



**Woodside Submission:**  
**Government of Western Australia**  
**Climate Change Issues Paper and State**  
**Climate Policy**

29 November 2019

# Executive Summary

Woodside is pleased to contribute to the discussion on the State's Climate Change Issues Paper and Climate Policy and about how we, as a member of the West Australian community, can work towards a resilient low-carbon economy.

We live in a world that needs more energy, delivered in cleaner ways. It is widely recognised that natural gas has a big role to play in meeting these energy requirements. Natural gas is clean, reliable and the ideal partner for renewables. Woodside is working to contribute to lowering global emissions by supplying gas, lowering our net emissions and developing innovative new market and technologies for the efficient delivery of energy.

Woodside is considering billions of dollars' worth of investment in facilities that would export natural gas for decades to come. The exported liquefied natural gas (LNG) from these facilities supports a transition to a lower carbon economy by displacing emissions in our customer markets which reduces overall global emissions. Woodside is also developing projects that would further benefit a low carbon economy including an offsets business, hydrogen capability and the potential to integrate renewable power into its operations.

We advocate for Australian climate and energy policy that is scientifically based, stable, effective, incentivises all low-cost abatement and enhances international competitiveness. Whilst the Commonwealth has primary responsibility for setting Australia's national targets and establishing the policy mechanisms to meet it, Woodside proposes that the Western Australia Government (WA) consider the following complementary policies:

- 1. Leading by example in State owned operations**
  - Reducing emissions from the State Government sector
- 2. Establishing supportive State policy frameworks**
  - Decarbonising electricity supply
  - Promotion of low emission fuels through policy and incentives
  - Development of a WA hydrogen export and domestic industry, for example commencing with a mandated quantity of hydrogen in the domestic gas supply network
  - Development of deep, liquid and transparent offset markets with high levels of integrity in both carbon accounting and operational and contractual standards
  - Promoting energy efficiency standards through product, vehicle and building labelling
- 3. Delivering education, research and leadership**
  - Education and behaviour change
  - Establishment and promotion of low carbon pilot projects, such as a carbon free Rottneest Island
  - Understanding climate science by establishing a partnership to mature the science into extreme offshore and onshore WA storms
  - Promotion of WA's role in contributing to the world's decarbonisation through LNG its exports

Further details to these proposals are provided in this submission and our response to the specific questions in the Issues Paper are in Appendix 1.

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# About Woodside

Woodside is the pioneer of the LNG industry in Australia. We have a global portfolio and are recognised for our world-class capabilities as an integrated upstream supplier of energy. We produce 6% of the current annual global LNG supply. With a portfolio that comprises primarily natural gas, we see a role for our products to displace more emissions intensive fuels and to support the increased share of renewables by ‘firming’ intermittent supply.

Technology and innovation are essential to our long-term sustainability. Today we are pioneering remote support and the application of artificial intelligence, embedding advanced analytics across our operations while recognising digital security issues. We are developing a business to supply LNG as a low-emissions and economically viable fuel to domestic users and the international shipping industry.

We are supportive of an approach to climate policy that is national, consistent with the Paris Agreement and which balances the environment and industries to support jobs and economic growth. These are not competing goals but need to be aligned if outcomes are to be sustainable.

## Woodside and the challenge of climate change

Woodside supports the Paris Agreement goal of net zero global greenhouse emissions around the middle of this century. The scientific consensus on climate change, and the commitment of global governments to reduce emissions, is clear. The need to increase access to modern energy for people living without it, and to improve local air quality, is also clear. Access to clean, cheap and reliable energy improves living standards dramatically, and the world’s growing population is driving increased demand for it. The United Nations Sustainable Development Goals were adopted in September 2015 and include *Affordable and Clean Energy* (Goal 7, “by 2030, ensure universal access to affordable, reliable and modern energy services”) as well as *Take urgent action to combat climate change and its impacts* (Goal 13), highlighting the multi-faceted dimensions of sustainability.

In short, the world needs more energy, delivered in cleaner ways. Natural gas has a big role to play. It is clean, reliable, and the ideal partner for renewables. LNG demand is predicted to grow strongly over the next two decades in the International Energy Agency’s “Sustainable Development Scenario”, which outlines a pathway to meeting the Paris Agreement goals, delivering universal access to modern energy, and dramatically reducing premature deaths from energy related air pollution.

The 2014 report<sup>1</sup> of the Intergovernmental Panel on Climate Change (IPCC) said that “GHG emissions from energy supply can be reduced significantly” by switching to gas. According to the IPCC, electricity generated from gas has on average around half the greenhouse emissions of electricity generated from coal. For example, in 2018, coal-to-gas switching helped avert 95MT of CO<sub>2</sub> emissions, according to the International Energy Agency (IEA)<sup>2</sup>. Moreover, the IEA’s 2019 report “The Role of Gas in Today’s Energy Transitions” examined the role of fuel switching from coal to natural gas. The report found since 2010, coal-to-gas switching has saved around 500 million tonnes of CO<sub>2</sub> – the equivalent of taking 200 million petrol or diesel powered cars off the road for a year.

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<sup>1</sup> IPCC, 2014: *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Page 100

<sup>2</sup> International Energy Agency: 2019: *World Energy Outlook 2019*

Moreover, as a readily dispatchable power source, gas-fired power is an ideal partner with renewables. Renewable power is typically intermittent, so to provide system stability at high levels of renewable penetration “firming” capacity in the form of dispatchable power such as gas is essential.

Whilst the natural gas that Woodside produces contributes in these ways, Woodside is also committed to lowering its own direct emissions through plant design, efficient operations, and offsets. In our own operations, we understand that improving our energy efficiency reduces our environmental impact and increases shareholder value.

Earlier this year, we established a carbon offsets company in order to be able to develop and acquire quality offsets at scale. We have set ourselves a new target to offset equity reservoir CO<sub>2</sub> across our entire global portfolio from 2021, i.e. our share of the CO<sub>2</sub> that occurs naturally in our gas reservoirs and needs to be removed prior to the liquefaction process. Since 2008 we have been offsetting Pluto emissions through our partnership with CO<sub>2</sub> Australia. The scheme has offset more than 500,000 tonnes of CO<sub>2</sub> and 42 million native trees have been planted. We have also recently entered a partnership with Greening Australia for large-scale, native tree planting projects to generate quality carbon offsets. The first phase involves planting up to 5,000 hectares primarily in Western Australia.

Over the lifespan of our projects, we expect our reservoir CO<sub>2</sub> will be on average around a third of our total direct emissions – the rest comes from our use of energy to run our plants and keep them safe. We set a target to improve energy efficiency of our operations by 5% in five years (2016-20), and by the end of 2018, we had delivered 3.4% of this target. Now, we have set a new energy efficiency target of 5%, for the 5 years after that. Looking further into the future, our aspiration is that by 2050 we will be at net zero in relation to all of our direct emissions. We are a signatory to the Guiding Principles on reducing methane emissions across the natural gas value chain as well as the World Bank’s Zero Routine Flaring initiative.

We are developing new opportunities for LNG to displace higher-emission fuels, including in trucks, trains and ships, building capability to produce and transport hydrogen from both renewable and non-renewable sources, and exploring options for integrating renewables and batteries with gas-fired power at our facilities.

### Woodside’s climate change policy advocacy principles

Where Woodside has the opportunity to engage with governments about their climate change policies, we are guided by the following key principles.

We recognise that an ideal policy – global in nature, stable over the long term, with targets based upon science, and delivering objectives at the lowest global cost – is not currently contemplated by the international community through a single mechanism or institution. Instead, pragmatic and incremental policies should be (and are being) implemented but should trend towards the ideal whilst mitigating the interim potential disadvantages of piecemeal action. For example:

- Policy objectives and targets should be based on the internationally accepted climate scientific consensus. National commitments and actions should be geared to make appropriate contributions to the scientifically derived global objective. Formal review cycles should ensure targets remain appropriate and that policies are effective in achieving them.
- Policies should target action to which ever global sector or geography can meet objectives at the lowest cost. To reduce the gap to global action, jurisdiction should be held at the highest level of a country’s system of government and should endeavour to link internationally where possible. We believe that free markets efficiently allocate resources, and that a global market for high quality

offsets should be encouraged and supported. Pre-competitive research and development support should be deployed to accelerate lower emission technologies down their cost curve in order to reduce the future marginal cost of abatement.

- Policies should enhance national competitiveness and reduce trade distortion by targeting relief to energy intensive trade exposed (EITE) sectors that compete with, or export to, markets that impose less ambitious policies upon their own equivalent sectors. Without effective EITE relief, local jobs will be unfairly disadvantaged which could create resistance to rapid national action.
- Policies should be enduring over the long term in order to allow sound investment decisions. This means that they must accommodate the delivery of multiple priorities such as energy security, energy poverty, economic development, and urban air quality; and they need to be enduring which implies a need for pragmatism in service of bipartisan consensus.

# State policy approach

## The role of the Commonwealth, States and Territories

Climate change is a global challenge. Trillions of dollars of investment in new technology and cleaner industrial infrastructure is needed as part of a global response. To marshal such investment, policymakers need to offer stable and consistent settings, in response to which business can effectively plan and invest. The global response to climate change has been agreed by the 197 countries that are party to the United Nations Framework Convention on Climate Change and the subordinate Paris Agreement.

Setting Australia's national target within the Paris Agreement Framework and allocating the task of meeting that target across the economy is clearly a role that only the Commonwealth Government can discharge. Efforts by sub-national governments to establish their own levels of ambition are counterproductive, spread confusion, and are likely to result in duplicative and inefficient efforts.

Woodside recognises and supports WA in framing policy considerations aligned with the Commonwealth target and WA's recently announced 2050 net zero aspiration. This provides a frame for considering policies, evaluating progress and discussing WA's contribution. The role of WA in global supply chains will be an important consideration as this policy matures. WA has the potential to develop industries that will prosper in a lower carbon world and support the transition to global net zero emissions: in addition to the role of natural gas, other key resources such as lithium and minerals associated with battery technology are clear examples. However, they will in many cases incur emissions within WA boundaries, which are more than exceeded by the emissions reductions they enable elsewhere. It will be important for WA to manage its emissions trajectory within this global context to ensure the right holistic outcomes. Similarly, industries such as agriculture contribute to other facets of global sustainability such as tackling hunger and poverty, and it is against this backdrop that their emissions should be judged.

Policy measures on climate change can be considered in terms of the demand-side and the supply-side. On the demand side, the demand for greenhouse gas emissions reduction is set by the target. The clearer and more consistent this demand signal is, the better it will encourage supply-side investment and innovation to meet it. Within the Paris Agreement Framework, the Federal Government has the responsibility for setting levels of ambition for greenhouse gas emissions reduction. Australia's initial Nationally Determined Contribution (NDC) under the Paris Agreement has been submitted to the United Nations and is a 2030 target of 26-28% reduction from 2005 emission levels.

There is however a clear role for both the States and the Commonwealth on the supply side of policy (i.e. working on measures to ensure the cost of delivering abatement reduced). These might include:

- Ensuring emissions reduction in state owned and controlled sectors of the economy
- Support of emerging technology (e.g. fiscal subsidies, removing regulatory barriers)
- Investment facilitation and attraction in lower carbon industries
- Direct regulation to resolve market failures (e.g. building energy efficiency standards)
- Offset industry capacity and capability development

Woodside also notes that there is an ongoing discussion regarding the role of environmental regulators, for example arising in the case of the Western Australian Environmental Protection Authority's proposed Greenhouse Gas Guideline (March 2019) and in the legal challenges to projects such as the Carmichael coal mine in Queensland. In both cases, the WA Environmental Protection (EP) Act and the Federal Environment Protection and Biodiversity Conservation (EPBC) Act could give clearer guidance to

the regulators and the courts on the treatment of greenhouse matters. Such legislation is currently being reviewed and this process should ensure that it is supporting rather than duplicating or confusing the Federal approach to regulating industrial emissions via the Safeguard Mechanism.

Within the context of the proposed State Climate Policy the following are proposed measures Woodside advocates can be used to transition WA to a resilient low carbon economy.

## 1. Leading by example in State owned operations

### Reducing emissions from the State Government sector

The State Government is a significant part of the economy. It has direct control over large parts of the electricity sector, the public transport system, schools and hospitals, and significant influence over other sectors through the power of its procurement processes. A plan to decarbonise the State Government's own operations consistent with its overarching net-zero aspiration could include:

- A low emissions target for the State Government's direct electricity consumption and generation
- A low emission fuel target for the State Government's vehicle fleet (e.g. LNG, hydrogen electric and battery electric)
- A target for solar panels on State Government owned properties
- Adopting higher energy efficiency standards in the public sector building stock
- Visible leadership and promotion of these efforts in the community
- When making purchasing decisions, the State could include emissions metrics in the evaluation criteria.

## 2. Establishing supportive policy frameworks

### Decarbonising electricity supply

The State has already begun work on an Energy Transition Strategy. As the system regulator, as well as the largest owner and operator of electricity generation, transmission and supply in the State, it is important the Government takes a clear and visible leadership role and charts a path to reducing emissions at its own assets, which could include average emission intensity targets, progressively for key milestones such as 2030, 2040 and 2050.

Australia's Renewable Energy Target (RET) has successfully commercialised a renewable industry and resulted in significant reductions in electricity emissions. Despite the RET having been delivered, renewable capacity continues to grow, suggesting that renewable energy is increasingly cost competitive without subsidy. This growth has however created challenges such as integration of large quantities of intermittent generation, and it does not apply any pressure on emissions in the non-renewable part of the electricity system.

The electricity sector continues to offer some of the lowest cost emission reduction opportunities, so policies should be crafted to take advantage of this. Future policy should be emissions focussed, not technology focussed, and should reward reliability as well as lower emissions. Many potential mechanisms have been proposed. An emissions intensity scheme, a WA version of the National Energy Guarantee, or modifications to the safeguard mechanism could all contribute to delivering these objectives.

## Low emission transport and liquid fuels

Some sectors may be more difficult to decarbonise than others, such as heavy transport and remote power generation. Greater use of LNG in these applications is possible. Woodside has already taken the step of establishing an LNG supply chain in the Pilbara via trucked LNG from our existing export production facilities. With low emissions and domestically produced fuels available to mining operators in WA, the State could be considering how it can promote the uptake of cleaner fuels.

As a resource intensive state, WA consumes a large amount of diesel extracting and transporting minerals. Some three billion litres of diesel are imported into the Pilbara each year, primarily to fuel the region's, mining industry included heavy mining equipment, trains and power generation. It is feasible for many of these applications to convert to LNG, reducing shipping emissions by ~27% on a lifecycle basis<sup>3</sup>. Incentives and support for accessing federal funding could promote the displacement of diesel in remote locations with lower emission fuels such as LNG in such applications.

Shipping from Western Australia is also a significant emitter, with the WA to North Asia iron ore trade being the world's largest bulk commodity trading route. Whilst only part of these emissions are in Australian waters, a significant reduction in global emissions could be achieved by transitioning these ships from fuel oil to cleaner fuels. It is generally accepted that in the near-term, the only viable lower-carbon option for shipping is LNG<sup>4</sup>, and if all of WA's iron ore was exported using ships fuelled by LNG produced in WA, this alone could provide a lifecycle emissions reduction of up to 5.8 million tonnes per annum, the equivalent of taking 1.8 million cars off the road<sup>5</sup>.

BHP recently issued a tender to transition some of their iron ore shipping to LNG-fuelled vessels. WA could support this transition by implementing Emission Control Areas at WA Ports, reducing port fees for low emission vessels that bunker in WA, such as those in place in Rotterdam and Singapore, and by ensuring efficient licensing and regulation of LNG bunkering activities at its ports.

## Hydrogen production

As the pioneer of the LNG industry in Australia Woodside sees hydrogen as a natural evolution of our energy export business model, post 2030. We have commended Council of Australian Governments (COAG) in developing a National Hydrogen Strategy and believe WA can play a key role in the development of a domestic and export hydrogen industry.

Jurisdictions like Saudi Arabia, USA, Norway, and Qatar are rapidly developing their hydrogen industries. Other Australian States such as South Australia and Queensland are seeking to follow suit. For WA to compete globally the correct support, policy settings and regulations need to be developed and adopted. In the context of developing a hydrogen industry, Woodside advocates a technology-neutral, lowest-cost approach. Lower costs will stimulate a hydrogen economy, resulting in faster uptake and more commercially viable projects.

Woodside is focusing on two technologies: carbon-neutral hydrogen, sourced from gas ('blue' hydrogen), and zero-carbon electrolysis of water powered by renewable energy ('green' hydrogen).

There is an opportunity to tap into an emerging hydrogen export market. To leverage these efforts into major investment decisions, WA could consider a mechanism to stimulate domestic hydrogen demand

<sup>3</sup> Energetics Study: "Lifecycle Emissions of LNG from Woodside fuelling iron shipping from the Pilbara"

<sup>4</sup> DNV-GL Maritime Energy Transition Outlook 2019

<sup>5</sup> Energetics Study: "Lifecycle Emissions of LNG from Woodside fuelling iron shipping from the Pilbara"

and use, such as targeting a 10% hydrogen content in natural gas pipelines, potentially starting with blue and transitioning to green hydrogen. This hydrogen supply could reduce the risk of a domestic gas shortfall, whilst maximising use of existing infrastructure and underpinning the creation of a globally dominant hydrogen export industry comparable to our current LNG industry.

### Hydrogen in transport

A transition to zero-emission vehicles can be implemented in WA. Hydrogen fuel cell electric vehicles can provide a low emissions transport option however infrastructure, such as refuelling stations, are needed to assist the adoption and take up. This could be facilitated by a commitment from government in terms of setting targets in owning and take up of a zero-emission fleet.

Vehicle availability and relative pricing influence the uptake rate. Competition will occur once there is greater optionality in the market. Government fleet purchasing of hydrogen fuel cars could kick-start local sales.

The first models of hydrogen buses, cars, trains, ferries and forklifts are available in global markets. WA could prioritise the acceptance of these initial models, potentially providing accelerated or concessional approvals and consider direct subsidies for these vehicles.

Hydrogen trains should be considered as part of a low emissions public transport solution; such trains are already operating in Germany and Canada. The advantage over a conventional electric train, is the elimination of the capital cost of the electricity infrastructure.

### Downstream Processing

A large domestic hydrogen supply chain presents an opportunity for downstream mineral processing, for example with iron ore. This could increase the value capture of WA's largest export product, resulting in a higher-value, low-emissions steel export products. The emission free aluminium collaboration between the Canadian and Quebecois governments, Apple, Alcoa and Rio Tinto, could serve as a model.

### Supporting offset markets

Woodside is developing a new business to develop and acquire carbon offsets at scale. This forms a key part of our climate change strategy, and as part of it we are supportive of developing a deep, liquid and transparent offsets market, characterised by high levels of integrity in both carbon accounting methodologies and in the operational and contractual standards of the participants

We believe carbon farming will not only contribute to the creation of this offsets industry, but also that it could create opportunities to achieve positive social, environmental and financial outcomes for pastoral businesses and their surrounding communities. It is therefore important that the State advocates for the adoption of methods within the Carbon Farming legislation that are suitable to WA's landscape. This will ensure better representation of projects within the Federal Government's Emissions Reduction Fund.

The agricultural sector has the potential to supply significant volumes of abatement to carbon markets, enabling the transition to a lower-carbon economy. The importance of this role cannot be underestimated since current projections suggest there is currently insufficient supply to meet expected offset demand. Measures available to the State include:

- Removing barriers that exist in legislation/regulation. For example, supporting resolution to enable Human Induced Regeneration (HIR) carbon sequestration projects in WA. HIR projects have potential to scale into tens of millions of tonnes over 25 years. WA Government consent for these could unlock jobs and growth in regions and communities. There has excellent cooperation and consultation between State Government and WA Chamber of Minerals and Energy, Australian Petroleum Producers and Explorations Association to move this forward.
- Releasing unallocated crown land, parks or agency land for use in carbon farming projects.
- Establishment of dedicated incentive schemes, like the recently-established land-restoration fund from the Queensland Government.
- Dedicated funding could support innovation, research and development to improve the viability of carbon farming projects and build the industry. Opportunities include the application of robotics, drones, remote sensing, data science and artificial intelligence to reduce costs and enhance carbon yields.
- Working with offset producers to meet relevant industry standards at scale, like the way Industry Capability Networks have developed suppliers in the resources value chain.
- Agreeing complementarity principles with the Commonwealth to increase the ability for WA offsets to participate as Australian Carbon Credit Units (ACCUs).

Savannah and desert burning methods can deliver good land management outcomes through better management of biodiversity, feral animals, weeds, endangered species. The development of both savannah burning and desert burning projects should be considered a priority for this purpose due to their ability to deliver a range of community benefits. These include the facilitation of on-country living rather than town living, which will often assist in reducing social issues and tensions, and consequent public costs.

Woodside believes the social and economic co-benefits of an offsets industry could be significant. Social Ventures Australia have identified Ranger employment to conduct savannah burning at scale has community-wide benefits that include reduced alcohol consumption and domestic violence, reduced interaction with the justice system, better school attendance, and increased resilience of individuals that lead to better personal choices for healthy lifestyles.<sup>6</sup> Investment in education and information to ensure communities and broader stakeholders understand the potential opportunities, can implement good governance and are able to have on-ground practice will be key.

The success of these methods will require them to have sufficient scale and resourcing to ensure proper engagement of remote communities in culturally appropriate ways.

### Energy efficiency standards

Through COAG, WA could work to expand the disclosure and regulation of energy efficiency appliances, vehicle efficiency standards and building standards. The community is accustomed to seeing white goods labelled for energy and water efficiency and the State can start to incentivise or regulate the sale of such goods operating at the lower end of the range.

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<sup>6</sup> SVA Consulting Department of Prime Minister and Cabinet Consolidated report on Indigenous Protected Areas following Social Return on Investment analyses February 2016

### 3. Education, Research and Leadership

#### Education and behaviour change

The State is a world leader in behaviour change programs, with the Department of Transport's TravelSmart project which informed other campaigns including water use programs. These programs have been demonstrated to have exceptional returns on investment and could be significantly expanded. The State can also promote:

- WA's chosen response to building resilience against climate change
- The role that gas production plays in reduces emissions in WA and globally
- Relevant university courses, similar to STEM campaigns
- Community based "Transition Town" programmes

#### Low carbon projects: Rottnest Island - a zero-carbon ecotourism model

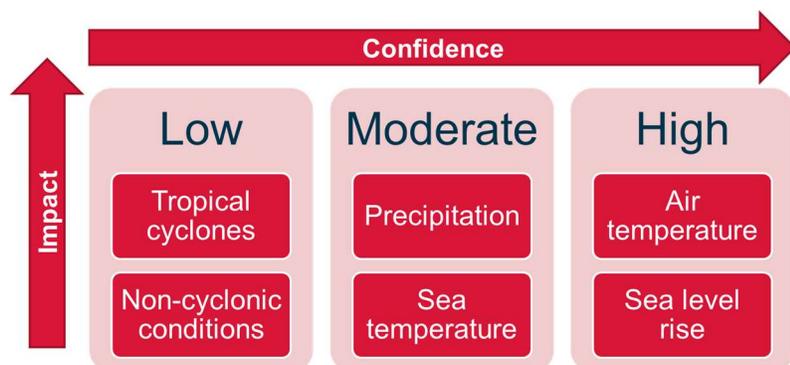
Low carbon demonstration sites can be used to promote ideas, educate and test emerging technologies. Rottnest Island presents a unique opportunity. Rottnest Island has already adopted a low carbon footprint with a hybrid power supply consisting of wind, solar PV, batteries, electric vehicles and a demand response desalination facility. This presents a real opportunity to set a more ambitious goal of achieving a zero-carbon Rottnest.

By establishing a clear goal and building appropriate partnerships, Rottnest Island could completely decarbonise. Using excess energy from additional renewable generation capacity, a hydrogen system could solve seasonal intermittency issues, provide fuel for buses and ferries, and energy for accommodation.

Although this may be an ambitious target when viewed in isolation, these efforts can de-risk future investment in low carbon technologies for the rest of the State. Such a project can highlight barriers, identify solutions and prioritise opportunities to facilitate more robust long-term planning for WA's recently announced net-zero ambition.

#### Understanding of Climate Science

The world has already warmed due to climate change. Adaptation to this needs to be managed using the most robust understanding of future climate states. The impact and level of confidence of various climate parameters varies.



A key area of risk for WA is tropical cyclones, however our scientific understanding of non-cyclonic weather could also be improved. Woodside has worked on Joint Industry Projects (JIP) with other resource companies and the Bureau of Meteorology to improve tropical cyclone forecasting and

Objective Tropical Cyclone Reanalysis. A subsequent Joint Industry Project could be used to improve this understanding, specifically to downscale the models or use finer resolution analytical tools such as Coupled Model Intercomparison Project (CMIP) 6. This type of JIP could be relevant to all infrastructure owners, including government, LNG and mining.

#### Promoting WA's role in global emissions reduction

As many Western Australians are aware, WA plays a very important role in global commodity supply chains. Our natural gas, iron ore and lithium and agricultural produce that we export to the world are critical to countries developing towards a more sustainable future.

This creates a dilemma for Western Australia that has become increasingly evident in public debate. The development of these resources leads to an increase in emissions within WA, but the products they create are playing a significant role in global decarbonisation. Experts like the UN's Intergovernmental Panel on Climate Change (IPCC) and the International Energy Agency (IEA) have repeatedly advised that the use of gas is helping avoid emissions by replacing higher emission fuels, and can dramatically improve local air quality.

We see benefit in government led public information campaign promoting the role of WA's resource exports in tackling global climate change. Western Australians should be equipped with the facts so that they can rightly feel proud of the contribution that their State, its industries and their jobs are making to global sustainability. Better understanding of these facts will also provide community context and support for better informed policy and regulatory frameworks.

# Appendix 1. Responses to specific questions

<b>Transforming Energy Generation</b>	
What are the main challenges for decarbonising Western Australia's electricity supply while ensuring adequate generation capacity, security and reliability?	The South West Interconnected System (SWIS) capacity market provides a layer of reliability that the National Energy Market (NEM) does not have. As such, the key challenge with decarbonising the electricity grid is to establish a policy that prioritises low emission generation and to capitalise on the role that rapidly dispatchable fuels like natural gas and hydrogen can play in 'firming' renewables.
What are the most effective ways to overcome these challenges by 2030?	Renewable targets need to be balanced with measures in the non-renewable component to achieve lower emissions and greater flexibility in dispatch so that deeper penetration of renewables can be supported. This could be an emissions intensity scheme or modelled off the National Energy Guarantee. It would be better to implement this policy nationally, but since the grids are distinct, it would be appropriate for the WA Government to implement this sort of policy unilaterally if necessary.
Should the electricity sector make a pro-rata (or greater) contribution to Australia's national greenhouse gas emission targets?	Where sectoral policies are used, they should be calibrated such that they impose the same marginal cost as other sectors face. It's likely that this would result in WA's electricity sector delivering more than its pro-rata share of emissions reduction. This should not be an objective in itself, but rather an outcome of policies that deliver least cost abatement from across the economy.
How fast do you think the transition of the electricity sector should occur?	We think that the pace of decarbonisation should be aligned to ensure that all sectors face the same marginal cost. However, with its own assets, the State has the option to take a leadership role and set internal emissions reduction targets.
<b>Industry innovation</b>	
What measures have been implemented by your business to lower energy use or emissions?	Woodside has set a target to improve energy efficiency by 5% between 2016 and 2020, based on a 2015 baseline. We have delivered efficiency improvements 3.4% of this target

	<p>by the end of 2018. We have also committed to a new 5% energy efficiency target covering the period 2021-25.</p>
<p>What are the barriers to decoupling energy use and emissions in the resources sector?</p>	<p>Woodside is investigating options to use renewable electricity to partially power our WA LNG facilities.</p> <p>It is technically possible to use almost 100% renewable energy to liquefy natural gas if a 24/7 stable energy source can be provided cost effectively. For example, hydro-electricity.</p> <p>Natural gas reservoirs also typically contain carbon dioxide, which is separated and typically vented as part of the liquefaction process. Carbon capture and sequestration is one option to avoid this emission source, but is highly project specific, since CO2 sequestration requires a suitable aquifer to be available, and as a result offsets present a more technically and financially viable solution.</p>
<p>Have you assessed the implications of the low-carbon transition for your business or sector? How are these risks disclosed to stakeholders?</p>	<p>We have assessed the transition and adaption impacts of various future emission levels. We explained our approach and philosophy in <i>Our Energy Future in a Lower Carbon World</i> and <i>Sustainable Development Report 2018</i>.</p>
<p>What exemptions should apply to trade-exposed sectors in reducing our emissions?</p>	<p>Policies should enhance national competitiveness and reduce trade distortion by targeting relief to energy intensive trade exposed (EITE) sectors that compete with, or export to, markets that impose less ambitious policies upon their own equivalent sectors. Without effective EITE relief, the pace of national action will be constrained by the needs of the most vulnerable sector.</p> <p>None of the top 10 LNG exporting nations have a domestic carbon price or intend to implement one. WA should ensure policies enable industries remain competitive against other international LNG suppliers' or similar. Factors which impact Australia's competitiveness include higher labour costs.</p>
<p>How can the Government of Western Australia foster clean industries and technologies?</p>	<p>Policy and legislative settings to support a technology neutral response, for example exporting hydrogen at scale is an opportunity for WA. As a State we have natural gas and potentially significant resources of renewable energy. Woodside we are a world leader in industrial gas handling and cryogenic processes which will be required for a future liquified hydrogen export industry.</p> <p>As with the LNG industry, which started with a domestic gas market, a hydrogen export industry can be accelerated by stimulating domestic hydrogen supply. This could be</p>

	done by mandating a gradual ramp up to 10% of domestic supply being provided by green hydrogen.
<b>Future Mobility</b>	
What are the barriers to purchasing a low-emissions vehicle for your household or business?	<p>Key barriers include:</p> <ul style="list-style-type: none"> <li>• Vehicle availability</li> <li>• Higher upfront prices</li> <li>• Lack of battery and hydrogen fuel cell refuelling infrastructure</li> <li>• EV battery life being shorter than the service life of an internal combustion engine</li> </ul>
What can be done to facilitate the uptake of electric and other low-emission vehicles in Western Australia?	<p>The State should set out a plan to use its own procurement powers and transition its fleet to low and zero emission options, eg LNG, hydrogen fuel cell electric and battery electric.</p> <p>Support for LNG for shipping and hydrogen could be through the implementation of emission control areas, capital grants for refuelling infrastructure, and recognizing the use of low emission fuel in major project environmental approvals.</p>
How can we ensure that Western Australia isn't left behind in the transition to cleaner transportation?	<p>We believe WA could demonstrate its leadership through policies, innovation and investment that further the support cleaner transport by the use of hydrogen and LNG fuels.</p> <p>For hydrogen development Woodside is promoting four ideas: (1) the lowest cost pathway commencing with blue hydrogen then transitioning to green; (2) offering the consumer choice based on gas source; (3) the use of bio-sequestration to achieve carbon neutrality at lowest possible cost, which could also generate additional environmental and social benefits and (4) district level hydrogen generation and storage sites, which can be used for Hydrogen Fuel Cell Electric Vehicle (HFCEV) refuelling, Battery Electric Vehicle (BEV) recharging, and local level grid stabilization to enable high levels of renewable penetration in the energy system.</p> <p>LNG may become a fuel of choice in heavy transport, particularly in deep-sea shipping.</p> <p>Woodside also already delivers LNG overseas in tankers fuelled by LNG. Other types of ocean-going ships are starting to be built to operate using LNG as a fuel, including 32 large cruise ships and 20 container ships.</p>

	<p>There is an opportunity for ships trading to and from Australia to be fuelled by LNG. Specifically, Woodside sees an opportunity for the bulk carriers, which carry iron ore from WA.</p> <p>Working with BHP, FMG and Rio Tinto since 2017, Woodside is part of the 'Green Corridor' project that has designed LNG-fuelled ships to carry iron ore. By using LNG produced in Australia rather than fuel oil purchased in Asia, these ships could operate at lower cost, with reduced emissions.</p> <p>Following the investment, we have made to provide natural gas for on-land uses such as power generation and trucking, Woodside is also considering an investment to support the uptake of LNG in shipping on this trade router. This would take the form of an LNG bunker vessel (essentially a mobile refuelling ship) which would allow ships operating from north-west Australia, such as iron ore carriers, to refuel with Australian LNG. This outcome is not guaranteed, as Australia faces significant competition from other countries (e.g. Singapore) where commitments to LNG bunkering infrastructure have already been made, often with government backing.</p> <p>We believe the WA Government could work to ensure this opportunity is captured through incentives to promote initial demand and supply infrastructure, similar to other jurisdictions.</p> <p>WA has the resources and capability to be a global leader in hydrogen and LNG fuels for transport</p>
<b>Regional Prosperity</b>	
How will climate change affect your regional community?	Woodside has assessed our infrastructure against future climate changes.
How can we support the agricultural sector to participate in the low-carbon transition?	Please refer to <i>Supporting Offset Markets</i> in main submission.
What opportunities do carbon offset markets present for Western Australian land managers, including Aboriginal groups?	Please refer to <i>Supporting Offset Markets</i> in the main submission.
What matters should the State Government take into account in developing a strategy for carbon farming in Western Australia?	Please refer to <i>Supporting Offset Markets</i> in the main submission.
<b>Resilient Infrastructure and Businesses</b>	

What are the key climate risks for the primary industry or resources sectors?	Woodside considers both transition and physical climate risks as part of our business resilience assessment.
Do you currently assess the impact of physical climate risks on your business, assets or infrastructure?	Yes. We conduct climate modelling and assess potential future climates during our project design phases. We also reassess our understanding of future climate on a five yearly basis and conduct risk assessments when our understanding changes.
Is there information which would assist you to do this better?	<p>The modelling of tropical cyclones under various future climate scenarios has a material impact on our infrastructure and is one of the least well understood issues.</p> <p>A collaborative approach to conducting additional research could help reduce uncertainty and provide benefit to Woodside, other resource companies and local communities through the Pilbara.</p>
What are the best ways to enhance the resilience of public and private infrastructure?	The key opportunity to enhance our resilience is to better understand the potential tropical cyclones.
<b>Protecting Biodiversity</b>	Please refer to <i>Supporting Offset Markets</i> in the main submission.
<b>Strengthening Adaptive Capacity</b>	Please refer to responses to <b>Resilient Infrastructure and Businesses</b> above.