



Climate change in Western Australia Issues paper – September 2019

CONTENTS

KEY POINTS	2
INTRODUCTION	4
THE WESTERN AUSTRALIAN UPSTREAM OIL AND GAS INDUSTRY	4
APPEA'S STANCE ON CLIMATE CHANGE.....	6
THE KEY ROLE NATURAL GAS PLAYS IN REDUCING GLOBAL GREENHOUSE GAS EMISSIONS.....	7
NATURAL GAS: INTEGRAL TO A LOW CARBON WESTERN AUSTRALIAN ECONOMY	7
NATURAL GAS: INTEGRAL TO LOW CARBON ECONOMIES IN ASIA	9
INTERNATIONAL COMPETITIVENESS: THE MAJOR CHALLENGE.....	13
COMMENTS ON SPECIFIC SECTIONS OF THE ISSUES PAPER.....	14
INTERNATIONAL AND NATIONAL CONTEXT (AND THE NEED FOR A NATIONAL APPROACH)	14
TRANSFORMING ENERGY GENERATION	15
INDUSTRY INNOVATION	16
FUTURE MOBILITY.....	17
REGIONAL PROSPERITY.....	18
RESILIENT INFRASTRUCTURE AND BUSINESSES / STRENGTHENING ADAPTIVE CAPACITY	19
CONCLUSIONS / NEXT STEPS	19
ATTACHMENT 1. APPEA'S CLIMATE CHANGE POLICY PRINCIPLES	21
ATTACHMENT 2: ACTIONS TAKEN BY THE UPSTREAM OIL AND GAS INDUSTRY TO REDUCE EMISSIONS AND TO EMBED CLIMATE CHANGE CONSIDERATIONS INTO DECISION-MAKING.....	29



KEY POINTS

- The Australian Petroleum Production & Exploration Association (APPEA) is the peak national body representing upstream oil and gas explorers and producers active in Australia. APPEA's member companies account for more than 90 per cent of Australia's petroleum production. Further information about APPEA can be found on our website, at www.appea.com.au.
- APPEA welcomes the opportunity to provide comment to the Department of Water and Environmental Regulation on its *Climate change in Western Australia Issues paper – September 2019* (the Issues Paper).
- **APPEA supports a national climate change policy that delivers greenhouse gas emissions reductions, in line with Paris Agreement commitments, at least cost and facilitates broad-based investment decisions consistent with an international price on carbon.**
- Reliable, secure and competitively priced energy is crucial to our everyday lives in Australia, including in Western Australia. Oil and gas plays a key role in meeting many of our energy needs. Gas-fired electricity generation is a cost-effective technology which combines reliability and rapid ramp-up times to complement intermittent renewable energy technologies.
- The industry in Western Australia plays a particularly important role. The upstream oil and gas industry (including crude oil, condensate, LNG, natural gas and LPG), accounted for 26 per cent of the total value of WA's mineral and petroleum sales in 2018-19. This made it the second most valuable sector after iron ore. The sector was valued at \$38.4 billion in 2018-19, an increase of 45 per cent from \$26.5 billion in 2017-18.
- The effective and efficient management of greenhouse gas emissions is an issue which APPEA and its members takes very seriously and APPEA and its members have been engaged constructively in the development of climate change policy for more than 25 years. APPEA supports the science of climate change and acknowledges the need to reduce emissions across the globe.
- Making genuine progress requires an integrated set of solutions. This includes actions by industry to reduce emissions, provide and advance lower carbon energy technologies and solutions, and support effective national and international policies.
- Western Australia could generate significant additional national economic, environmental and social benefits through greater utilisation of its substantial natural gas resources.
- Gas has an essential role to play in reducing emissions. In the home, natural gas is a cleaner fuel, as well as being a relatively low emissions generation source that can see the emissions intensity of electricity generation in the South West Interconnected System (SWIS) fall, gas-fired generators can be rapidly started making them complementary with intermittent renewable energy.
- Exporting gas as LNG will allow our Asian trading partners to reduce the emissions from their economies. Using more natural gas in Western Australia's power generation and resource processing would significantly enhance the nation's ability to meet increasing energy needs and reduce emissions.
- APPEA supports a national approach to greenhouse gas emissions reduction policies, which are the responsibility of the Australian Government as the signatory to Australia's Paris Agreement commitments.
- The Western Australian Government's 28 August 2019 Brief Ministerial Statement on *Greenhouse Gas Emissions Policy for Major Projects* provides direction for both the Government's policy position for major projects under assessment by the EPA and the for this State Climate Change Policy.



- The statement also provides some clarity, particularly on the importance of alignment with, and complementarity to, the Australian Government's climate change policy approach and the obligations placed on major projects and plant upgrades by the safeguard mechanism.
- Natural gas can play a key role in transforming energy generation in Western Australia. Lower emissions in Western Australia. This can be achieved through an open, competitive and efficient electricity market that allows fuel sources and power generation technologies to compete on their merits.
- The industry has a long history of taking actions to reduce emissions in and around its operations, and across Australia, including in Western Australia. Case studies are provided in this submission highlighting some of these actions and initiatives, with a particular focus on Western Australia.
- In relation to reducing energy use and energy productivity/efficiency, APPEA member companies have in place long-standing and pervasive energy management policies, systems and measurement indicators that form a core part of their operational performance. The industry has also been a participant in numerous voluntary and mandatory energy efficiency and energy efficiency related programs. In addition, individual APPEA members have, in their submissions, provided perspectives on the questions asked in this section, particularly the measures they have implemented lower energy use or emissions and the way in which they assess the implications of the low-carbon transition for their business and these risks disclosed to stakeholders.
- Western Australia is well-placed to lead the uptake of LNG fuels, with large LNG production facilities close to fuel-intensive mining developments. Around three billion litres of diesel are imported into the Pilbara every year, primarily for mining. The ships moving mining exports to market use around five billion litres of heavy fuel oil.
- LNG can replace these higher-emissions fuels, reducing greenhouse gas emissions by around 30 per cent on a lifecycle basis, while virtually eliminating emissions of sulphur dioxide and fine particulate matter, and dramatically reducing emissions of nitrous oxide.
- APPEA in October 2019 provided a submission to the Department of Primary Industry and Regional Development's *Human-Induced Regeneration: Carbon Farming and the Resources Sector* Discussion Paper. The APPEA submission noted that amongst a portfolio of options, purchasing carbon offsets from Australian landowners may form a part of APPEA members' respective climate change mitigation strategies. In addition, APPEA notes carbon farming can create opportunities to achieve positive social, environmental and financial outcomes for pastoral businesses and their surrounding communities.
- Adaptation is an important element of climate change policy response. Adaptation strategies must be used to mitigate the risks that a changing climate may pose. Adaptation strategies to mitigate the risks posed by a changing climate should include: enhanced climate modelling to provide location specific climate change forecasts; research into possible climate change impacts on the Australian environment; development of land use and planning guidelines consistent with the available evidence of likely climate change impacts; and development of risk management strategies to reflect likely impacts of climate variability current. Given the location of many of its operations in Western Australia (such as the north-west), the upstream oil and gas industry has a long history of project design that takes account of climate variability as a fundamental aspect of project design.
- APPEA looks forward to participating in the Department's work and also looks forward to ongoing consultation ahead of the release of the update to the Western Australian Government's climate change policy in early 2020.



INTRODUCTION

The Australian Petroleum Production & Exploration Association (APPEA) is the peak national body representing upstream oil and gas explorers and producers active in Australia. APPEA's member companies account for more than 90 per cent of Australia's petroleum production. Further information about APPEA can be found on our website, at www.appea.com.au.

APPEA has been engaged in the greenhouse policy debate since its inception and has participated in every major consideration of climate change policy approaches in Australia. APPEA welcomes the opportunity to provide comment to the Department of Water and Environmental Regulation on its *Climate change in Western Australia Issues paper – September 2019* (the Issues Paper).

APPEA is committed to working with policymakers as they develop policy responses to climate change. With that in mind, APPEA in 2016 released a second edition of its *Climate Change Policy Principles* – a copy of which is at [Attachment 1¹](#) – setting out the principles that APPEA considers should underpin Australia's response to climate change.

Most importantly, APPEA supports a national climate change policy that delivers greenhouse gas emissions reductions, in line with Paris Agreement commitments, at least cost and facilitates broad-based investment decisions consistent with an international price on carbon.

APPEA is also a member of the Australian Industry Greenhouse Network (AIGN), a network of industry associations and individual businesses that contribute to the climate change policy debate and see value in joint industry action on climate change policy issues in order to promote sustainable industry development². APPEA has contributed to the AIGN submission to the Issues Paper.

In addition to the APPEA submission, a number of APPEA members have made individual submissions to the Issues Paper. This response should be read in conjunction with submissions from APPEA members.

APPEA's submission addresses specific aspects of the Issues Paper, focussing on those areas that are particularly important for the upstream oil and gas industry.

THE WESTERN AUSTRALIAN UPSTREAM OIL AND GAS INDUSTRY

It is also important to place our views on the issues raised by the Department in the Issues Paper within the context of the current state and potential future contribution of the upstream oil and gas industry to the Western Australian economy and to the welfare of all Western Australians.

Reliable, secure and competitively priced energy is crucial to our everyday lives in Australia, including in Western Australia. Oil and gas plays a key role in meeting many of our energy needs. Gas-fired electricity generation is a cost-effective technology which combines reliability and rapid ramp-up times to complement intermittent renewable energy technologies.

Our abundant natural gas resources, in particular, place Australia in an enviable position to maintain long-term, cleaner energy security domestically and internationally. Natural gas makes it possible for

¹ A copy of APPEA's *Climate Change Policy Principles* can also be found at www.appea.com.au/2016/02/appea-updates-climate-change-policy-principles.

² See www.aign.net.au for further information.



Australia to meet the world's growing energy needs over the coming decades while incorporating a strategy to curb emissions and address the risks posed by climate change.

Gas is an indispensable fuel for many industrial processes and a critical feedstock for industry that often cannot be substituted in producing fertilisers, cleaners, polymers and refrigerants. A large part of the manufacturing sector uses natural gas to generate electricity, heat and steam for industries, including alumina refining, food and beverage manufacturing, and grocery production³.

Provided we have appropriate regulatory and policy settings, including through Western Australia's climate change policy approach, the State's abundant natural gas resources places Western Australia (and Australia more broadly) in an enviable position to deliver long-term, cleaner energy domestically and across the Asia-Pacific. Western Australia's liquefied natural gas (LNG) exports offer a cleaner energy source to a world with a steadily growing appetite for energy.

The stakes are high in realising the industry's full potential benefits. However, future investment is not certain. The challenging market and increasingly challenging regulatory conditions facing the industry, both globally and in Australia, mean it is more important than ever to ensure the policy and regulatory framework facing the oil and gas industry in Western Australia remains competitive and encourages further exploration and development activity.

Nationally, LNG is now Australia's second largest export commodity after iron ore, with export revenue of over \$50 billion in 2018-19, and has more than doubled over the last two years (from \$22.3 billion in 2016-17). The oil and gas industry supports 80,000 jobs directly and indirectly in Australia and hundreds of thousands more in the manufacturing industry.

The industry in Western Australia plays a particularly important role⁴. The upstream oil and gas industry (including crude oil, condensate, LNG, natural gas and LPG), accounted for 26 per cent of the total value of WA's mineral and petroleum sales in 2018-19. This made it the second most valuable sector after iron ore. The sector was valued at \$38.4 billion in 2018-19, an increase of 45 per cent from \$26.5 billion in 2017-18.

The majority of petroleum production (more than 90 per cent) originates from projects in adjacent Commonwealth offshore areas. This production comes from 23 principal petroleum projects producing oil, gas and condensates from 57 fields onshore and in the Commonwealth offshore areas around Western Australia.

Australia's LNG history began in Western Australia and LNG remains WA's most valuable petroleum product, accounting for 20 per cent of all mineral and petroleum sales in 2018-19. The value of LNG sales rose more than \$10 billion from \$18.9 billion in 2017-18 to \$28.9 billion in 2018-19, over 55 per cent of the total for Australia. The volume of LNG produced in WA increased 113 per cent in the five years to 2018-19, with sales reaching a record 37.9 Mt in 2018-19. The year-on-year increase was 5.7 million tonnes (15 per cent) in 2018-19. In 2018-19, crude oil volumes were down 34 per cent to 3.2 gigalitres (GL), while condensate production increased almost 60 per cent to 11 GL.

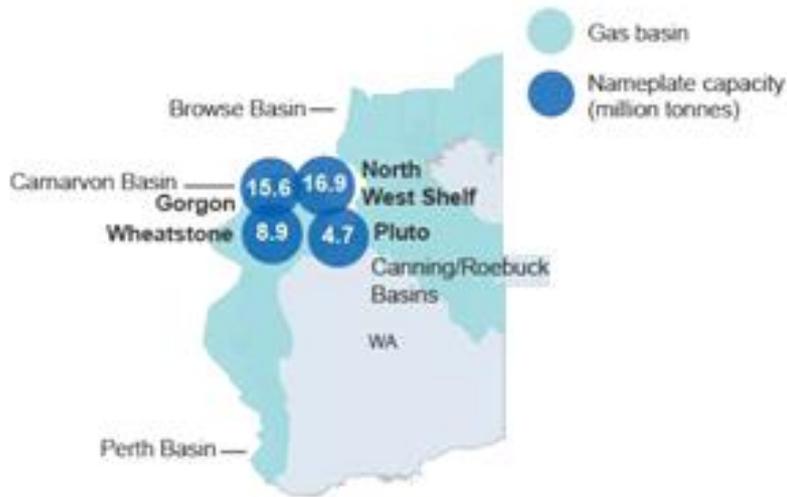
Japan remained the primary export destination for petroleum, taking 43 per cent, or \$16.9 billion, of Western Australia's petroleum production. China and Singapore were the next largest with 15 per cent and 13 per cent of petroleum exports respectively.

³ See www.appea.com.au/oil-gas-explained/benefits/gas-and-manufacturing.

⁴ See dmp.wa.gov.au/About-Us-Careers/Latest-Statistics-Release-4081.aspx for more information.



Figure 1. Western Australia's LNG projects and gas basins



Source: Adapted from Department of Industry, Innovation and Science (2019).

Data from the Department of Mines, Industry Regulation and Safety, shown in Table 1, demonstrates that the industry has over \$5.7 billion in investment in new projects underway in Western Australia and, very importantly, nearly \$64 billion in investment under consideration.

Table 1. Proposed investment in WA upstream oil and gas industry

COMMODITY	CAPEX (A\$ MILLION)	
	COMMITTED / UNDER CONSTRUCTION	PLANNED / POSSIBLE
Crude oil and condensate	0	0
Gas	0	5,000
LNG	5,714	58,951
Pipelines and infrastructure	0	0
TOTAL PETROLEUM	5,714	63,951

Source: Adapted from Department of Mines, Industry Regulation and Safety (2019).

This means that the stakes are high in realising the industry's potential benefits.

APPEA'S STANCE ON CLIMATE CHANGE

The effective and efficient management of greenhouse gas emissions is an issue which APPEA and its members takes very seriously and APPEA and its members have been engaged constructively in the development of climate change policy for more than 25 years.

APPEA supports the science of climate change and acknowledges the need to reduce emissions across the globe.

Societies around the world will continue to face two major, interdependent challenges:



- Maintaining and expanding affordable, secure energy supplies to meet growing consumer demand.
- Addressing the social, economic and ecological risks posed by rising greenhouse gas emissions and climate change.

Managing greenhouse gas emissions and meeting growing energy demand requires action by individuals, companies, and governments.

Making genuine progress requires an integrated set of solutions. This includes actions by industry to reduce emissions, provide and advance lower carbon energy technologies and solutions, and support effective national and international policies.

Reliable and competitively priced and reliable energy underpins economic growth and stability, and is crucial to raising living standards in both developing advanced nations.

Therefore, policies aimed at reducing greenhouse gas emissions must do so at the lowest possible cost.

THE KEY ROLE NATURAL GAS PLAYS IN REDUCING GLOBAL GREENHOUSE GAS EMISSIONS

Greater use of Australian natural gas – in the domestic market in Western Australia, and in Asia as LNG exports – can significantly reduce greenhouse gas emissions.

NATURAL GAS: INTEGRAL TO A LOW CARBON WESTERN AUSTRALIAN ECONOMY

Western Australia could generate significant additional national economic, environmental and social benefits through greater utilisation of its substantial natural gas resources.

Gas has an essential role to play in reducing emissions⁵. In the home, natural gas is a cleaner fuel, as well as being a relatively low emissions generation source that can see the emissions intensity of electricity generation in the South West Interconnected System (SWIS) fall, gas-fired generators can be rapidly started making them complementary with intermittent renewable energy.

Exporting gas as LNG will allow our Asian trading partners to reduce the emissions from their economies. Using more natural gas in Western Australia's power generation and resource processing would significantly enhance the nation's ability to meet increasing energy needs and reduce emissions.

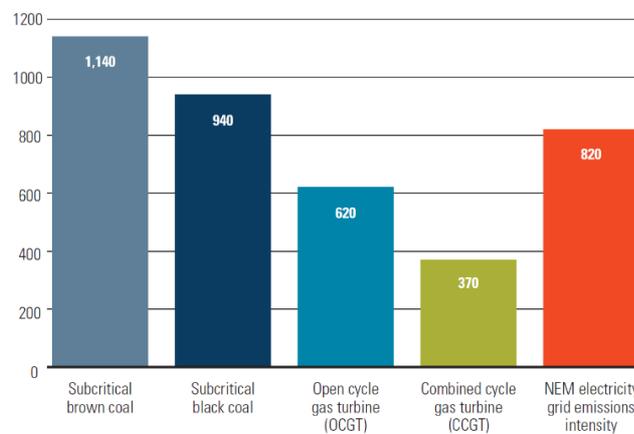
⁵ See *Gas Vision 2050* for more information. *Gas Vision 2050* was developed by Australia's peak gas industry bodies and demonstrates how gas can continue to provide Australians with reliable and affordable energy in a low-carbon energy future. See www.appea.com.au/media_release/gas-vision-2050 and www.appea.com.au/wp-content/uploads/2017/03/GasVision2050_March2017.pdf for more information.



These outcomes are possible because, as data on page 203 of the *Independent Review into the Future Security of the National Electricity Market – Blueprint for the Future* (the Final Report) shows⁶, available natural gas power generation technologies can reduce greenhouse gas emissions by 68 per cent compared to current brown coal generation technologies and 61 per cent compared to current black coal generation technologies.

This is illustrated in Figure 2, which shows, using data from page 203 of the Final Report, the significantly lower greenhouse gas emission associated with the use of gas-fired power generation compared to the use of other conventional fuels. Coal, for example continues to be the largest source fuel for power generation, both in Australia and in much of Asia⁷.

Figure 2. Estimated Operating Emissions for New Power Stations (kg CO₂-e/MWh)



Source: Data from *Independent Review into the Future Security of the National Electricity Market – Blueprint for the Future* (2017).

The potentially growing role of natural gas considered in this and other reports reflects the role gas could play as a lower-emissions and cost effective generation technology, both in replacing coal-fired generation and in complementing the growth in renewable technologies. Intermittent renewable energy requires “on call” electricity generation to manage falls in renewable output or peaks in demand. Gas-fired generation is a key technology capable of delivering that flexible response. As more renewable energy is integrated into the grid, this balancing role becomes more critical.

In Western Australia, for example, the relatively higher proportion of natural gas in the electricity generation mix means that average emissions in Western Australia are lower than the National Electricity Market (NEM) average and amongst the lower of all Australian States.

⁶ See www.energy.gov.au/publications/independent-review-future-security-national-electricity-market-blueprint-future for more information.

⁷ For example, the IEA's *2019 World Energy Outlook* shows that in 2018, 66 per cent of power generation in China as from coal-fired power stations. In India, it was 74 per cent and 40 per cent.



For example, the Department of the Environment and Energy, in its *National Greenhouse Accounts Factors, August 2019*⁸, estimated the emissions intensity of the South West Interconnected System at 0.69 kgCO₂-e/KWh, the North West Interconnected System 0.59 kgCO₂-e /KWh. This compares the NEM average of 0.81 kgCO₂-e/KWh, the New South Wales and Australian Capital Territory average 0.81 kgCO₂-e/KWh, the Victorian average of 1.02 kgCO₂-e/KWh, the Queensland average of 0.81 kgCO₂-e/KWh, and the South Australian (a State with an even high proportion of gas-fired power generation) average 0.44 kgCO₂-e/KWh.

Experience in the United States demonstrates how quickly emissions from the generation sector can be cut by fuel switching. Data from the US Government Energy Information Administration (EIA)⁹ shows energy-related emissions in the US in the first six months of 2016 were at their lowest level since 1991, down about 13 per cent from their peak in 2007. Amongst other reasons, this was because the US is developing its abundant natural gas resources. More recently, the EIA found¹⁰ emissions from power generation are expected to fall by over 2 per cent in 2019. The EIA noted:

Although the electric power sector is using more natural gas, EIA does not expect the increase in natural gas emissions in 2019 to offset the decrease in coal emissions because natural gas-fired electricity generation is less carbon-intensive than coal-fired electricity generation.

There is a similar opportunity, both in Western Australia and in Australia more broadly. If the industry is able to develop them, there are sufficient natural gas resources to underpin a historic shift to a lower emissions generation sector, across Australia, including in Western Australia.

The increased use of natural gas also has several additional environmental benefits, such as:

- Reduced emissions of fine particulates.
- Reduced emissions of sulphur dioxide (an important contributor to smog and acid rain) and nitrogen oxides.
- Significantly lower demand for water for power station cooling.

Greater use of Western Australia's extensive gas resources will be crucial in meeting the challenge of significantly reducing global greenhouse gas emissions at least cost whilst enhancing Western Australia's economic and export performance.

NATURAL GAS: INTEGRAL TO LOW CARBON ECONOMIES IN ASIA

In considering Western Australia's climate change policy responses both in the period to 2030, and beyond, and Australia's existing and future contribution to global emissions reduction efforts, it is important to acknowledge the positive contribution Australia's LNG exports – including from Western Australia – make now and will increasingly make to that global effort.

Australia's LNG industry is in a unique position to contribute substantially to the economic development of the nation and to reduce greenhouse gas emissions. Australia's resources of natural gas and proximity to growing markets make us well-placed to meet the global climate change challenge while substantially contributing to Australia's economic growth.

⁸ See www.environment.gov.au/climate-change/climate-science-data/greenhouse-gas-measurement/publications/national-greenhouse-accounts-factors-august-2019 for more information.

⁹ See www.eia.gov/todayinenergy/detail.php?id=28312 and www.eia.gov/todayinenergy/detail.php?id=30712 for more information.

¹⁰ See www.eia.gov/todayinenergy/detail.php?id=40094 for more information.



While the demand for energy as part of the industrialisation of Asian economies is a key driver, the properties of natural gas as a lower emitting and cleaner burning fuel is also driving much of the international demand for LNG.

As the International Energy Agency (IEA) found in its *2019 World Energy Outlook (2019 WEO)*¹¹, the use of natural gas is expected to grow consistently to 2040 under all scenarios. For example, in its 'Stated Policies Scenario'¹² (the central scenario in the 2019 WEO) the IEA expects global natural gas demand to grow by around 36 per cent over the Outlook period.

Average annual growth of 1.4 per cent means natural gas increases its share in global primary energy demand from 22 per cent today to 25 per cent in 2040. In the 'Sustainable Development Scenario'¹³, gas use plateaus from the 2030s, but the IEA notes, as a cleaner and flexible fuel, gas still sees its share increasing.

The IEA also expects LNG exports will overtake pipeline gas as the main form of long-distance trading, accounting for more than 60 per cent of inter-regional trade by 2040. This outlook is positive for Australia in general and Western Australia in particular. Most of the growing demand for natural gas will come from China (as part of a long-term and deliberate coal-to-gas switching program¹⁴), India and other countries in Asia which are turning more and more to natural gas to help improve urban air quality.

In addition, the IEA's July 2019 report *The Role of Gas in Today's Energy Transitions*, examined the role of fuel switching, from coal to natural gas, to reduce greenhouse gas emissions and air pollutants globally¹⁵. The report found that since 2010, coal-to-gas switching has saved around 500 million tonnes of CO₂ (see Figure 3 below) – the equivalent of putting an extra 200 million electric vehicles on the road running on zero-carbon electricity over the same period.

The report also highlighted a significant opportunity in the global electricity generation sector to reduce emissions by switching from coal-fired power plants to gas-fired power plants, which presented "*a potential quick win for emissions reductions*". The report found:

¹¹ See www.iea.org/weo for more information.

¹² According to the IEA, the (former) New Policies Scenario (NPS), now known as the Stated Policies Scenario (SPS) "... provides a detailed sense of the direction in which today's policy ambitions would take the energy sector. It incorporates policies and measures that governments around the world have already put in place, as well as the effects of announced policies, as expressed in official targets and plans."

¹³ The Sustainable Development Scenario (SDS), introduced for the first time in 2017, "... maps out a way to meet sustainable energy goals in full, requiring rapid and widespread changes across all parts of the energy system. This scenario charts a path fully aligned with the Paris Agreement by holding the rise in global temperatures to "well below 2°C ... and pursuing efforts to limit [it] to 1.5°C", and meets objectives related to universal energy access and cleaner air. The breadth of the world's energy needs means that there are no simple or single solutions. Sharp emission cuts are achieved across the board thanks to multiple fuels and technologies providing efficient and cost-effective energy services for all".

¹⁴ For an overview of the role natural gas, including Australian LNG, plays in China's coal-to-gas switching program, see Oxford Institute for Energy Studies (2018), *The Outlook for Natural Gas and LNG in China in the War against Air Pollution*, December (available at www.oxfordenergy.org/publications/outlook-natural-gas-lng-china-war-air-pollution).

¹⁵ See www.iea.org/publications/roleofgas for more information.



There is potential in today's power sector to reduce up to 1.2 gigatonnes of CO₂ emissions by switching from coal to existing gas-fired plants, if relative prices and regulation support this potential.

To put this opportunity in perspective, the potential for emission reductions across the global economy of 1.2 gigatonnes (in the short-term) is more than double Australia's total annual emissions and more than thirteen times Western Australia's total annual emissions in 2017¹⁶.

Figure 3. CO₂ savings from coal-to-gas switching by region compared with 2010



Note: Mt CO₂ = million tonnes carbon dioxide. Coal-to-gas switching includes emissions reductions in sectors where the market share of coal decreased, and the market share of gas increased within each region. The baseline increase in emissions assumes no improvement in the carbon intensity of energy or the energy intensity of gross domestic product (GDP) since 2010. Savings are calculated as those which occur compared to 2010.

Source: International Energy Agency (2019)

In a Western Australian context, a 2008 (updated in 2011) study by WorleyParsons¹⁷, for example, compares lifecycle greenhouse gas emissions of Australian LNG exports from the North West Shelf Project with Australian east coast black coal exports in terms of lifecycle greenhouse gas emissions: from extraction and processing in Australia through to an end use of combustion (using different power generation technologies) in China for power generation.

Figure 4 below is derived from data within the study, and shows that:

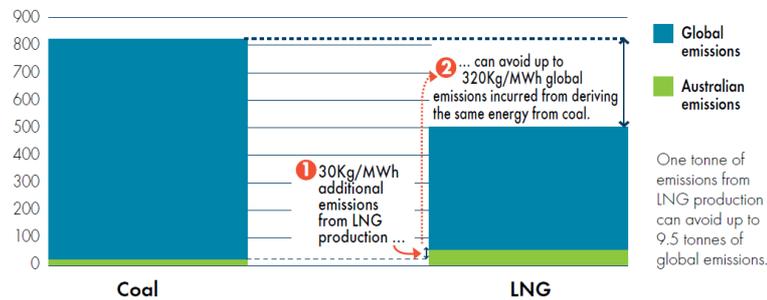
- For every tonne of CO₂-e emitted in LNG production within Australia, between 5.5 and 9.5 tonnes of emissions from the coal alternative can be avoided globally.
- LNG has a substantially lower greenhouse footprint associated with it compared to coal – not just in combustion emissions, but throughout its lifecycle.
- The lifecycle greenhouse intensity for LNG is about 50 per cent lower than that of coal.

¹⁶ According to the Department of the Environment and Energy's *State and Territory Greenhouse Gas Inventories 2017*, Western Australia's total emissions in 2017 were 88.5 Mt CO₂-e (and Australia's total emissions were 532.8 Mt CO₂-e). See www.environment.gov.au/system/files/resources/917a98ab-85cd-45e4-ae7a-bcd1b914cfb2/files/state-territory-inventories-2017.pdf.

¹⁷ WorleyParsons (2008; 2011), *Greenhouse Gas Emissions Study of Australian LNG*, originally prepared August 2008; updated for public release, March 2011.



Figure 4. Displacement of Coal by LNG (kg/MWh CO₂-e by Fuel Source)



Source: Derived from data in WorleyParsons (2008; 2011).

More recently, a report¹⁸ by Environmental Resources Management (ERM) in conjunction with Life Cycles (and peer reviewed by CSIRO), released in November 2019, analysed the full life-cycle impacts of LNG production and utilisation from two proposed gas reservoirs; Browse and Scarborough. The main market for LNG from these reservoirs is Asia, and in particular China, Japan, Southeast Asia (ASEAN) and India. The study compares the environmental impact of electricity generated in the four target markets, from LNG originating from Browse and Scarborough, with the environmental impact of specific electricity grid mixes in the same markets. This analysis demonstrates how Browse and Scarborough-sourced gas would compare, either on a grid-average basis, directly against coal-fired generation, or against a portfolio of fossil fuel power sources.

The report finds increasing natural gas use tends to contribute to lower greenhouse gas emissions, as it can replace the burning of coal and oil for power generation, as well as combustion for heat. Natural gas is also increasingly used as a substitute for petroleum fuels in petrochemicals.

In Europe, the USA and China, increasing consumption of natural gas has contributed to lower emissions. Natural gas has played a varying role in these three markets, but in all of them it has substantially contributed to decarbonisation. Gas from the Browse and Scarborough projects is expected to play this role in the four markets under consideration.

The report finds, under scenarios that example production of gas from Browse and Scarborough produced to 2040, with an assumed distribution into the target markets of China (33 per cent), Japan (25 per cent), ASEAN (26 per cent), India (16 per cent), where Browse and Scarborough gas is assumed to be displacing fossil-generated electricity:

The report finds that using Browse and Scarborough gas to generate power in the target markets, results in avoided emissions of 406 Mt CO₂-e under the NPS and 415 Mt CO₂-e under the CPS. The report also finds significant benefits for particulate matter (PM_{2.5}), photochemical ozone equivalents (NMVOC e), acidification (H⁺e) for electricity produced from LNG sourced from Browse and Scarborough for all four regions, under three different policy scenarios, averaged over the timeframe

¹⁸ See Environmental Resources Management Australia (2019), *Comparative Life Cycle Assessment: Browse and Scarborough*, November (see www.erm.com/woodside-proposed-gas-fields-lca) for further details, including details of the scenarios considered in the analysis.



2025-2040. Electricity from LNG has significant benefits in photochemical ozone formation, acidifications, and particulate matter in all regions.

In addition, according to recent Australian Government estimates, Australian LNG exports have the potential to reduce greenhouse gas emissions by 159 million tonnes in customer nations, equivalent to nearly 30 per cent of Australia's annual emissions¹⁹ and around double Western Australia's total emissions in 2017.

In addition, and as noted above, burning gas instead of coal improves urban air quality. This is particularly important in many Asian countries that are importing Australian LNG or considering imports.

There are significant benefits to Australia and the world from the greater use of gas as a lower greenhouse gas emitting energy source.

Greater use of Australia's extensive gas resources will be crucial in meeting the challenge of significantly reducing global greenhouse gas emissions at lowest possible cost whilst enhancing Australia's economic and export performance.

It is vital that the Government recognise the key role Western Australia's gas industry can play in reducing Western Australia's greenhouse gas emissions and the role Western Australian LNG exports can play in global greenhouse emissions reductions.

In addition, the industry has a long history of taking actions to reduce emissions in and around its operations, and across Australia. Case studies highlighting some of these actions and initiatives can be found at [Attachment 2](#).

INTERNATIONAL COMPETITIVENESS: THE MAJOR CHALLENGE

The major challenge to the industry's continued growth is maintaining Western Australia's international competitiveness in the face of growing global competition. A relatively high-cost local environment, growing policy and regulatory challenges and the emergence of new LNG competitors increases the level of competition Western Australia faces, as it seeks to win market share and attract investment.

The industry and our governments must do everything possible to ensure the projects that remain under construction, commence production in a timely and cost-effective manner and that Western Australia secures future oil and gas investment to supply to domestic and international needs.

Some factors affecting existing and future investment, such as movements in the Australian dollar or oil prices, are beyond the ability of the industry to influence. However, other key challenges must be addressed.

Western Australia's existing and any future climate change policies should be aimed at enhancing the state's international competitiveness as a destination for oil and gas investments. They should not add to the cost burden facing the industry or detract from Western Australia's attractiveness as an investment destination.

¹⁹ See minister.environment.gov.au/taylor/news/2019/australias-national-greenhouse-gas-inventory-june-2019-quarterly-update-released for more information.



COMMENTS ON SPECIFIC SECTIONS OF THE ISSUES PAPER

INTERNATIONAL AND NATIONAL CONTEXT (AND THE NEED FOR A NATIONAL APPROACH)

As noted above, APPEA supports the science of climate change and acknowledges the need to reduce emissions across the globe. This will require action by individuals, companies, and governments.

Societies around the world will continue to face two major, interdependent challenges:

- Maintaining and expanding affordable, secure energy supplies to meet growing consumer demand.
- Addressing the social, economic and ecological risks posed by rising greenhouse gas emissions and climate change.

Managing greenhouse gas emissions and meeting growing energy demand requires action by individuals, companies, and governments.

Making genuine progress requires an integrated set of solutions. This includes actions by industry to reduce emissions, provide and advance lower carbon energy technologies, and support effective national and international policies.

Reliable and competitively priced and reliable energy underpins economic growth and stability, and is crucial to raising living standards in both developing advanced nations. Therefore, policies aimed at reducing greenhouse gas emissions must do so at the lowest possible cost.

As noted earlier in this submission, APPEA has developed a set of *Climate Change Policy Principles* to assist policymakers in developing efficient and effective responses to deal with climate change.

As part of this, APPEA supports a national climate change policy that delivers greenhouse gas emissions reductions, in line with Paris Agreement commitments, at least cost and facilitates broad-based investment decisions consistent with an international price on carbon.

APPEA's *Climate Change Policy Principles*, reproduced in Attachment 1, emphasise four key points:

1. International engagement is crucial.
2. Climate change and energy policies must be integrated and harmonised.
3. Climate change adaptation strategies are necessary.
4. Climate policy must not compromise national or global economic development or energy security.

APPEA has used the Principles as the basis for engagement with the governments over many years, for example, with the Australian Government during the development of its Emissions Reduction Fund and associated Safeguard Mechanism, the Climate Solutions Package and a range of additional climate change measures and for the basis of constructive engagement with various jurisdictions, most recently the Northern Territory, as those jurisdictions consider and development climate change policy responses.

As noted above, APPEA supports a national approach to greenhouse gas emissions reduction policies, which are the responsibility of the Australian Government as the signatory to Australia's Paris Agreement commitments.



In addition to opportunities to pursue emissions reduction opportunities through the Emissions Reduction Fund²⁰ (the ERF, soon to become the Climate Solutions Fund), projects with annual emissions above 100,000 tCO₂-e are subject to the ERF's safeguard mechanism²¹. The safeguard mechanism requires facilities covered by it to keep their emissions within established baselines. This is to ensure emissions reductions are not displaced significantly by a rise in emissions elsewhere in the economy.

As a package of measures, the CSP has been designed, according to the Australian Government, to meet its Paris Agreement commitments. In addition, the national approach to meeting Australia's commitments to 2030 and beyond will be the subject of formal review during 2020 (and 2025 and every five years thereafter) and is also subject to regular review by the Climate Change Authority. For example, the latest review of the Australia's approach to meeting its emissions reduction commitments was commenced by the Authority in July 2019 and is due to report to the Australian Government by the end of 2019²².

The Western Australian Government's 28 August 2019 Brief Ministerial Statement on *Greenhouse Gas Emissions Policy for Major Projects*²³ provides direction for both the Government's policy position for major projects under assessment by the EPA and the for this State Climate Change Policy.

The statement also provides some clarity, particularly on the importance of alignment with, and complementarity to, the Australian Government's climate change policy approach and the obligations placed on major projects and plant upgrades by the safeguard mechanism.

TRANSFORMING ENERGY GENERATION

APPEA's views on the key role natural gas can play in lower emissions in Western Australia were outlined above.

The way in which this can be achieved in Western Australia is through an open, competitive and efficient electricity market that allows fuel sources and power generation technologies to compete on their merits.

²⁰ The ERF is enacted through the *Carbon Credits (Carbon Farming Initiative) Act 2011*, the *Carbon Credits (Carbon Farming Initiative) Regulations 2011* and the *Carbon Credits (Carbon Farming Initiative) Rule 2015*. A number of activities are eligible under the scheme and participants can earn Australian carbon credit units (ACCUs) for emissions reductions. One ACCU is earned for each tCO₂-e stored or avoided by a project. ACCUs can be sold to generate income, either to the government through a carbon abatement contract, or in the secondary market. See www.cleanenergyregulator.gov.au/ERF/About-the-Emissions-Reduction-Fund for more information.

²¹ See www.cleanenergyregulator.gov.au/ERF/About-the-Emissions-Reduction-Fund/the-safeguard-mechanism for more information.

²² See climatechangeauthority.gov.au/updates/authoritys-advice-meeting-australias-paris-agreement-commitments for more information.

Through this process, the Authority will be updating its previous advice to Government on policies to meet Australia's greenhouse gas emissions reduction commitments under the Paris Agreement. According to the Authority, "... the updated advice will seek to provide recommendations that ensure Australia is well-placed to meet its 2030 emissions target and that are consistent with meeting subsequent targets with enhanced ambition that put Australia on a path to net zero emissions, consistent with the Paris Agreement framework."

²³ See

[www.parliament.wa.gov.au/publications/tables/papers.nsf/displaypaper/4012678a0a52a718c07088d948258465001cef75/\\$file/2678.pdf](http://www.parliament.wa.gov.au/publications/tables/papers.nsf/displaypaper/4012678a0a52a718c07088d948258465001cef75/$file/2678.pdf) for more information.



APPEA supports Government intervention to correct market failure where it can be demonstrated market failures exist and intervention would improve outcomes, but does not support subsidies for individual power sources or generation technologies.

INDUSTRY INNOVATION

As the Issues Paper notes on page 7 Western Australia's energy, mining and manufacturing industries, including the upstream oil and gas industry, are key drivers of the State's economy, with the resources sector (including oil and gas) contributing almost one third of the state's gross state product.

While the growth in LNG development and production has been associated in an increase in greenhouse gas emission from the sector this, as noted above, is only part of the story, with the greater use of Australian natural gas – in the domestic market in Western Australia, and in Asia as LNG exports – possessing the potential to significantly reduce greenhouse gas emissions.

As noted briefly above, the Western Australian Government's 28 August 2019 Brief Ministerial Statement on *Greenhouse Gas Emissions Policy for Major Projects*²⁴ provides direction for both the Government's policy position for major projects under assessment by the EPA and the for this State Climate Change Policy.

The statement also provides some clarity, particularly on the importance of alignment with, and complementarity to, the Australian Government's climate change policy approach and the obligations placed on major projects and plant upgrades by the safeguard mechanism.

Importantly, the statement notes

The Government understands that national and international policies are constantly evolving, and this policy seeks to complement rather than duplicate them.

And further notes

The Policy acknowledges existing obligations for large energy users and designated facilities under the National Greenhouse and Energy Reporting Act 2007 and the Safeguard Mechanism.

In addition, and as noted above, the industry has a long history of taking actions to reduce emissions in and around its operations, and across Australia, including in Western Australia. Case studies highlighting some of these actions and initiatives, with a particular focus on Western Australia, can be found at [Attachment 2](#).

In relation to reducing energy use and energy productivity/efficiency, APPEA member companies have in place long-standing and pervasive energy management policies, systems and measurement indicators that form a core part of their operational performance. The industry has also been a participant in numerous voluntary and mandatory energy efficiency and energy efficiency related programs.

²⁴ See

[www.parliament.wa.gov.au/publications/tailedpapers.nsf/displaypaper/4012678a0a52a718c07088d948258465001cef75/\\$file/2678.pdf](http://www.parliament.wa.gov.au/publications/tailedpapers.nsf/displaypaper/4012678a0a52a718c07088d948258465001cef75/$file/2678.pdf) for more information.



The industry has many of the existing and powerful drivers for energy efficiency that pervade the operations of the upstream oil and gas industry in Australia and the industry's history of reducing the energy intensity of its operations and increasing its energy production efficiency.

A clear example of these drivers can be found in the operations of Australia's LNG facilities. The process of liquefying natural gas for export involves the conversion of natural gas to LNG by cooling it to -161° C, changing it from a gas into a liquid $\frac{1}{600}$ th its original volume. This dramatic reduction in size allows it to be shipped safely and efficiently aboard specially designed LNG vessels.

This process, known as liquefaction, requires energy. The fuel used to power the various processes at the facility is in many cases derived from the natural gas itself. Any gas used to serve as an energy source for the process is gas that cannot be liquefied and sold to export customers.

This means that the use of natural gas as an energy source at the LNG facility has a very direct opportunity cost associated with it – every unit of gas that can be saved through reducing energy use is a unit of gas that can be sold (recognising that this may not occur until later in the life of a project).

This driver, that pervades the initial design and ongoing operation of these facilities exists independent of a climate policy and/or any energy efficiency policy or program and drives energy efficiency actions throughout the facility. Similar drivers exist for other upstream oil and gas facilities, producing crude oil and condensate, or gas for domestic use.

In addition, individual APPEA members have, in their submissions, provided perspectives on the questions asked in this section, particularly the measures they have implemented lower energy use or emissions and the way in which they assess the implications of the low-carbon transition for their business and these risks disclosed to stakeholders.

FUTURE MOBILITY

Western Australia is well-placed to lead the uptake of LNG fuels, with large LNG production facilities close to fuel-intensive mining developments. Around three billion litres of diesel are imported into the Pilbara every year, primarily for mining. The ships moving mining exports to market use around five billion litres of heavy fuel oil.

LNG can replace these higher-emissions fuels, reducing greenhouse gas emissions by around 30 per cent on a lifecycle basis²⁵, while virtually eliminating emissions of sulphur dioxide and fine particulate matter, and dramatically reducing emissions of nitrous oxide.

The global momentum towards LNG as a marine fuel is driven in part by the introduction from January 2020 of the International Maritime Organisation's 0.5 per cent sulphur cap on shipping fuels. The organisation has also committed to halving greenhouse gas emissions from shipping by 2050. Unique to the LNG industry, LNG shipping has from many years been used LNG as a fuel sources and now this technology is looking to be adapted to other parts of the global shipping fleet.

The global fleet of LNG-fuelled ships is growing rapidly. This includes 27 large cruise ships, with the first having started operations in 2018. Woodside already has one LNG-powered marine vessel in its fleet, the *Siem Thiima*, and is looking to add more. Delivered in 2017, the *Siem Thiima* is the first LNG-fuelled marine support vessel in the southern Hemisphere.

²⁵ See Energetics (2019), *Lifecycle Emissions of LNG from Woodside fuelling iron shipping from the Pilbara*, for more information.



Woodside is working on developing the use of LNG to generate power in remote areas of Western Australia and to fuel heavy transport. This has the potential to improve Australia's fuel security and reduce reliance on imports. Woodside is preparing an LNG fuels hub to capture the environmental and commercial benefits. Woodside has built the Pluto LNG Truck Loading Facility to supply trucked LNG, which will displace diesel used in remote power generation and mining equipment, including trucks and trains. The second phase of the LNG fuels hub will be a bunker ship, to deliver LNG fuel to ocean-going vessels, such as iron-ore carriers.

REGIONAL PROSPERITY

APPEA in October 2019 provided a submission to the Department of Primary Industry and Regional Development's *Human-Induced Regeneration: Carbon Farming and the Resources Sector Discussion Paper*²⁶.

The APPEA submission noted the oil and gas industry brings two important perspectives to this issue:

- As a potential explorer and developer of onshore gas resources that seeks to develop oil and gas resources in harmony with stakeholders, including other potential users of the land on which exploration or development takes place.
- As a stakeholder with a key interest in the development of deep and liquid carbon markets, including the potential for carbon farming in Western Australia.
 - The industry may, for example, have interest in acquiring Australian Carbon Credit Units (ACCUs) or otherwise being involved in future projects that utilise the Human Induced Regeneration Methods under the Emissions Reduction Fund (ERF) or any future national climate policy approach.

This means that, given the lead time required to generate material volumes of offsets, the development of a series of viable carbon farming in Western Australia is an important issue for both industry, the Western Australian Government and indeed for the broader community.

Amongst a portfolio of options, purchasing carbon offsets from Australian landowners may form a part of APPEA members' respective climate change mitigation strategies. In addition, APPEA notes carbon farming can create opportunities to achieve positive social, environmental and financial outcomes for pastoral businesses and their surrounding communities.

For Western Australian-based oil and gas companies, access to ACCUs from Western Australia may assist in providing access to relatively low cost abatement and allow APPEA members to show support for local Western Australian communities.

The means the resolution of issues that enable human-induced regeneration carbon sequestration projects in Western Australia is important. The abatement from these projects has significant potential to scale into tens of millions of tonnes over 25 years. State Government consent could unlock jobs and growth in adversely affected regions and communities, through the future success and development of carbon farming in Western Australia.

²⁶ See www.agric.wa.gov.au/sites/gateway/files/Human-Induced%20Regeneration%20Carbon%20Farming%20and%20the%20Resources%20Sector%202019.pdf for more information.



RESILIENT INFRASTRUCTURE AND BUSINESSES / STRENGTHENING ADAPTIVE CAPACITY

Adaptation is an important element of climate change policy response. Adaptation strategies must be used to mitigate the risks that a changing climate may pose. Adaptation strategies to mitigate the risks posed by a changing climate should include:

- Enhanced climate modelling to provide location specific climate change forecasts.
- Research into possible climate change impacts on the Australian environment.
- Development of land use and planning guidelines consistent with the available evidence of likely climate change impacts.
- Development of risk management strategies to reflect likely impacts of climate variability current.

Given the location of many of its operations in Western Australia (such as the north-west), the upstream oil and gas industry has a long history of project design that takes account of climate variability as a fundamental aspect of project design.

Such considerations have long been a feature of project assessment and have long been incorporated in, for example, environmental impact assessments/statements. Climate change adaptation responses can therefore form a component of the overall risk management strategies employed by the industry.

Uncertainty is a key feature of adaptation debates and adaptation policy design, with information at the local level either unavailable or subject to extreme level of uncertainty.

APPEA has previously called for government funding of an enhanced greenhouse impacts modelling program directed at giving better information on climate impacts (variable, intensity, variability, timing, location) as a way to address uncertainty in the context of adaptation to climate change²⁷.

If adequate location specific data on potential impacts of climate variability is available, the industry is in a better position to, as appropriate, review (and if necessary adapt) their risk management strategies (encompassing engineering design, safety and environmental assessments) to reflect new learnings on the likely impacts of climate variability.

The Western Australian Government can also complement industry action by continuing to develop and refine risk management strategies in areas such as health care, water supply, emergency services and suitable developments in coastal areas and on flood plains. This sort of action planning should give the community greater confidence about how climate change adaptation issues are being addressed.

CONCLUSIONS / NEXT STEPS

Abundant natural gas resources place Western Australia in an enviable position to maintain long-term, cleaner energy security domestically and internationally. Natural gas makes it possible for Australia to meet the world's growing energy needs over the coming decades while incorporating a strategy to curb emissions and address the risk of climate change.

²⁷ An historical example is the work of the Indian Ocean Climate Initiative (IOCI), a partnership of the State, CSIRO, and the Bureau of Meteorology, formed by the Western Australian Government to support informed decision-making, on climate variability and change in Western Australia. See www.ioci.org.au for more information.



appea the voice of australia's
oil and gas industry

APPEA looks forward to participating in the Department's work and also looks forward to ongoing consultation ahead of the release of the update to the Western Australian Government's climate change policy in early 2020.



appea the voice of australia's
oil and gas industry

ATTACHMENT 1. APPEA'S CLIMATE CHANGE POLICY PRINCIPLES



appea

Climate change policy principles

Second edition: December 2015
Australian Petroleum Production & Exploration Association



**APPEA has developed these
climate change policy
principles to assist policymakers
in developing efficient and
effective responses to deal with
climate change.**

APPEA supports a national climate change policy that delivers greenhouse gas emissions reductions at least cost and facilitates broad-based investment decisions consistent with an international price on carbon.

Climate policy must be fully integrated and consistent with policies in other areas – including energy, international trade, taxation, economic growth, population, and environmental and social responsibility.



Policy principles

1. International engagement is crucial.

Australia should continue to engage the international community to pursue environmentally effective and economically efficient climate change policies¹.

An international policy framework should:

- Promote international participation.
- Minimise the costs and distribute the international burden equitably.
- Be comprehensive in its coverage.
- Allow for the unrestricted flow of credible emissions units between international jurisdictions.
- Be underpinned by transparent reporting arrangements.

2. Climate change and energy policies must be integrated and harmonised.

Australia's policy response should seek to:

- Deliver lowest cost greenhouse gas emissions abatement through an appropriately designed mechanism that provides an economy-wide transparent price signal to shape business and consumer plans and investments. The mechanism should be efficient, have low compliance costs, and support international trade that recognises different national circumstances.
- Recognise and allow the use of the widest range of credible domestic and international offsets.
- Provide a level playing field for new entrants.
- Avoid penalising early movers who have previously implemented abatement measures.
- Support research into low-emissions technologies, and development and deployment of such technologies.

In the event Australia takes action before comparable action is taken by the nations with which we compete, the Australian policy response should maintain the competitiveness of Australian trade exposed industries, such as LNG, by minimising the costs the industry faces in the absence of a carbon price being imposed on energy sources in customer countries and competitors.

Policies inconsistent with the principles should be phased out and additional measures should only apply to sectors of the economy that are not covered by the price signal on greenhouse gas emissions.

3. Climate change adaptation strategies are necessary.

Australia must:

- Continue to support international and national modelling to provide location-specific climate change forecasts.
- Develop risk-management strategies to reflect likely impacts of climate variability.

4. Climate policy must not compromise national or global economic development or energy security.

Australia's policy response should recognise that:

- Increasing global population and urbanisation generate growing demand for energy.
- Secure energy supply is crucial for a strong modern economy and a healthy, vibrant society.
- Natural gas has a key role to play in the transition to a low-carbon economy – switching to gas could halve the emissions from the Australian electricity sector – and if solar and wind power are to deliver genuine emissions reductions they must have gas-fired back-up.

¹ Australia's contribution to the global climate change effort as set out here reflects the principle in Article 3.1 of the United Nations Framework Convention on Climate Change (UNFCCC) (see unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf). In determining Australia's differentiated responsibilities and capabilities, consideration should be given to matters such as Australia's economic growth and structure, population growth, energy production and energy use.



Australian LNG exports can make an important contribution to reducing global greenhouse emissions intensity.

The global challenge

Throughout the world, policymakers are implementing a variety of regulatory responses to reduce greenhouse gas emissions and mitigate the risks of global climate change.

The Intergovernmental Panel on Climate Change (IPCC) found in its Fifth Assessment Report (AR5) that:

- The human influence on the climate system is clear.
- The more we disrupt our climate, the more we risk severe, pervasive and irreversible impacts.
- Humans can limit climate change and build a more prosperous, sustainable future.²

The multilateral United Nations Framework Convention on Climate Change (UNFCCC) has elicited a global commitment to holding the increase in the global average temperature to well below 2 degrees Celsius above pre-industrial levels and to pursuing efforts to limit the temperature increase to 1.5 degrees Celsius above pre-industrial levels.³

APPEA's stance on climate change

Societies around the world will continue to face two major, interdependent challenges:

- Maintaining and expanding affordable, secure energy supplies to meet growing consumer demand.
- Addressing the social and ecological risks posed by rising greenhouse gas emissions and climate change.

Managing greenhouse gas emissions and meeting growing energy demand requires action by individuals, companies, and governments. Making genuine progress requires an integrated set of solutions. This includes increasing energy efficiency, advancing lower carbon energy technologies, and supporting effective national and international policies.

Reliable and competitively priced energy underpins economic growth and stability, and is crucial to raising living standards in both developing and advanced nations. Therefore, policies aimed at reducing greenhouse gas emissions must do so at the lowest possible cost.

² 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 [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland (available at www.ipcc.ch).

³ UNFCCC (2015), Adoption of the Paris Agreement, 12 December (available at unfccc.int/resource/docs/2015/cop21/eng/09r01.pdf).



Natural gas: integral to a low-carbon economy

Natural gas is a lower-carbon form of energy suitable for electricity generation, industry and households.

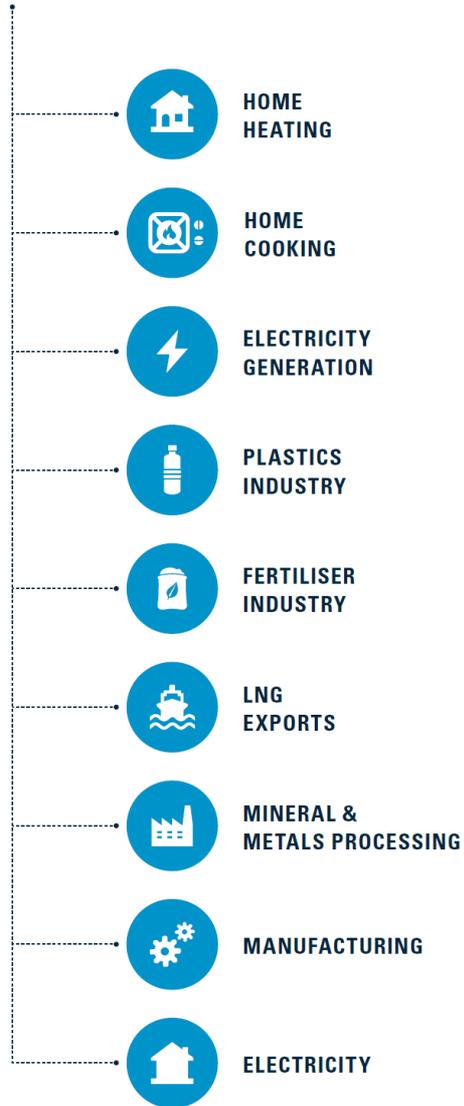
Increasing its use can deliver immediate and substantial carbon savings. Simply switching from coal to natural gas can reduce greenhouse gas emissions by 40-50% and by as much as 75% in some circumstances.⁴

Australia's gas industry, domestically and through our exports of liquefied natural gas (LNG), contributes substantially to the economic development of the nation and reduces global greenhouse gas emissions.

Natural gas is a highly flexible fuel:

- Natural gas is commonly used to generate electricity, heat and steam for industries, including alumina refining, food and beverage manufacturing, and grocery production.
- Natural gas is ideally suited as a complement to renewable electricity generation because gas generation plants can be rapidly turned on and off to respond to changes in intermittent generation from renewable sources.
- Natural gas is the fuel of choice in co-generation and tri-generation. These technologies can provide electricity, heating and cooling at very high thermal efficiencies approaching 80%.⁵
- Compressed natural gas and LNG are used in the transport sector, and this use can be expanded.
- Innovative technologies, such as natural gas fuel cells, have been developed that can provide electricity and heat requirements in applications ranging from a small house to a medium sized office or factory. These technologies can deliver thermal efficiencies as high as 85%.⁶
- Natural gas is also a critical feedstock for industry that often cannot be substituted in producing fertilisers, cleaners, polymers and refrigerants.

NATURAL GAS



⁴ Australian Council of Learned Academies (2013), Engineering Energy: Unconventional Gas Production, June (available at www.acola.org.au/index.php/projects/securing-australia-s-future/project-6). While the emissions benefit is lower when compared to ultra supercritical coal fired power generation, as the Council has noted "gas-fired electricity generation will generally replace existing coal-fired boilers that are less efficient subcritical facilities".

⁵ These technologies are already being deployed in commercial buildings in Australia (see www.urbanenergy.com.au/projects, www.originenergy.com.au/files/Origin_Coca_Cola_place_FactSheet.pdf, www.cityofsydney.nsw.gov.au/vision/towards-2030/sustainability/carbon-reduction/trigeneration and www.qantas.com.au/travel/airlines/electricity/global/en#power for examples).

⁶ Recently there have been significant advances in ceramic fuel cells that run on natural gas, with a range of commercial available products now on the market.



Reducing emissions

The Australian Council of Learned Academies has found using gas to provide more baseload and peak electrical power generation in Australia – in scenarios of higher use of both renewables and gas – would deliver substantial emissions reductions.

This would reduce the Australian electricity generation sector's emissions by between 54 Mtpa-103 Mtpa CO₂-e (million tonnes per annum, carbon dioxide equivalent) by 2030 – a reduction of 27% to 52% from the base case of 197 Mtpa CO₂-e in 2012.

Other environmental benefits

Fuel switching would also have other benefits. Natural gas plants use much less water than coal-fired power and produce much lower levels of noxious substances such as sulphur dioxide, nitrogen oxides and fine particle emissions.

Burning gas instead of coal improves urban air quality. This is particularly important in many Asian countries that are importing Australian LNG or considering imports.

Baseload power is the level of generation needed to meet forecast minimum demands. Baseload power plants must run constantly and at predictable levels. Peaking power is power that can be brought online quickly in periods of peak demand. Intermittent power is any source of energy (such as solar and wind) that is not continuously available.

The range of life cycle emissions for electricity generation (tonne CO₂-e/MWh) from a range of energy sources



7 IPCC (2011), Summary for Policymakers. In: IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation [O. Edenhofer, R. Pichs-Madruga, Y. Sokona, K. Seyboth, P. Matschoss, S. Kadner, T. Zwickel, P. Eickemeier, G. Hansen, S. Schlomer, C. von Stechow (eds)], Cambridge University Press, Cambridge, UK and New York, NY, USA (available at srren.ipcc-wg3.de/report/IPCC_SRREN_SPM.pdf).



Australia has substantial natural gas resources. Natural gas offers a relatively low-cost emissions abatement opportunity. This means developing these resources can provide significant national environmental, economic and social benefits.



The Moomba gas plant in South Australia.

Carbon capture and storage (CCS)

Greenhouse gas storage is seen as one of the pathways to the continued use of fossil fuels in a low-carbon economy.

The global oil and gas industry is leading the world in the practical deployment of this technology. Norway's Statoil has developed large carbon capture and storage (CCS) projects at Sleipner and Snøhvit. In Canada, Shell has developed the Quest CCS project.

In Australia, the oil and gas industry has been at the leading edge of researching and deploying greenhouse gas storage technologies.

The industry instigated significant research efforts into greenhouse gas storage in the late 1990s through the Australian Petroleum Cooperative Research Centre (which has continued through the CO2CRC Limited).

Since that time, several hundred million dollars has been invested in assessing large greenhouse storage projects.

The Gorgon Carbon Dioxide Injection Project⁸ – soon to be commissioned – is the world's largest greenhouse gas mitigation project undertaken by industry.

⁸ See www.chevronaustralia.com/our-businesses/gorgon/carbon-dioxide-injection for more information.



APPEA supports a national climate change policy that delivers greenhouse gas emissions reductions at least cost and facilitates broad-based investment decisions consistent with there being an international price on carbon.

APPEA climate change policy: key points

1. International engagement is crucial.
2. Climate change and energy policies must be integrated and harmonised.
3. Climate change adaptation strategies are necessary.
4. Climate policy must not compromise national or global economic development or energy security.

APPEA and its members will continue to work with all of Australia's governments to:

- Support a national climate change policy response consistent with the policy principles outlined in this paper.
- Expand the use of natural gas in the domestic economy, with consequent reduction in the emissions intensity of the Australian economy, for example, in electricity generation and resource processing.
- Promote development of lower emissions technologies, such as high-efficiency electricity generation and greenhouse gas storage.
- Make Australia more attractive as an investment destination for LNG projects, so that Australian LNG can help Australia's trading partners reduce their greenhouse gas emissions, thereby contributing to a potential significant reduction in global emissions when compared to the use of higher-emitting fuels.

About APPEA

The Australian Petroleum Production & Exploration Association is the peak national body representing Australia's oil and gas exploration and production industry. APPEA has about 80 full member companies. These are oil and gas explorers and producers active in Australia. APPEA members account for an estimated 98 per cent of the nation's petroleum production. APPEA also represents more than 230 associate member companies that provide a wide range of goods and services to the upstream oil and gas industry.

APPEA works with Australian governments to help promote the development of the nation's oil and gas resources in a manner that maximises the return to the Australian industry and community. APPEA aims to secure regulatory and commercial conditions that enable member companies to operate safely, sustainably, and profitably. The Association also seeks to increase community and government understanding of the upstream petroleum industry by publishing information about the sector's activities and economic importance to the nation.

www.appea.com.au



ATTACHMENT 2: ACTIONS TAKEN BY THE UPSTREAM OIL AND GAS INDUSTRY TO REDUCE EMISSIONS AND TO EMBED CLIMATE CHANGE CONSIDERATIONS INTO DECISION-MAKING

As noted in the body of APPEA's submission, one of the largest contributions Australia, including Western Australia, can and does make to reduce global greenhouse gas emissions is through the use of natural gas both domestically and through LNG exports to Asia. Taken together, these actions have reduced global greenhouse gas emission by millions of tonnes per annum and as Australia's LNG exports grow, this positive contribution will also grow.

Beyond this contribution, the industry is itself undertaking a range of significant and ongoing activities and initiatives to reduce its own greenhouse gas emissions profile in and around its operations, and across Australia.

THE INDUSTRY HAS A LONG HISTORY OF MEASURING, REPORTING AND TAKING ACTIONS TO REDUCE ITS GREENHOUSE GAS EMISSIONS

The Australian upstream oil and gas industry, including in Western Australia, has a long history of measuring, reporting and taking actions to reduce its greenhouse gas emissions²⁸. Submissions from APPEA members to the Issues Paper provide a number of examples of actions companies have taken to reduce their emissions profile and to embed climate change considerations into company decision-making.

In addition to a commitment to the APPEA *Climate Change Policy Principles*, many APPEA member companies have corporate emissions reduction targets, place climate change issues at the forefront of their corporate sustainability reporting and executive remuneration and use internal carbon prices as part of their assessment of investment decision-making. Many of these actions encompass the entire oil and gas exploration and production life cycle.

Looking forward, technical improvements and equipment upgrade opportunities may become available (as they have for other projects). Such opportunities are generally linked to capital investment cycles that can extend for a number of years.

Case studies follow, highlighting global and local joint industry initiatives and practical emissions abatement efforts by APPEA members, with a particular focus on activities in Western Australia.

Case Study 1: Industry joint initiatives

The oil and gas industry, both internationally and in Western Australia, has come together around several industry initiatives to act collectively to reduce greenhouse gas emissions and play a positive role in climate change policy developments.

²⁸ For example, the upstream oil and gas industry, through APPEA, was one of only two industries to sign a Co-operative Agreement with the Australian Government under the (former) Greenhouse Challenge program. Under that agreement, which ran from 1996 to 2007, the industry provided reports to the Government containing industry-wide data on greenhouse gas emissions (dating back to 1990) and outlining activities planned, in progress or completed by a member company that resulted in reductions in greenhouse gas emissions.



Oil and Gas Climate Initiative

The Oil and Gas Climate Initiative (OGCI) is a voluntary, CEO-led initiative which aims to lead the industry response to climate change. Launched in 2014, OGCI comprises thirteen oil and gas companies, six of whom are APPEA members, that pool expert knowledge and collaborate on action to reduce greenhouse gas emissions²⁹.

OGCI aims to increase the ambition, speed and scale of the initiatives members undertake as individual companies to reduce the greenhouse gas footprint of their core oil and gas business – and to explore new businesses and technologies.

OGCI Climate Investments

In November 2016, OGCI launched a billion-dollar investment vehicle, OGCI Climate Investments³⁰. OGCI Climate Investments invests in technologies that have the potential to significantly reduce greenhouse gas emissions, and that are economically viable. OGCI Climate Investments focus is on innovative companies with promising technology and business models that are ready to be commercialised.

Zero Routine Flaring by 2030

This World Bank initiative³¹, brings together governments, oil and gas companies (six of whom are APPEA members), and development institutions who agree to cooperate to eliminate routine flaring no later than 2030.

Companies that endorse the Initiative will develop new oil fields they operate according to plans that incorporate sustainable utilisation or conservation of the field's associated gas without routine flaring.

Oil companies with routine flaring at existing oil fields they operate will seek to implement economically viable solutions to eliminate this legacy flaring as soon as possible, and no later than 2030.

Climate and Clean Air Coalition Oil and Gas Methane Partnership

The Climate and Clean Air Coalition (CCAC) created a voluntary initiative to help companies reduce methane emissions in the oil and gas sector³². The Oil and Gas Methane Partnership was launched in September 2014³³.

The Oil and Gas Methane Partnership provides companies a mechanism to systematically and responsibly address their methane emissions, and to demonstrate this systematic approach and its results to stakeholders.

²⁹ See www.oilandgasclimateinitiative.com. APPEA member companies BP, Chevron, Eni, Equinor, ExxonMobil and Shell are OGCI members.

³⁰ See www.oilandgasclimateinitiative.com/climate-investments.

³¹ See www.worldbank.org/en/programs/zero-routine-flaring-by-2030 for more information. APPEA member companies BP, Eni, Equinor, OMV Group, Shell and Woodside Energy have endorsed the Initiative.

³² See www.ccacoalition.org/en/activity/ccac-oil-gas-methane-partnership for more information. APPEA member companies BP, Eni, PTT, Shell and Equinor are partner companies.

³³ See www.ccacoalition.org/en/resources/reducing-methane-emissions-across-natural-gas-value-chain-guiding-principles for more information. APPEA member companies BP, Eni, Equinor, ExxonMobil, Shell and Woodside are signatories to the Guiding Principles.



In 2017, eight companies, six of whom are APPEA members, signed a set of *Guiding Principles on Reducing Methane Emissions across the Natural Gas Value Chain*. The principles are to:

- Continually reduce methane emissions.
- Advance strong performance across gas value chains.
- Improve accuracy of methane emissions data.
- Advocate sound policies and regulations on methane emissions.
- Increase transparency.

The Guiding Principles are complementary to and mutually reinforcing of other initiatives, including the OGCI.

Case Study 2: Greenhouse gas storage and the Gorgon Carbon Dioxide Injection Project

Greenhouse gas storage is the process whereby large volumes of captured carbon dioxide are safely injected and stored deep underground rather than being released to the atmosphere. It is seen as one of the pathways enabling the continued use of fossil fuels in a low-carbon economy and may be vital in reducing emissions from industries such as steel and cement manufacture.

Since 1996 the global oil and gas industry has led the world in the practical deployment of this technology. Equinor is operating large projects alongside their Sleipner and Snøhvit gas processing operations and in Canada, Shell has developed the Quest Carbon Capture and Storage (CCS) project.

In Australia, the oil and gas industry has been at the leading edge of researching and deploying greenhouse gas storage technologies. The industry instigated significant research efforts into greenhouse gas storage in the late 1990s through the Australian Petroleum Cooperative Research Centre which undertook the first assessments of possible storage sites across Australia.

Several years later that work was taken over by CO2CRC Limited. They are recognised as one of the world's leading collaborative research organisations focused on carbon capture and storage.

The CO2CRC continues to receive backing from the oil and gas industry.

The Australian industry has privately funded several hundred million dollars undertaking detailed storage site and project scoping assessments in the Perth, Carnarvon, Browse, Bonaparte and Cooper Basins. The Gorgon Project on Barrow Island, operated by Chevron, includes the Gorgon Carbon Dioxide Injection Project, the safe underground injection and storage of between 3.4-4.0 million tonnes CO₂-e greenhouse gases per year, or around 100 million tonnes over the life of the project.

The Gorgon Carbon Dioxide Injection Project is the largest greenhouse gas mitigation project in Australia and the largest undertaken by industry globally.

The Australian oil and gas industry has also assisted other organisations undertaking storage site assessments in the Gippsland and Perth Basins.

In addition to assessing potential storage sites the Australian oil and gas industry has played a pivotal role in the development of legislative and regulatory regimes required to enable the technology to be deployed. The legislation enabling the Gorgon Carbon Dioxide Injection Project is believed to be the world's first storage specific legislation and the Project was the first large scale project to have its environmental impact assessed under State and Federal Environmental laws.



The experience at Gorgon was subsequently used to help develop the Australian *Offshore Petroleum and Greenhouse Gas Storage Act 2006* and continues to be a test case for regulatory developments in other areas such as the reporting of storage site emissions.

Case Study 3: Advanced Process Control

Many incremental energy-efficiency gains are possible with more precise control of the processes at facilities across the industry. As an example, to capture these, Woodside installs Advanced Process Control (APC) systems, which use computer algorithms to make extensive incremental changes. These changes allow facilities to operate closer to their design limits and increase performance, which may result in higher throughput, and/or reduced energy use. An APC installed at Pluto LNG in Western Australia improved the process stability and reduced operator workload. It also reduced flaring by 10,000 tonnes CO₂-e per year. As Woodside develops its data science capacity, they are finding more opportunities to use existing equipment in smarter ways to reduce emissions intensity and to add value.

Case Study 4: Advanced air filters

An LNG facility is essentially a large, industrial refrigerator, cooling natural gas to below -161°C so it can be transported in liquefied form. The process is driven by gas turbines. Over time, dust and other contaminants in the air can degrade the performance of the turbines and reduce their efficiency.

Based on the successful implementation of new technology at the Karratha Gas Plant in Western Australia, Woodside recently upgraded turbine air filters at Pluto LNG, so they now capture particles as small as 0.1 microns.

These more advanced filters reduce the rate at which performance degrades, resulting in increased production, with no increase in emissions.

The increased production at Pluto LNG is equivalent to an annual emission saving of approximately 20,000 tonnes CO₂-e.

Case Study 5: Pluto gas plant power optimisation

Woodside's Pluto gas plant was designed to operate with four gas turbine generators – three to provide power and one running as a backup. Previous optimisation efforts had already resulted in a generator being turned off during winter months and in late 2018 modifications were made so that the facility can run with three generators all year.

This required improvements to the Fast Load Shedding facility which turns off selected equipment in the case of one generator malfunctioning, meaning that the backup generator is no longer needed to be kept running.

This change has resulted in an additional 20,000 tonnes CO₂-e of emissions savings per year, or about 1 per cent of Pluto's annual emissions.

Case Study 6: Chevron R,D&D investment in Australia

Chevron Australia has invested more than \$1.5 billion into research and development activities since 2009. This investment allows for R&D across the LNG value chain and includes technology deployment for Chevron Australia's various operations.



Some of the initiatives include work undertaken to support Chevron Australia's business by experts in its Perth Global Technology Centre, Gorgon's Carbon Dioxide Injection Project, as well as industry-related research projects with universities and research bodies.

Most of Chevron's research projects are undertaken through WA:ERA, which includes CSIRO, Curtin University and The University of Western Australia (UWA).

Since Chevron began participating in the alliance in 2005, it has invested nearly \$50 million in about 150 research projects as well as academic chairs and professorships. In addition, since 2008 Chevron has invested more than \$9.6 million in chairs and professorships at local universities to foster academic excellence and build research capacity.

Case Study 7: Hydrogen

Natural gas can provide a fuel source for hydrogen made through the process of steam methane reforming (SMR), with any greenhouse gas emissions generated during SMR managed through market offset or technical abatement to offer a carbon neutral product³⁴.

For example, as a producer of natural gas, Woodside is well positioned to prepare for a future in which hydrogen may play a growing role in the energy mix. Woodside is watching developments in hydrogen power closely and talking to researchers and other stakeholders. It is a natural step as customers demand energy that is transportable and does not release carbon. Existing technology, known as steam methane reforming, allows for the economic conversion of methane (CH₄) into hydrogen (H₂). The process can be combined with carbon capture or otherwise carbon offset to produce a carbon neutral hydrogen product. Woodside is also monitoring the development of another technology, electrolysis of water to separate hydrogen from oxygen, as it becomes economically viable.

In June 2018, Woodside signed non-binding memoranda of understanding with Korea Gas Corporation to cooperate on hydrogen opportunities, and with Pusan National University in South Korea to jointly explore technology applications across the hydrogen value chain.

Woodside already produces large amounts of natural gas and are expert at liquefying it and transporting it to customers.

This gas carries more hydrogen by weight than any other carrier, excluding liquid hydrogen. Some of the markets Woodside has long supplied with gas, in Japan and Korea, are interested in the potential for hydrogen power, and so the company may end up supplying existing customers with energy in new ways.

³⁴ See www.energyinformationaustralia.com.au/natural-gas-to-hydrogen-conversion for more.