptation needs of local communities, and will typically be the first to respond to local impacts.

Opportunities for strengthening adaptive capacity

- Greater integration of climate considerations into core policy and sectoral areas will lead to more climate-resilient and reliable government services and assets, and stronger economic performance for the State.
- Best practice community engagement can support a greater awareness of the link between climate change and equity, support understanding of how climate change will impact on vulnerable groups and empower our service organisations to respond.
- Provision of up-to-date, accessible climate science and climate-related information can build adaptive capacity across the community. Ensuring climate science is highly relevant and translated to local, regional or sectoral impacts will support the adaptive capacity of key sectors.



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Make a submission

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Access the submissions portal at:
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Hard copies can be mailed to:
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Locked Bag 10 Joondalup DC WA 6919

Closing date
29 November 2019, 5pm (AWST)

For further information
Email: climate@dwer.wa.gov.au