Australian Government

Future Gas Strategy

May 2024

industry.gov.au/FutureGasStrategy

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Acknowledgement of Country

The Future Gas Strategy was developed on Aboriginal and Torres Strait Islander lands. The government acknowledges and pays respect to all First Nations peoples across Australia, who are the Traditional Custodians of the land and waters and are the oldest continuous living cultures on Earth. We pay respect to Elders past and present. The Australian Government is committed to strengthening First Nations engagement and greatly values the insights and perspectives shared by First Nations peoples during the development of this strategy.

Minister's foreword

Gas plays a critical role in Australia's economy.

Gas is also an important part of Australia's future, because it will enable us to compete successfully in the global race for jobs and opportunities in a net zero world. The global shift to clean energy is Australia's biggest opportunity for growth and prosperity.

Over the past year, my department has rigorously researched, modelled and analysed the future of gas. This work has been real-world tested through extensive consultation and peer-review. I am proud to publish this work alongside the strategy in a comprehensive analytical report.

The analytical findings are clear. Under all credible net zero scenarios, natural gas is needed through to 2050 and beyond, though its production and use will change over this period. Gas will be essential to the transition because our energy system needs gas to achieve net zero. Gas will be a transition fuel that firms renewable power generation and is required for manufacturing and minerals processing until such time as alternatives are viable. Gas can support our future made in Australia. However, the greenhouse gas emissions associated with gas must sharply decline and where gas use cannot be reduced, emissions must be increasingly abated and offset.

The Future Gas Strategy sets out the Australian Government's approach to gas policy. The strategy uses evidence and data to establish 6 clear, enduring principles that will underpin future government policies and actions. It is vital for the whole community that discussion of gas and gas policy moves beyond unthoughtful slogans and centres on evidence-based principles.

We cannot rely on past investments in gas to get us through the next decades. We need continued investment in, and development of, gas supply and transport infrastructure to get us through the energy transition with thriving industries. To secure the clean, affordable and reliable energy Australia needs to compete in the global race for jobs and opportunities, and we need to capitalise on our natural resource endowment.

I want to make a point I have made many times before and will continue to make: Australia is and will remain a reliable and trusted trade and investment partner, including for liquified natural gas (LNG). Our trade partners have made large investments over decades in Australia's resources industry. They are relying on Australian gas to transition their economies to net zero. Australia is broadening and deepening our existing energy partnerships into emerging industries like critical minerals, hydrogen, carbon capture and storage, and other clean energy exports. The strength of our relationships, based on mutual economic benefit and friendship, will endure.

I would like to thank and acknowledge the significant contribution from all who helped develop this strategy. I look forward to continuing to work closely with industry and communities as we work towards net zero and a future made in Australia. The road to both runs through the Australian resources sector.

The Hon Madeleine King MP

Minister for Resources
Minister for Northern Australia

The strategy at a glance

> The Future Gas Strategy maps the Australian Government's plan for how gas will support our economy's transition to net zero in partnership with the world.

The Future Gas Strategy is our plan for gas production and consumption in Australia. The strategy explains the principles the Australian Government will use to guide policymaking about gas to support the transition to net zero.

The strategy is an evidence-based framework built around 6 principles. It draws on the *Future Gas Strategy Analytical Report*, which provides in-depth analysis of relevant data about gas supply, consumption and emissions. The strategy is also shaped by extensive public consultation, which revealed the barriers and opportunities around gas supply and consumption for Australian households and businesses and our international trade partners.

The role of gas will change as we reach net zero in Australia by 2050. Even in net zero scenarios, Australia and the world will need gas at lower levels through to 2050 and beyond. Australian gas will play an important role in an orderly global and domestic energy transformation. However to meet our legislated climate goals, we must find alternatives to gas, and gas-related emissions must decline.

Throughout the strategy, we use several scenarios to help shape our understanding of the future of Australian gas. These scenarios are not predictions. They let us compare potential versions of the future based on different assumptions. This helps decision makers understand potential trade-offs and make the best choices possible. Read more information about these scenarios in Appendix A.

Objectives of the Future Gas Strategy

The Future Gas Strategy outlines a pathway for Australia to manage its evolving role as a trusted gas producer and as a responsible climate actor which acts with transparency, integrity, and from a strong evidence base.

The strategy does not exist in isolation. Our policies for gas are shaped by a complex geopolitical environment, energy security, national security, wellbeing, living standards and the net zero transformation.

Managing the complexity of the future of gas will require continued collaboration, close monitoring, regular review, and adjustment of actions.

The strategy's objectives are to:

- support decarbonisation of the Australian economy
- safeguard energy security and affordability
- entrench Australia's reputation as an attractive trade and investment destination
- help our trade partners on their own paths to net zero.

Guiding principles for Australia's gas

The strategy adopts 6 principles that will guide policy actions to achieve the strategy's aims.

1. **Australia is committed to supporting global emissions reductions to reduce the impacts of climate change and will reach net zero emissions by 2050.** Gas production and use must be optimised through the transition and residual use must be abated or offset to achieve this economy-wide commitment.
2. **Gas must remain affordable for Australian users throughout the transition to net zero.** A future made in Australia, our competitive advantage in abundant resources, and our standard of living requires reliable, affordable and clean energy. Continued gas development and more flexible gas infrastructure is needed to increase the resilience of Australia's energy system and keep costs down as we transition. Government decisions on gas development rights should prioritise timely development and discourage repeated delays to ensure supply and affordability.
3. **New sources of gas supply are needed to meet demand during the economy-wide transition.** Government policies to enable natural gas exploration and development should focus on optimising existing discoveries and infrastructure in producing basins. This includes applying technology-neutral approaches to exploration data acquisition (to minimise seismic surveying where possible), prioritise energy security, and align with our net zero emissions targets. Robust environmental approval processes are key to the social license of the gas industry.
4. **Reliable gas supply will gradually and inevitably support a shift towards higher-value and non-substitutable gas uses. Households will continue to have a choice over how their energy needs are met.**
5. **Gas and electricity markets must adapt to remain fit for purpose throughout the energy transformation.**
6. **Australia is, and will remain, a reliable trading partner for energy, including Liquefied Natural Gas (LNG) and low emission gases.** Australia's ambition to become a renewable energy superpower will involve developing new low emissions energy exports to support the energy security and decarbonisation efforts of our trade partners.

Immediate actions arising from these principles include:

- updating Commonwealth retention lease policies to encourage more timely development of existing gas discoveries, and considering a firmer 'use it or lose it' policy
- working with regulators and industry to reduce and, where possible, eliminate gas venting and flaring, unless required for safety purposes
- continuing to release offshore acreage for greenhouse gas storage
- establish a new Transboundary Carbon Capture and Storage (CCS) Program which will provide options for energy security and carbon management solutions for our regional partners
- clarifying consultation requirements for offshore petroleum and greenhouse gas storage activities as part of a broader three year review of the offshore environmental management regime.

These actions will be adapted and refined as we move toward 2050.

This strategy is supported by the *Future Gas Strategy Analytical Report* that provides the Australian Government's assessment of the latest available evidence.

How we wrote the strategy

The government developed the *Future Gas Strategy Analytical Report* to provide the data for the Future Gas Strategy. When writing the strategy, we also consulted with domestic and international stakeholders.

As part of the consultation, the department received almost 300 written submissions and met individually with more than 50 stakeholders. The department engaged with representatives from:

- industry groups
- unions
- academic institutions
- household and business advocacy groups
- environmental advocacy groups
- gas producers
- foreign governments
- gas retailers
- transmission networks
- First Nations peoples
- land holders impacted by gas developments.

Written submissions that the department received consent to publish are available on the Department of Industry, Science and Resources website.

The feedback from consultation, and the conversations that have followed, highlight the complex role that gas plays in households, businesses, electricity generation, and liquefied natural gas (LNG) exports, both in Australia and for our trade partners. This feedback shows the uncertainty stakeholders have around emerging technology for industrial applications of gas, such as high-heat minerals processing and carbon capture, use and storage. It shows uncertainty about natural gas alternatives and their pathways to commercialisation. It also shows that stakeholders have concerns about greenhouse gas emissions and the environmental impact of gas.

The *Future Gas Strategy Analytical Report* is an essential companion to this document. It provides in-depth analysis of relevant data about gas supply and consumption both in Australia and, where relevant, by our trading partners. The analytical report uses International Energy Agency (IEA) and Australian Energy Market Operator (AEMO) scenarios. These scenarios are well known and tested, and reflect policy decisions and intentions both globally and in Australia. Read more information about these scenarios in Appendix A.

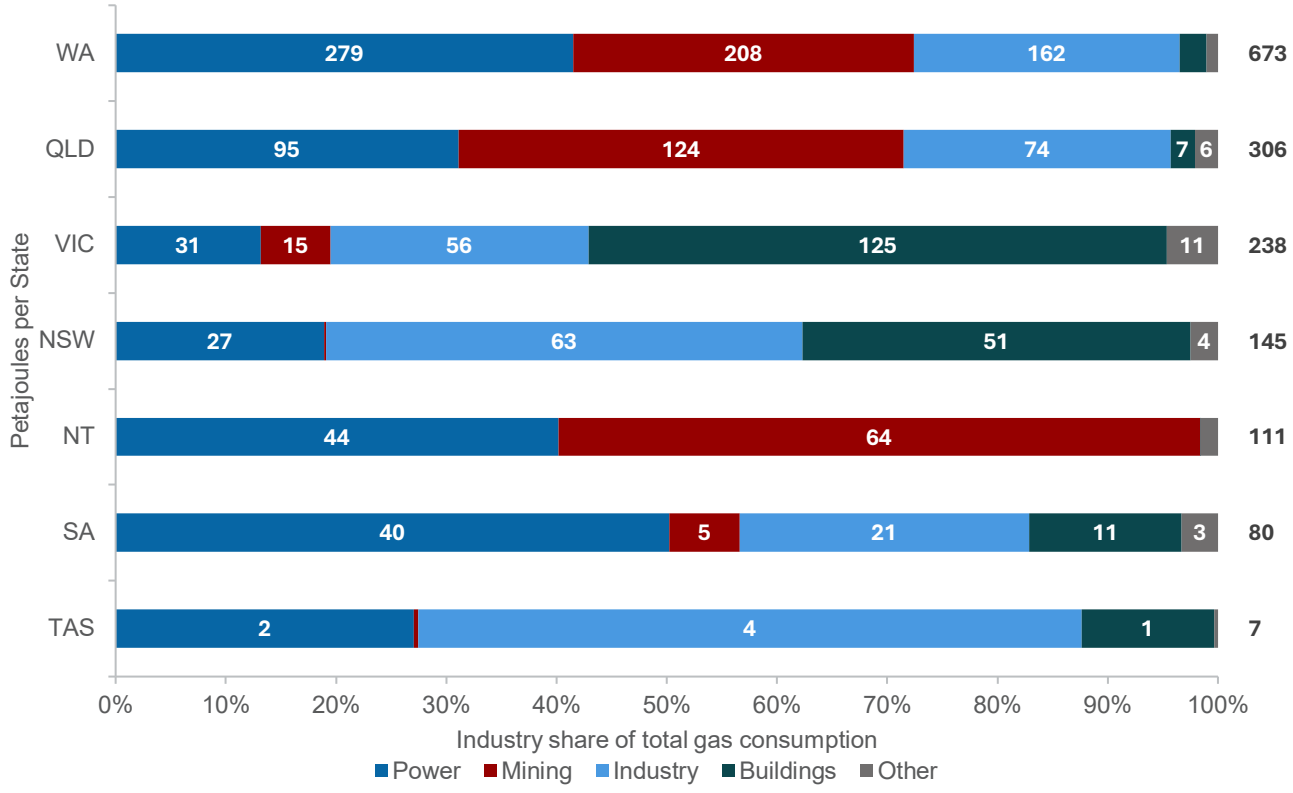
How Australian gas is used today

Gas use in Australia

Sustaining investment in all parts of our energy system to achieve our climate, energy, and social goals is a key challenge for Australia.

Today, natural gas supports our standard of living and Australia's energy security, providing over a quarter of our energy needs. We use gas to heat and cool our homes and businesses, heat our water and cook our food. Gas is also an essential part of how we generate electricity. However, the way we use it in electricity generation varies across the country (figure 1). In Western Australia, gas-power generation supports the electricity grid and many remote mine sites. The Western Australian Government has announced that gas will replace coal-fired generation by 2029. Uniquely among Australian jurisdictions, most Victorian gas consumption is in buildings (households and small businesses like restaurants). Victoria has policies to reduce this consumption by, for example, banning gas connections in new buildings. In the Northern Territory, gas is responsible for 88% of electricity generation. South Australia, which has some of the highest uptake of renewable power generation in the world, uses solar and wind during the day. At night, gas-powered generation helps fill the gap.

Figure 1: Gas consumption by state/territory and sector, 2021–22



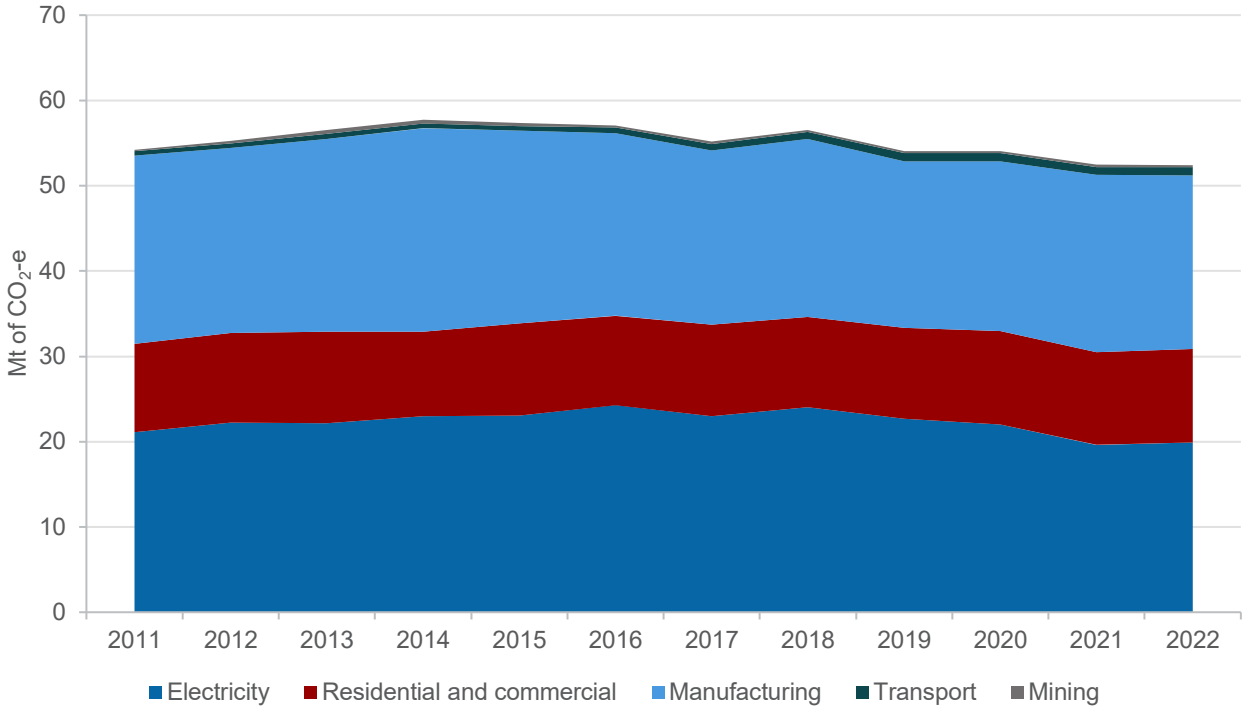
Notes: ACT included in NSW. On-site electricity generation is included in the power sector. Buildings demand includes gas use in both commercial and residential buildings. Mining demand includes gas used to power LNG liquefication. Power demand includes gas consumed by the manufacturing sector to generate off-grid electricity. Other demand consists of gas use for transportation, agriculture, construction, water and waste treatment and gas supply. Data in this graph may not align with that produced by AEMO. Source: Analytical Report Fig 3.1

With this use of gas comes associated greenhouse gas emissions (figure 2). To achieve net zero globally, we need gas to:

- support renewable generation
- process critical minerals
- help to lower emissions in steel and cement
- produce fertiliser
- manufacture the products we need to build a net zero economy.

Most of Australia's gas is exported as LNG to our region. Australia's LNG exports support and sustain millions of households and businesses which rely on the energy generated from LNG. Australia has benefited from the high levels of investment, income and employment that our LNG exports bring to our nation's economy. Between 2010 and 2020, direct investments in both up and downstream LNG facilities in Australia was nearly $250 billion. For the 2022-23 financial year, LNG was Australia's second largest export by value, with export earnings of $92 billion (nearly 20% of total Australian export earnings).

Figure 2: Emissions from the use of gas by sector



Notes: Gas consumption is calculated as the AEMO consumption figures for electricity, industrial and residential and commercial sectors. It excludes the LNG sector. Emissions from electricity generated at mining sites is allocated to the electricity sector. Source: Analytical Report Fig 2.2

Australia, like other countries, must move towards cleaner energy sources to reach net zero by 2050. To support this shift, Australia's gas sector must make deep and permanent cuts to its greenhouse gas emissions while scaling up carbon management solutions. By 2050, Australia's gas sector will be substantially different from today. Low emissions energy sources will grow in response to market signals and government policy. The ongoing role of natural gas both in Australia and globally will be defined by its cost and carbon competitiveness.

Read Section 1 of the analytical report for more information about Australia's gas markets, and Section 3 for more information about the domestic demand outlook.

Gas-powered generation

The electricity sector is a major source of domestic gas demand. In 2021-22, gas-powered generation (GPG) consumed 520 PJ, or 33% of total Australian gas demand, producing around 5.7% of Australia's greenhouse gas emissions. GPG is important for grid security and reliability as it can start up quickly. This means it can complement variable wind and solar generation and provide extra power supply during periods of peak electricity demand.

"... GPG is one of the key technologies to provide the firm capacity the power system needs to support high penetrations of variable renewable energy such as wind and solar. ... Barker Inlet Power Station (BIPS) ... often generates in the morning and evening peaks, when demand from households is high and output from solar is limited.
AGL Energy

The extent to which we use GPG in any given year depends on several factors. These include the coldness of the winter and the cost-competitiveness of alternatives. Gas-powered generators are versatile. They can scale up and down rapidly, and so can supply power during peak electricity demand (called 'peaking') and complement variable wind and solar generation (called 'firming'). Consequently, the volume of gas used for electricity generation fluctuates with electricity market conditions.

Remote communities are often powered by stand-alone diesel grids. The cost and reliability of these can be challenged by the logistical complexities of trucking fuel over large distances, year round. Those relying on them, disproportionately First Nations communities, note that the unreliability of these microgrids has adverse community effects. This unreliability affects access to education and healthcare, and makes it harder to remain engaged on issues critical to culture and communities.

Energy security is a pressing issue. ... an overwhelming number of all [NT] households (91%) experienced a disconnection from electricity during the 2018–2019 financial year. Almost three quarters of households (74%) were disconnected more than ten times. ... The loss of essential electricity supply has wide-ranging impacts on us. It makes it hard to safely store medicine and food, makes it hard to sleep and for children to turn up at school...
Nurrdalinji Native Title Aboriginal Corporation

The mining industry often generates electricity using stand-alone micro grids. Mine sites are increasingly using GPG, or renewables firmed by GPG, to replace diesel power generation.

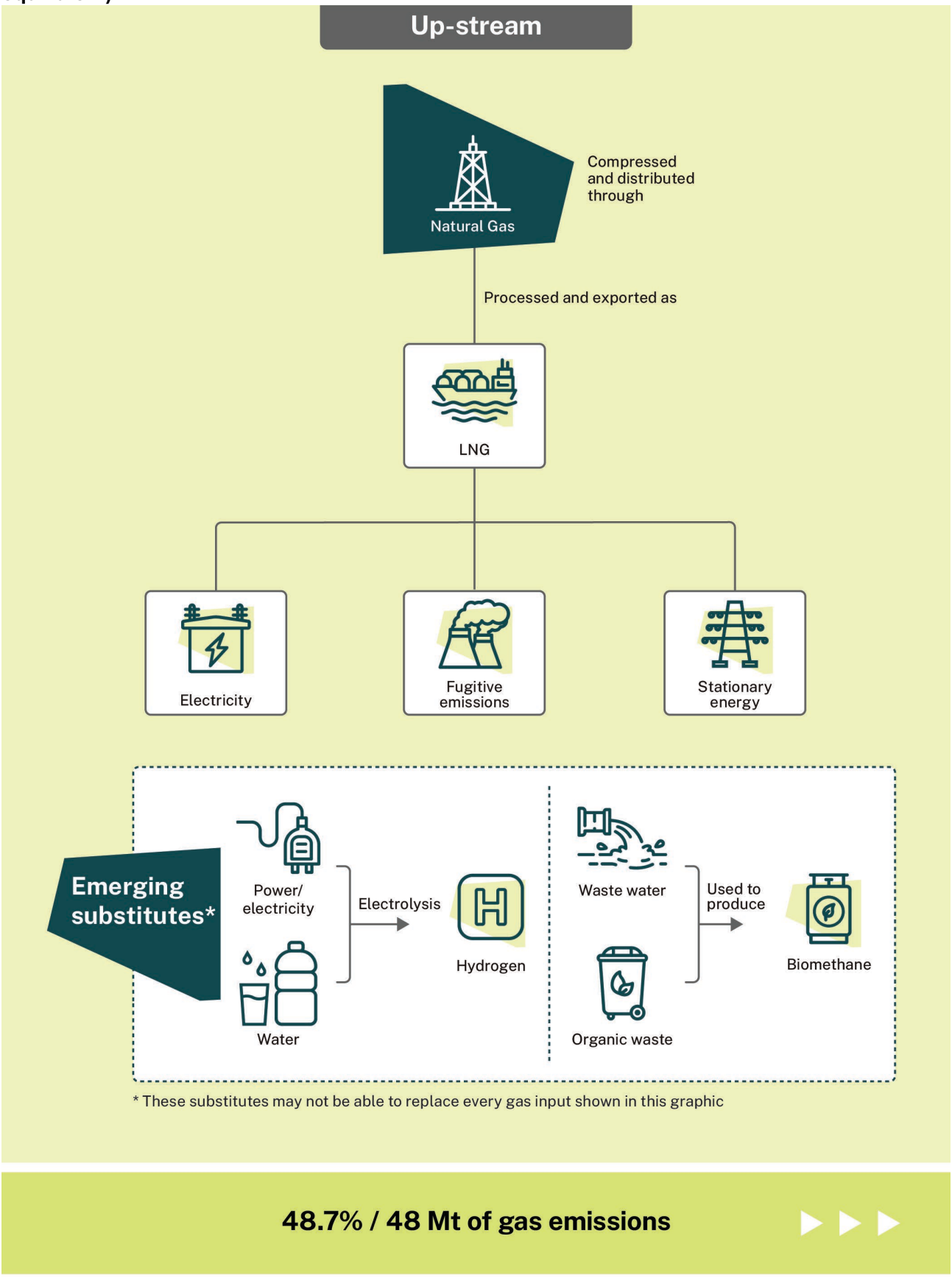
Gas use in industry

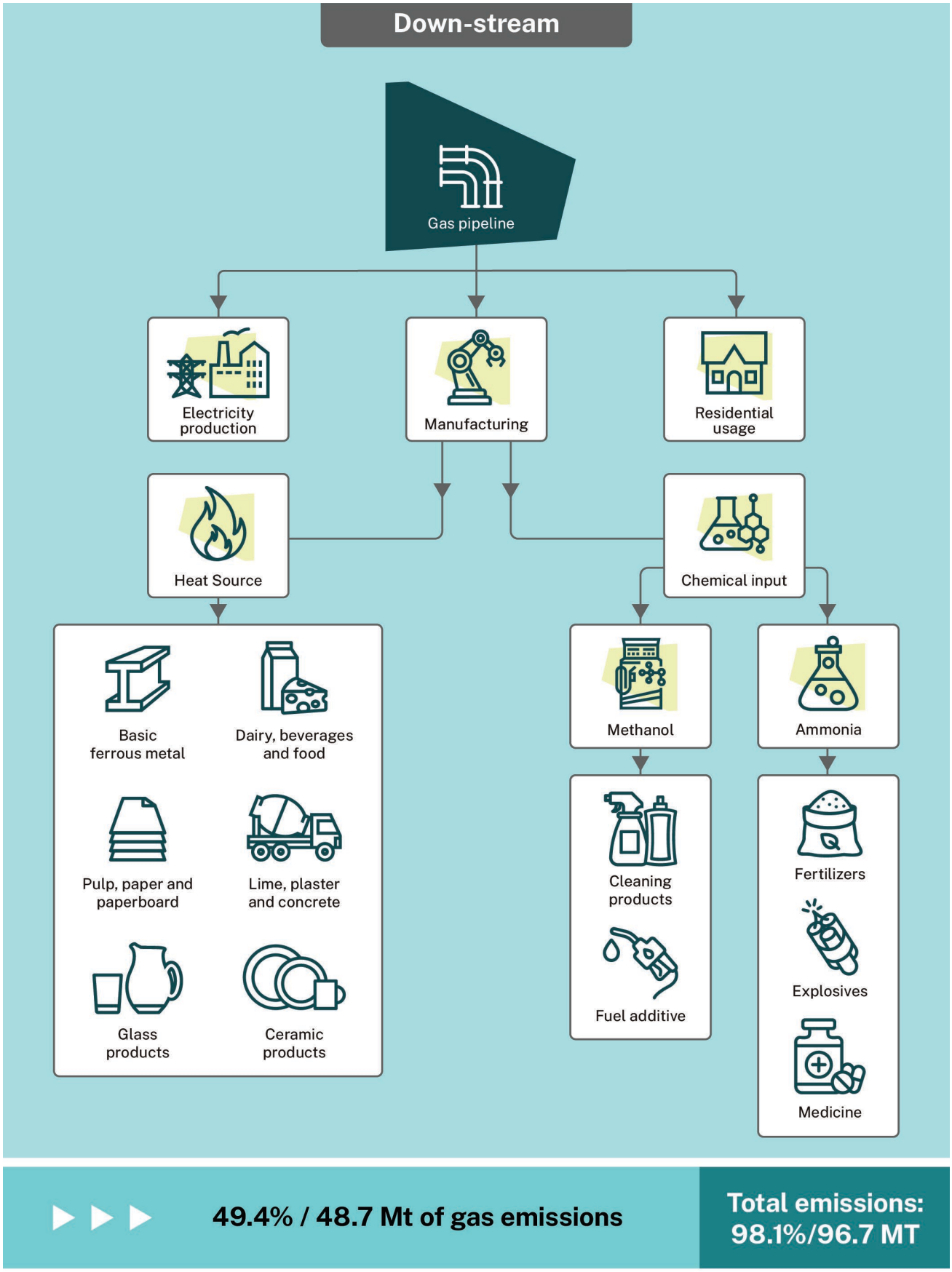
Natural gas is the largest source of energy for Australian industry. In 2020-21, Australia's manufacturing sector consumed 380 PJ of gas, or about 26% of domestic gas supply.

Around 74% of industrial gas consumption is for heat. Industrial heat is part of many processes that support our modern economy and plays a pivotal role in our everyday lives. From the buildings we live and work in to the food we eat, society would look very different if we did not have access to industrial heat (figure 3).

LNG facilities are significant consumers of gas to power compressors and generate electricity on-site.

Figure 3: Gas production and use in the Australian economy, including emissions (CO_2 equivalent)





Note: data in this graphic is based on estimated emissions in 2023, and 1.9% of gas production and use emissions occur through other processes not captured such as stationary energy emissions from domestic gas production and other downstream uses of natural gas.

Industrial heat use can be broken down into low, medium, and high heat applications.

Lower-heat range temperatures (below 150°C) are used for:

- manufacturing food and beverages
- chemical and paper production
- drying
- baking
- evaporation
- pasteurisation.

Medium heat range temperature (from 150° to 500°C) are used for:

- more advanced chemical production processes
- refining biofuel
- dying and drying materials in the textiles industry.

High-heat range temperatures (over 500°C) are used for:

- producing plastics
- smelting metals
- transforming limestone into clinker for cement
- heating kilns that fire bricks and ceramics.

Historically, the decision to use gas in these facilities has depended on how cost competitive the source and quality of heat is against alternatives. Low-emissions sources of industrial heat are entering the market for low temperature ranges through industrial heat pumps. For higher temperature ranges, the adoption of alternatives is limited because of technology challenges and high costs.

> Being a trade-exposed sector, any policy that affects food, beverage and grocery manufacturers' access to a reliable and affordable gas supply can impact their ability to compete in international markets. This is crucial given the intense competition from international competitors benefiting from lower-cost energy.
> **Australian Food and Grocery Council**

Around 17% (65 PJ) of Australian industrial gas is consumed as a chemical feedstock. In addition to its use as an energy source, natural gas molecules are chemically transformed into other products. Many of these products are used in our everyday lives such as:

- plastics
- fertilisers
- packaging
- clothing
- tyres
- detergents
- insulators
- rubber
- propellants
- medical products
- adhesives
- cosmetics.

Decarbonising these everyday products will depend on the availability and price of substitutes like hydrogen and biomethane. These substitutes are not currently cost competitive with natural gas and will require sufficient scale. Achieving scale and cost efficiencies in low-emission hydrogen production is the only way to decarbonise chemical processes that need ammonia as an input. The Australian Government is undertaking a review of the National Hydrogen Strategy. This will position Australia on a path to be a global hydrogen leader by 2030 on both an export basis and for the decarbonisation of Australian industries.

Commercial and industrial (C&I) users of gas include those using gas as feedstock for a wide range of products such as fertilizers, plastics, explosives, clothing, and medicines, as well as those requiring gas for high heat applications, such as in the smelting metals and minerals, particularly in the steel, aluminium and critical minerals. There are currently no ready alternatives to the use of gas in these applications.
Australian Chamber of Commerce and Industry

Read Section 3 of the analytical report for more information about the use of natural gas as a feedstock.

Gas in homes and small businesses

Australian homes consumed an average of around 200 PJ of gas per year between 2011-2021, representing around 2.3% of Australia's national net greenhouse gas emissions. Today, about 5 million households in Australia rely on natural gas. Most gas use in homes and small business is across Victoria, New South Wales, the Australian Capital Territory and to a lesser extent Western Australia and South Australia.

Homes and small businesses use gas to:

- cook food
- heat water
- warm and cool buildings.

Household gas consumption is relatively stable, although unusually cold winters can increase demand. Electrification is possible as there are widely available, cost competitive electric alternatives to household gas appliances. Low-income households, renters and those in community housing face barriers to electrification. These include the cost of switching and a lack of control over which appliances to install. The retail cost of gas appliances remains competitive with electric alternatives. The cost of adding more electrical circuits or upgrading the household connection to the grid is likely to remain a barrier to low-income households, and will be a factor in landlords' decision making.

Electrification of homes, business, industry and transport, underpinned by renewable energy and storage, is a key decarbonisation strategy for the Australian economy, and should be expedited wherever possible, noting the energy productivity benefits it offers consumers.
Clean Energy Council

How gas can help get us to net zero

The Australian Government is committed to sustaining an economy underpinned by reliable, affordable and clean energy. In 2021-22, gas provided 27% of Australia's energy needs. Production and domestic use of gas accounts for 24% of Australia's total emissions. Australia will need gas into the future, including as a bridging fuel. We also need to manage the emissions from gas, while ensuring affordability and reliability of energy as we undergo our energy transition.

Through consultation, we heard concerns about the role of gas and its contribution to climate change. Ensuring we reach net zero while maintaining living standards, industrial capacity, robust environmental standards, regional energy security and meeting our commitments to our trading partners are imperatives for the Australian Government.

We cannot turn off Australia's gas without significant adverse impacts on Australians and our region. Reducing supply without also reducing demand would put upward pressure on prices across the economy. This could lead to business closures and shortages of consumer goods and services. The food processing industry, for instance, relies heavily on gas. Manufacturing cement, bricks, glass products, nitrogen-based fertiliser and electric vehicle batteries all depend on a reliable and affordable supply of gas. Steel production is looking to gas to transition away from higher-emissions coal while developing new, net zero technology. Without GPG, the electricity grid would be unable to cope with peak electricity demand.

The detailed analysis underpinning this strategy shows that to meet net zero, gas consumption may increase in some parts of the Australian economy.

The role of gas is changing. Two factors will decide how quickly demand reduces:

- the development, scale-up and commerciality of renewables and low emission alternatives to gas, such as hydrogen or biomethane
- the development and commercialisation of new, net zero technology for industrial applications.

Consultation responses made it clear that both low-emission gases and technology transformation are necessary elements of the pathway to net zero. However, the development pathways for both are just beginning. Success in the long term will depend on supply chain development and cost competitiveness.

Australian gas will continue to be required, not only by us, but by our trading partners. International investment in Australia's LNG industry exceeded $398 billion between 2010 and 2022. The associated long-term offtake agreements mean that we export around 73% of Australian gas production as LNG. The level of investment required to create the large-scale projects that underpin Australia's LNG industry is far greater than our domestic gas demand can support. Australia's export percentage is likely to stay relatively consistent until 2035 due to long-term contracts. The ratio of exports to domestic consumption may change, based on changes in technology and the scaling up of alternatives. However, we will need further investment to support both domestic and export consumption. Arguments that Australia could divert gas developed for export fail to recognise the domestic gas market's reliance on supply from gas export projects, the nature of Australia's trade and investment relationships and the role of Australian gas in our trade partners decarbonisation pathways.

Emissions must be eliminated where possible and reduced where they cannot be eliminated. Gas emissions reduction strategies will be considered through the 6 sectoral plans which are being developed as part of Australia's Net Zero Plan. Over 97% of Australia's trade also goes to partners with net zero targets and new clean energy export industries will be important to Australia's long-term trading relationships and prosperity.

Read Section 1 of the analytical report for background on global and Australian gas markets, Section 2 for analysis of emissions from supply and use of gas, Section 3 of the analytical report for analysis of the domestic demand outlook, Section 4 for the international demand outlook, and Section 7 for options to close the supply gap.

Principle 1: Getting to net zero emissions by 2050.

> **Principle 1:** Australia is committed to supporting global emissions reductions to reduce the impacts of climate change and will reach net zero emissions by 2050. Gas production and use must be optimised through the transition and residual use must be abated or offset to achieve this economy-wide commitment.

Summary

In 2050, Australia's natural gas use will look very different from today. Australia cannot reach our 2050 net zero targets without reducing and decarbonising our consumption of natural gas. Natural gas consumption will continue on the pathway to net zero. Decarbonising natural gas use in Australia will need:

- increased energy efficiency and electrification of processes that currently use natural gas
- replacing natural gas with low-emission gases
- any remaining emissions from natural gas use to be reduced as low as possible, and where not possible, fully offset.

Gas consumption is not uniform across sectors or across Australia. Gas is used by households and small businesses, by industry and in power generation. Each of these broad sectors has a different pattern of gas consumption.

Gas is used in all states and territories. Each state and territory also has a different pattern of gas consumption.

Read Appendix A for information about the scenarios are used to help shape forecasts in this section.

Read Section 3 of the analytical report for analysis of domestic demand for natural gas.

Gas use in Australia's transition to a net zero economy

Gas will support our economy during the transition to net zero and will remain a critical part of the energy landscape in 2050 and beyond. Transforming how we make products and power our economy will be challenging, but the energy transformation is already underway.

Technologies allowing households and businesses to decarbonise are becoming increasingly available. For industrial gas use, the transition pathway is more complex and will depend on the cost and availability of alternatives. In some cases, these alternatives will require new technologies. In other cases, solutions will combine existing technologies in new ways. A challenge for governments, society, investors, and market participants will be to maintain investment across the energy sector at the pace required to achieve net zero.

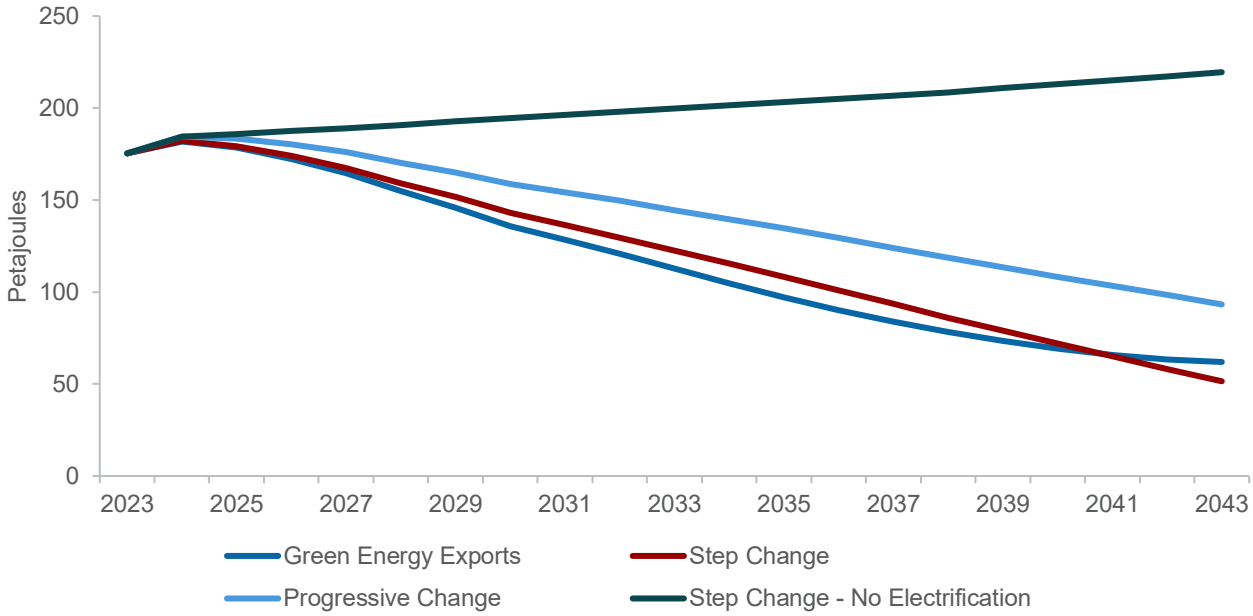
We explore these opportunities and challenges based on detailed projections of the east coast and west coast gas demand scenarios produced each year by the Australian Energy Market Operator (AEMO).

Australia's forecast natural gas demand depends on many factors. Each AEMO projection is based on assumptions about how quickly we adopt alternatives to gas, as well as social and economic conditions. These projections reflect the best knowledge available.

The largest declines in gas consumption are anticipated in east coast buildings

The largest declines in gas demand on the east coast are forecast for commercial and residential buildings. Depending on the scenario, by 2043, domestic and small business consumption of gas will decline between 49% and 72% on 2023 levels. This is unless residential and commercial consumers are unable, or choose not to, electrify (figure 4). These projections assume an increase in the rate of electrification (the replacement of existing gas appliances with electric alternatives), and a reduction in the rate of new natural gas connections.

Figure 4: Building demand for gas by scenario, 2023–43



Note: Building demand covers gas used for residential and commercial heating on the east coast

Source: Analytical Report, Figure 3.7; AEMO (2024b)

Achieving the reduction in household gas demand assumed in AEMO's high-ambition scenario ('green energy exports') will be challenging. In this scenario, Australia's east coast would need to disconnect, or provide low-emission gases to, around 144,000 houses each year for the next 20 years. This equates to removing just under 400 houses per day, which is a large logistics challenge. In 2021, about 68,000 households joined the gas network across NSW, Victoria, South Australia and the ACT.

Building (households and small business) gas demand makes up a small portion of Australia's domestic gas consumption (21%, excluding demand from the LNG sector). This means that reducing building gas consumption will have a modest impact on Australia's gas-related emissions and climate targets.

... to reach net zero by 2045, which Victoria is committed to ... about 200 Victorian homes would need to be upgraded every day between now and 2045.
Master Plumbers Australia and New Zealand

Electrifying Australian homes will mean a surge in demand for electricians and/or tradespeople with electrical licences...
AGL Energy

GPG will play a crucial role in assisting the transformation of our electricity markets

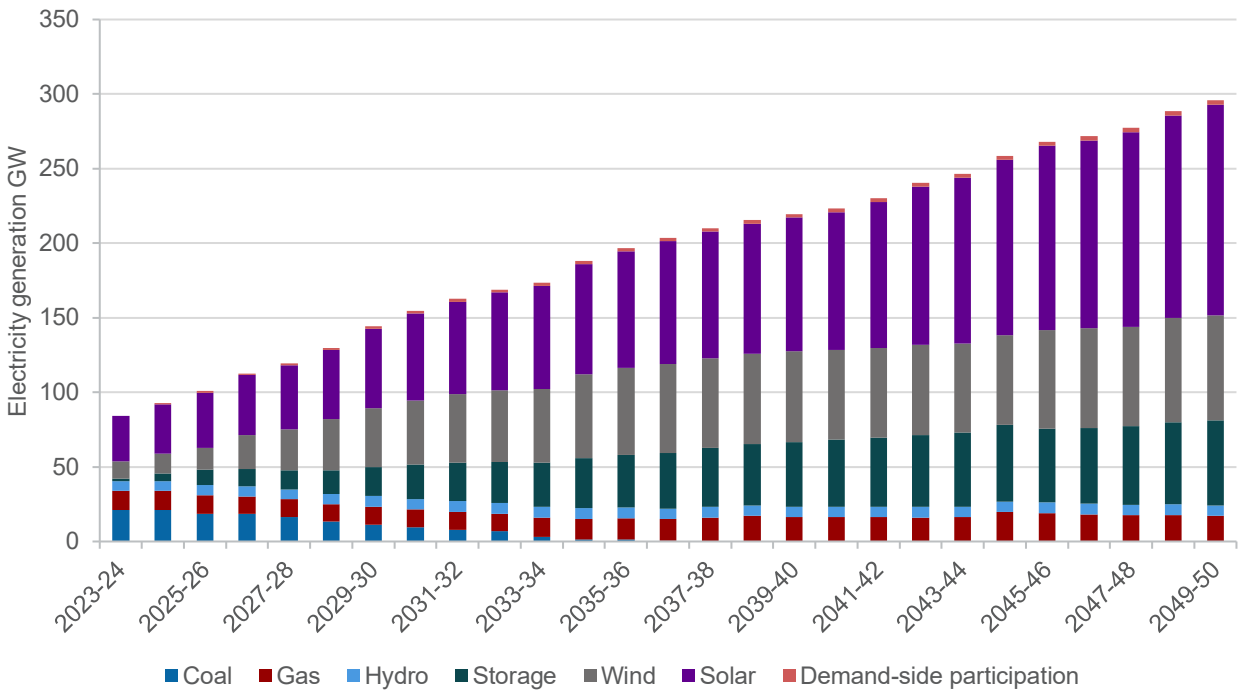
AEMO forecasts that 2035 gas demand from the electricity sector (GPG) could be 10% lower, or up to 96% higher than in 2024. The large range in forecast demand reflects the complex interaction between gas and electricity markets, driven by:

- the closure of coal-fired power generators
- how quickly renewables can be added, scaled up and commercialised
- the greater volume of electricity generation needed to support electrification of current gas consumption.

Under all scenarios, a point to note is that while we may use more gas overall, we may need less gas during specific periods of time. There is a strong potential for declining use of GPG up until 2032.

Figure 5 gives a simplified view by focusing on the Step Change scenario. Under this scenario, electricity generation is projected to more than triple by 2050 as more parts of our economy electrify. GPG capacity grows in absolute terms, but decreases significantly as a percentage of overall power generation.

Figure 5: Projected energy source in the NEM, Step Change



Notes: Data derived from the 2024 Draft Integrated System Plan (ISP) report for the Step Change scenario.
Source: Analytical Report, Figure 3.10;

From 2035 to 2050, annual demand for GPG is forecast to increase, with the need for large, time-limited contributions from GPG expected to continue.

Over time, clean and economic substitutes to unabated natural gas for power generation will emerge. We do have some grid scale alternatives today, such as pumped hydro power and battery power, while others such as biomethane, hydrogen and other biofuels are emerging. Which options ultimately prevail will depend on factors such as safety, reliability, whole-of-life cost, and carbon efficiency and performance.

Industrial users of natural gas may have few options available to switch from gas

For industrial gas consumers, through to 2035 on Australia's east coast, AEMO projects only small declines in industrial gas use. Even in the high-climate ambition, 'green energy exports', scenario, industrial gas demand is expected to fall by a maximum of 20% by 2042. This will follow an initial rise because of the rapid decrease in the use of coal.

> Industrial gas demand will vary considerably by industry and is more likely to be a series of step-changes, including in some cases, increased demand over the medium-long term ...
> **Manufacturing Australia**

These modest projected declines in gas consumption reflect the limited alternatives currently available for many gas uses in Australia's heavy industry and resources sectors. Reducing demand will need advances in a range of different technologies. Deployment of these technologies is likely to need substantial changes to facilities that use large amounts of gas. Consultation indicates that some large emitters plan to use natural gas as the first step to reduce emissions before alternative energy sources (like hydrogen) and alternative technologies are commercially available at scale. This emissions reductions task will require large capital investments in Australian industry.

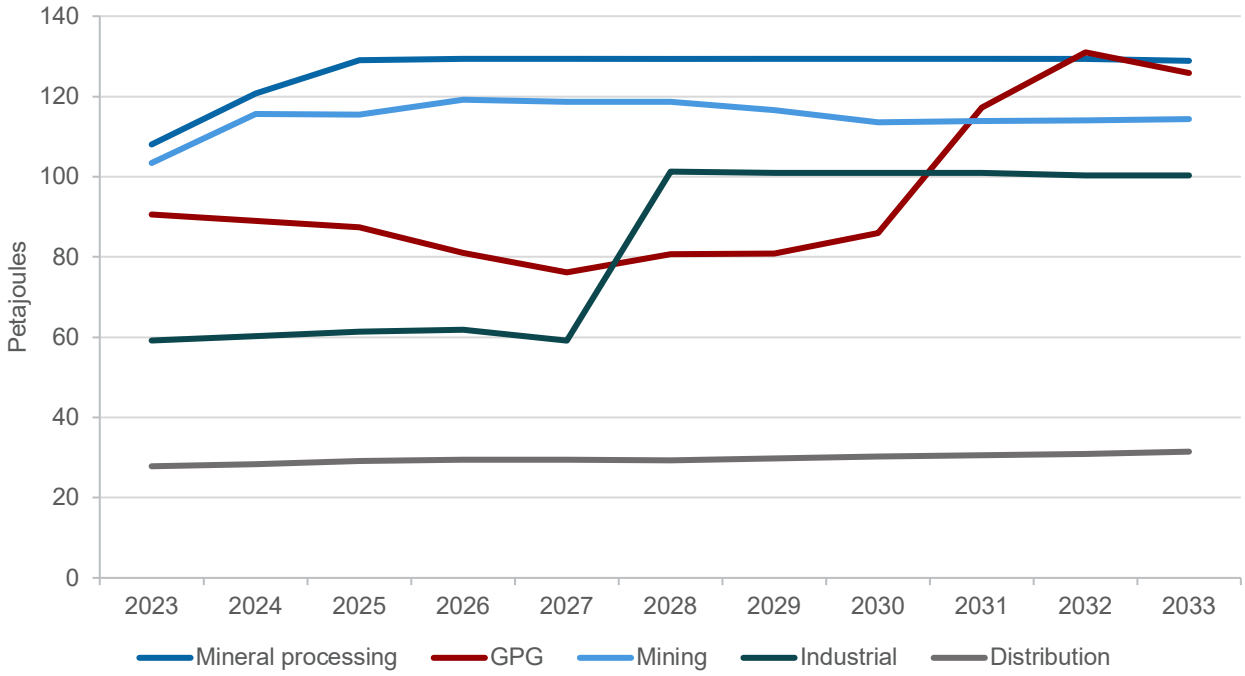
> Substituting gas applications for other technologies requires the business to understand the replacement technology, its business case, and how its technical characteristics relate to the operations of the business. For many businesses, especially smaller businesses, the lack of expertise on these matters is a significant barrier ...
> **Business NSW**

> Direct reduced iron (DRI) processes can be configured to use natural gas and transitioned (at relatively low cost) to hydrogen once it is price competitive ... Use of natural gas to manufacture DRI would ... reduce BlueScope's Scope 1 GHG emissions by approximately 3.7 million tonnes per annum.
> **BlueScope low emissions iron and steelmaking study**

Gas demand may increase on Australia's west coast

Through to 2035 on Australia's west coast, there are similar drivers for change in gas markets (figure 6). Demand from mining and mineral processing is forecast to increase slightly then remain flat. Industrial demand is likely to climb sharply in 2027, in large part due to Perdaman Industries brings its new urea plant (essential for fertiliser production) online in Karratha. Annual GPG gas use is expected to be broadly flat until 2030, before increasing to offset the exit of coal fired generation assets. The initial decline in GPG demand is driven by new renewable generation, specifically as wind combined with batteries is expected to replace a loss in coal generation capacity. High-efficiency GPG will meet an increasing portion of demand as coal exits WA's electricity system from 2030 to 2033.

Figure 6: West coast gas demand by sector, 2016–2033



Notes: Projections are derived from WA's expected case scenario.

Source: Analytical Report, Figure 3.13

AEMO's projections for WA gas use do not extend beyond 2033. However, the WA Government's Energy Transformation Strategy sees GPG remaining important beyond this outlook period. Western Australia has recently reviewed its Domestic Gas Policy, through which it aims to secure Western Australia's long-term energy needs.

Household use is a small component of west coast gas consumption and is expected to grow slightly over the outlook period. The increased uptake of electrical appliances, or addition of low-emission gases into the gas network, could instead see demand fall by the same amount.

Western Australia has a high concentration of industries that need high heat (for example, smelting) and a large mining and minerals processing sector. These sectors create future gas demand over the outlook period, and few commercially viable technology substitutions are expected to emerge during the forecast period to 2033. Expected rates of growth in gas demand will be driven by new minerals processing such as lithium hydroxide, and mining and manufacturing consumers.

Hard rock lithium processing

Western Australia has large deposits of lithium ore (spodumene). As demand for battery technology continues to grow to meet net zero targets, Australia is increasing its spodumene processing capabilities.

Lithium can be extracted from mineral concentrate by roasting and acid roasting at temperatures of around 1050°C and 200°C, respectively. From this process, lithium sulphate (which is soluble in water) is then transformed into lithium hydroxide which is used in electric vehicle batteries.

The technology to run high heat kilns on electricity or hydrogen is not yet available. Processing lithium still requires gas.

Carbon management and geological storage

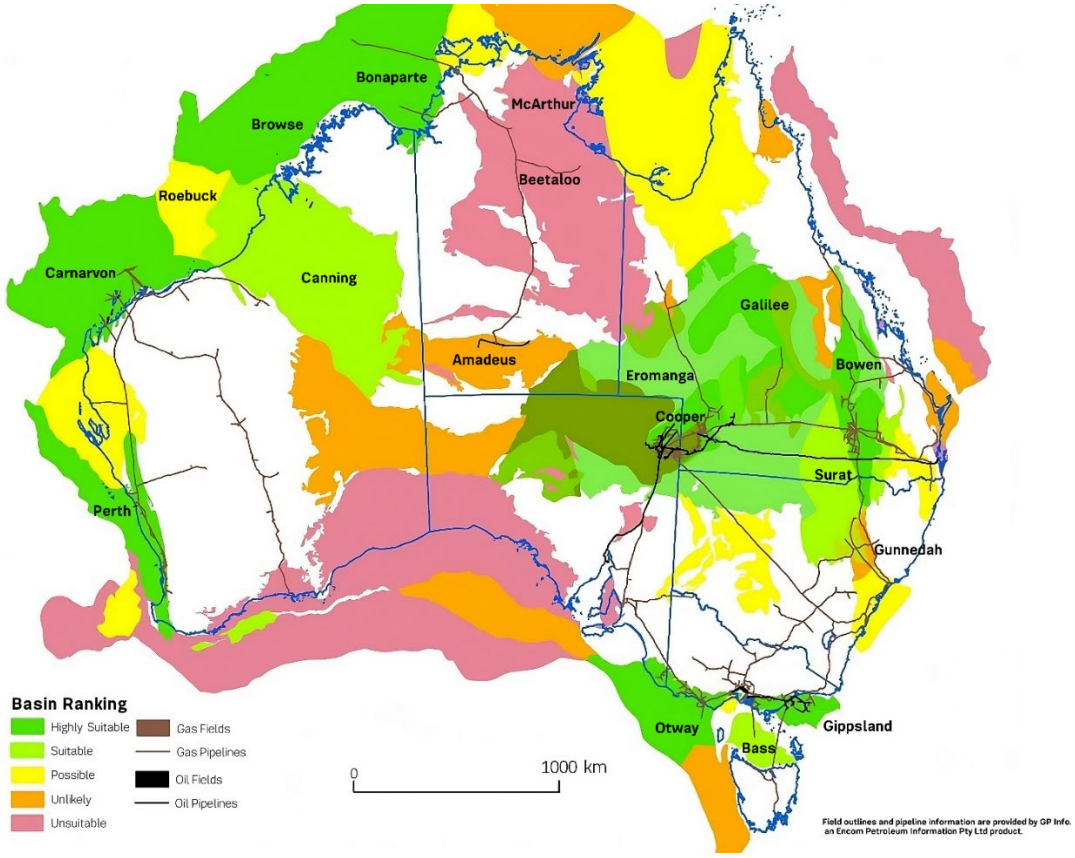
Geological storage is a method of permanently sequestering carbon from existing industrial facilities. Geological storage requires the use of carbon capture and storage (CCS) to capture and store CO_2 from industrial and extractive processes. It involves condensing CO_2 into a liquid and then transporting, injecting, and permanently storing the liquid CO_2 deep underground in a geological formation. Typically, it is stored at depths of more than 1 kilometre.

CCS will likely play an important role in the decarbonisation of Australia … CCS technology can also be used to sequester unavoidable greenhouse gas emissions from various sectors or produce fuels including ammonia and hydrogen.
Japan Australia LNG (MIMI) Pty Ltd

Australia has significant onshore and offshore storage reservoirs potentially suitable for CCS projects (figure 7). This includes storage in depleted petroleum fields. Successful deployment of CCS and negative emissions technologies can help decarbonise oil and gas operations and other hard-to-abate industries, such as cement production.

Given Australia's natural advantages in the storage of emissions, it [Australia] can support the decarbonisation of those [economies] that do not have the same access to renewable energy or viable CCS sites by providing CCUS as a service … Japan, Korea, Taiwan, and Singapore all have emission reduction ambitions that will likely need the support of other countries including by providing CCS as a service.
BP Australia

Figure 7: Australia's basins ranked for CO_2 storage potential



Source: Geoscience Australia (2023b)

Growing carbon management and geological storage in Australia

Australia's geological carbon management market needs to grow to support a least-cost energy transition and grow our economy. The Australian Government has committed $12 million over 3 years to provide regulatory and administrative certainty for offshore CCS projects.

There are commercial CCS projects in Australia and around the world. Australia hosts the world's largest commercial CCS project, the Chevron Australia Gorgon LNG Project at Barrow Island in Western Australia. Over the period 2019 to 2023, this project has stored 9 Mt-CO_2. This is nearly equivalent to the amount of annual emissions produced in Australia's residential and commercial buildings sector (figure 2).

Aside from the Gorgon Project, the Australian CCS industry continues to work towards large-scale commercial projects in Australia. To be successful, the identification of geological storage sites and development of infrastructure and processes will need significant work, collaboration across industries, and investment.

The 2023 Net-Zero Australia study suggested that a notional annual geological sequestration limit for Australia is 150 Mt-CO_2. For most scenarios in its report, annual sequestration demand reaches this limit by 2040. The study suggested that successful deployment of CCS would be a multi-decade effort. It investigated scenarios to meet all storage needs and suggested that storage prioritisation should focus on emissions that are hard to abate.

Success will need substantial investment from the private sector and will involve extensive project timeframes. Several Australian projects are in development.

- The CarbonNet Project, Victoria, seeks to develop a CO_2 collection hub with geological storage in the offshore part of the Gippsland Basin.
- The Moomba CCS project, South Australia, is a joint effort by Santos and Beach Energy. It aims to store 1.7Mt of CO_2 each year, starting operations in 2024. There is potential to eventually store 20Mt of CO_2 per year across the Cooper and Eromanga basins.
- The South-West Hub Project in Western Australia is investigating CO_2 storage in the Perth Basin.

Following the passage of amendments to the Sea Dumping Act, Australia and future exporting and importing destinations of CO_2 must adopt further regulatory processes before any CO_2 trade can occur. High levels of scientific and community confidence in the safety and efficacy of storing CO_2 will be critical to the success of scaling CCS. The Australian Government will continue to organise and attract investment in Australia's growing CCS industry through:

- maintaining offshore greenhouse gas acreage releases
- ensuring our regulatory systems remain fit for purpose, including through the government's review of relevant regulation
- encouraging innovation, including through the $15 million Carbon Capture Technologies Program
- encouraging collaboration across industries to enable projects to reach scale
- supporting uptake among existing industrial facilities, including through the Powering the Regions Fund.

The private sector is responsible for developing and carrying out projects where it identifies that CCS is a cost-competitive, safe, and verifiable approach to meeting emissions reduction obligations under the reformed Safeguard Mechanism. It is the Australian Government's expectation that Australian CCS facilities will provide cost-effective abatement options for Australian hard-to-abate industries. These include those for which CO_2 is an unavoidable byproduct of production (such as calcination of limestone to produce clinker for cement manufacture), and potentially for our trade partners.

Reaching net zero emissions will require concerted collaboration and effort, with no single solution available to decarbonise the economy. Technology, low-emission gases, and natural gas all have their roles to play, with some sectors able to decarbonise more quickly, and others increasing gas consumption as they transition away from current manufacturing processes. Natural gas has an important role to play, and will continue to be required by hard-to-abate industries beyond 2050.

Principle 2: Keeping gas affordable during the net zero transition.

> **Principle 2:** Gas must remain affordable for Australian users throughout the transition to net zero. A Future Made in Australia, our competitive advantage in abundant resources, and our standard of living requires reliable, affordable and clean energy. Continued gas development and more flexible gas infrastructure is needed to increase the resilience of Australia's energy system and keep costs down as we transition. Government decisions on gas development rights should prioritise timely development and discourage repeated delays to ensure supply and affordability.

Summary

Helping Australians with the cost of living is a priority for the Australian Government. Gas availability and pricing affects cost of living though electricity prices and the prices of consumer goods including food and manufactured products. Domestic gas prices in Australia reflect complex market dynamics. Prices are likely to increase over time unless new supply enters the market or anticipated demand diminishes. Price uncertainty and volatility, including from international and domestic shocks, is also likely to occur over the transition period, as it has done in the past.

The complex and interdependent gas markets will need careful management. Sudden changes in one section of the market are likely to have unintended consequences in other parts of the market. The Australian Government will work closely with states and territories, AEMO, industry and our community to ensure our regulations remain fit for purpose.

To ensure the wellbeing of Australians through the energy transition, the Australian Government will focus on:

- continuing to manage short-term affordability challenges through targeted intervention, such as the Energy Price Relief plan and the Gas Market Code of Conduct
- ensuring First Nations people are partners in, and benefit from, the transition to net zero
- continuing to maintain long-term domestic energy security through mechanisms such as the Heads of Agreement with East Coast LNG exporters, the Australian Domestic Gas Security Mechanism (ADGSM) and AEMO's market powers
- through the Net Zero Economic Agency (NZEA), ensuring plans are in place to support longer-term transitions in communities affected by declining fossil fuel demand
- reviewing the regulatory regimes to ensure they enable gas markets to evolve to meet our energy needs
- carefully managing changes to minimise unintended negative consequences.

Read Section 5 of the analytical report for analysis of natural gas supply outlook, and Section 6 for analysis of competition, costs and pricing.

Gas development is considered under Principle 3, while gas infrastructure is the focus of Principle 5.

Australian wellbeing

Australia's gas markets support the livelihoods and wellbeing of millions of Australians. In some regional communities, gas producers and industrial gas consumers are significant employers and contributors to regional economies. Australian law requires all companies to protect the rights and interests of our First Nations people, the environment, water, our cultural heritage, land access and the safety and health of workers. Australia's regulatory settings are designed and applied to promote community wellbeing.

Structural change in Australia's gas markets may impact the cost of living of Australian households and businesses. Australia's southern gas markets would feel this the most, as gas fields that have produced gas for decades continue to decline and eventually stop producing gas.

Price volatility can be due to external factors

Market uncertainty over future conditions and increased volatility in energy markets can substantially impact prices. As seen in 2022 and 2023, no economy is an 'energy island'. Russia's illegal invasion of Ukraine affected energy markets across the world. Combined with domestic outages in coal fired power stations, this substantially disrupted Australia's gas markets. The events of 2022 clearly showed the connection between Australia's domestic gas, electricity, and international energy markets. The interconnectedness of energy markets and supply chains holds important lessons for governments, industry and society as we navigate a complex and lengthy process to transform our energy system to cleaner energy sources and net zero.

Regional economic and employment impacts

ACIL Allen (2023) estimated that the gas industry directly supported 81,940 full-time equivalent jobs and contributed $84 billion to the economy in 2021–2022. The production and use of gas underwrites economic activity directly through gas exploration, production, transport and wholesale and retail sales, and indirectly through a variety of industrial and commercial uses. Many more work across other parts of the value chain. For instance, in 2023, the ABS indicated there were about 7,600 gasfitters.

According to the ABS (2023) an average of 21,100 people worked in oil and gas extraction, a subgroup of the industry as a whole. The vast majority of those employed in extraction worked full time and are paid higher than average wages. Many of these jobs are in regional and remote areas across Australia.

Over the course of the development of the gas industry, many tens of thousands of workers have been employed in construction, maintenance and ongoing operations.

> In 2021-22, oil and gas extraction employed 488 people within the council area, with $401.5 million in local sales … The MRC requests that the Australian Government ensure that any new gas strategy be carefully explored so that we will not lose jobs in our part of regional Queensland.
> **Maranoa Regional Council (MRC)**

Managing gas prices

Most gas is sold under contract

In Australia, most natural gas is bought and sold under bilateral contracts in the gas wholesale markets. As a result, there is no single market clearing price. The long-term nature of contracts gives producers the confidence to invest in new supply, while also giving consumers the confidence to invest in end-use production facilities. Wholesale spot markets, through which retailers or large gas users can buy gas without entering into a contract, is a smaller but growing component of the market.

Costs of production may increase prices

Costs are likely to increase over time in all gas markets. As gas reserves deplete and fields approach their economic end of life, sustained production will require additional investment. Eventually, production must shift to more expensive sources of supply. For example, a number of LNG import terminals have been proposed for the east coast. Any gas supplied through such LNG import terminals could be more expensive than gas developed closer to demand centres. This is because international LNG prices are historically higher than domestic gas prices and because of the costs associated with converting gas to LNG, transporting it by sea then re-gassing it at port, before its onward transport by pipeline.

The cost of abating or offsetting emissions associated with gas production, transport and use may increase with time. Typically, retail costs will also increase in line with wholesale cost increases.

Ensuring the wellbeing of Australians in changing times

In 2022, the Australian Government partnered with states and territories to deliver the Energy Price Relief Plan. This intended to address the immediate impact of price increases on Australian households and small businesses. Through the Energy Price Relief Plan the government:

- made a targeted intervention to limit gas and coal prices
- provided energy bill relief for households and small businesses
- drove investment in cleaner, cheaper, more reliable energy for the future.

The Australian Government has also entered into the Australian East Coast Domestic Gas Supply Heads of Agreement. The Heads of Agreement is a voluntary, industry-led agreement between the government and east coast LNG exporters. Its objective is to ensure:

- a sufficient supply of natural gas to meet forecast needs of energy users in Australia
- Australian gas users have access to affordable gas.

The Heads of Agreement works together with the ADGSM to prevent a gas shortfall in the east coast gas market.

In 2023, the ADGSM was reformed to allow for flexibility in responding to domestic gas supply shortfalls. The ADGSM ensures there is sufficient natural gas supply to meet the forecast needs of Australian energy users. The ADGSM gives the Australian Government's Minister for Resources the power to control the export of LNG if a domestic gas shortfall is forecast. It remains a measure of last resort to protect Australia's domestic energy security.

On 11 July 2023, the government's Gas Market Code of Conduct (the Gas Market Code) came into force and builds on the above measures. The Gas Market Code, which will be reviewed in 2025, ensures that east coast gas users can contract for gas at reasonable prices and on reasonable terms. It is designed to:

- secure additional supply commitments to anchor domestic prices at $12/GJ
- provide certainty to investors and incentivise new domestic supply to avoid projected shortfalls
- sustain reasonable domestic gas prices over the medium term.

While contract and spot prices vary across eastern Australia, the Gas Market Code sets a price anchor ($12/GJ) to which exemptions can be granted. These exemptions incentivise producers to commit extra supply in the short term and help investment in the medium term. This supports access to gas at reasonable prices and on fair terms. In January 2024, the Minister for Energy and Minister for Resources jointly announced that 4 exemptions under the Gas Market Code had resulted in the commitment of 564 PJ of gas to the east coast market from 2024 to 2033. This provides more affordable gas to the Australian market in the short to medium term.

West coast contracting and pricing reflects the presence of large producers and consumers of gas, which enter into long-term take-or-pay gas sales agreements. The Western Australian Government's domestic reservation policy requires delivery of 15% of export production to WA's domestic market. Households and residential users, represent a small portion of WA's gas market.

Government policies that manage acreage release, tenement and permit allocation and reservation, among other policies, also influence the market structure and dynamics. In Queensland, an Australian Market Supply Condition may be attached to a petroleum lease, with the objective of increasing supply and lowering prices for domestic users.

The Australian Government's focus through the net zero transition is to ensure all Australians have access to reliable, sustainable and affordable energy. The evolution of Australia's gas markets and how this affects communities and businesses will occur in parallel with broader changes required to transition our economy to net zero. The wellbeing of Australians is central to a successful energy transition.

Principle 3: Finding new sources of gas to meet demand.

> **Principle 3:** New sources of gas supply are needed to meet demand during the economy-wide transition. Government policies to enable natural gas exploration and development should focus on optimising existing discoveries and infrastructure in producing basins, applying technology-neutral approaches to exploration data acquisition (to minimise seismic surveying where possible), prioritise energy security, and align with our net zero emissions targets. Robust environmental approval processes are key to the social license of the gas industry.

Summary

Gas remains crucial to our economy and region to support the transition to net zero. To meet our future energy needs and decarbonise our economy, we need continued gas supply:

- at the right time
- in the right place
- with high levels of workplace safety and conditions
- at the lowest cost
- at the lowest emissions intensity
- with the least impact on our environment
- with the maximum benefit for communities.

In the near term, there is concern around the potential for demand to outstrip supply over coming years. This annual supply gap is forecast to emerge in 2028 on the east coast and by 2030 on the west coast if there is insufficient new supply developed. Meeting these supply challenges will need location-specific solutions, including:

- maximising production from existing resources and developing adjacent new gas fields supplying the domestic market, provided environmental impacts can be managed
- demand reduction through the net zero sectoral plans
- gas substitution through expanding the supply of low emission gases
- LNG producers making more gas available to domestic users
- expanding gas infrastructure, including pipelines and LNG import terminals.

We will likely need to explore all of these solutions to meet our gas demand needs through to 2050.

Developing new gas supply is technically challenging, expensive, and a lengthy process. Gas fields deplete as gas is extracted. Exploring for gas requires advanced technology and techniques, such as seismic surveys which, as with any other human activity, have the potential for some level of impact on the environment and must be managed accordingly. We need new and continued investment to develop and sustain supply to meet demand. This investment is facilitated by a strong regulatory framework that aims to balance environmental and social impacts while encouraging new supply. There is always room to improve our regulatory settings. They must remain fit for purpose to achieve Australia's goals.

Without continued investment in Australia's gas sector, both the east and west coast markets could experience gas price and supply volatility. In the near term, potential shortfalls in gas supply could increase volatility in gas markets and drive up prices. Without further investment in new gas supply and gas infrastructure, these shortfalls will negatively affect Australian households and businesses, and the reliability of our electricity system.

Alternative gas sources may also meet demands for gas. Low-emission gases such as hydrogen and biomethane may become important elements of Australia's energy landscape, as well as adding to our exports. These low-emissions gases are not yet produced at a scale or price able to compete with natural gas. However, they are expected to become more competitive as technology costs reduce and these gases are produced on a commercial scale.

Read Appendix A for more information about the scenarios that are used to help shape forecasts in this section.

Read Section 2 of the analytical report for information about alternative clean fuels, Section 5 of the analytical report for the natural gas supply outlook, and Section 7 for analysis of options to close the supply gap.

Where is natural gas produced today?

While Australia has substantial gas resources, they are not evenly spread. Most of Australia's remaining gas reserves are offshore, in the Northwest Shelf region, onshore Queensland, and onshore and offshore Northern Territory. This places most of the Australian gas resources and reserves geographically far from demand centres in the southern states. Gas produced in Commonwealth waters, south of Victoria, has declined to low levels after 50 years of production (figure 8). This offshore resource in Commonwealth waters is processed in Victoria, and supplied to customers in Victoria, Tasmania, NSW and South Australia.

The Australian Capital Territory does not produce gas. New South Wales, which currently produces minor quantities of natural gas, plans to develop resources around Narrabri in the Gunnedah Basin. If developed, Narrabri is expected to produce around 70 PJ per year for the domestic market once fully operational.

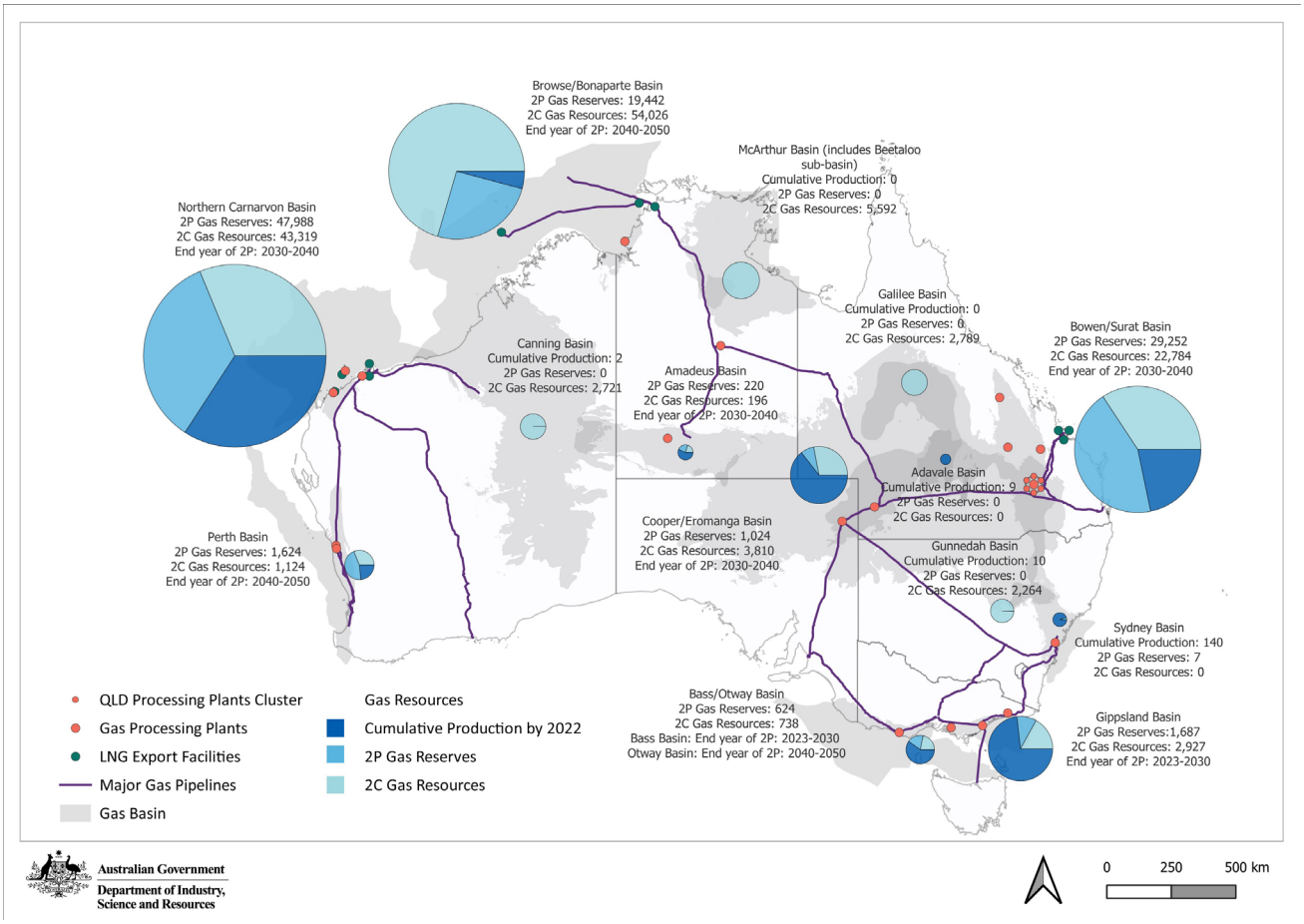
This production does not precisely align with gas markets. Australia has three distinct market segments with materially different outlooks for gas.

- East coast gas market has two segments:
    - southern states comprised of NSW, ACT, Victoria, South Australia, and Tasmania
    - northern states of Queensland and the Northern Territory.
- Western Australia is physically separated from the east coast gas market.

With local production in the Bass Strait approaching end of life, the southern states face the prospect of becoming dependent on gas transported from northern gas fields, or on yet-to-be-completed LNG import terminals to meet domestic demand. However, as noted previously, LNG imports to the east coast may be more expensive than the nearby depleted sources in offshore Commonwealth waters near Victoria.

Responsible management of Australia's natural gas resource is critical for securing the stable and affordable energy supply needed for economic growth while aligning with Australia's emissions reduction targets. Without future investment, there are real risks gas will become unaffordable and unavailable to Australian households and industry well before 2050. Accordingly, further exploration, acreage release and gas production will be required.

Figure 8: Australian gas basins, pipelines and LNG facilities

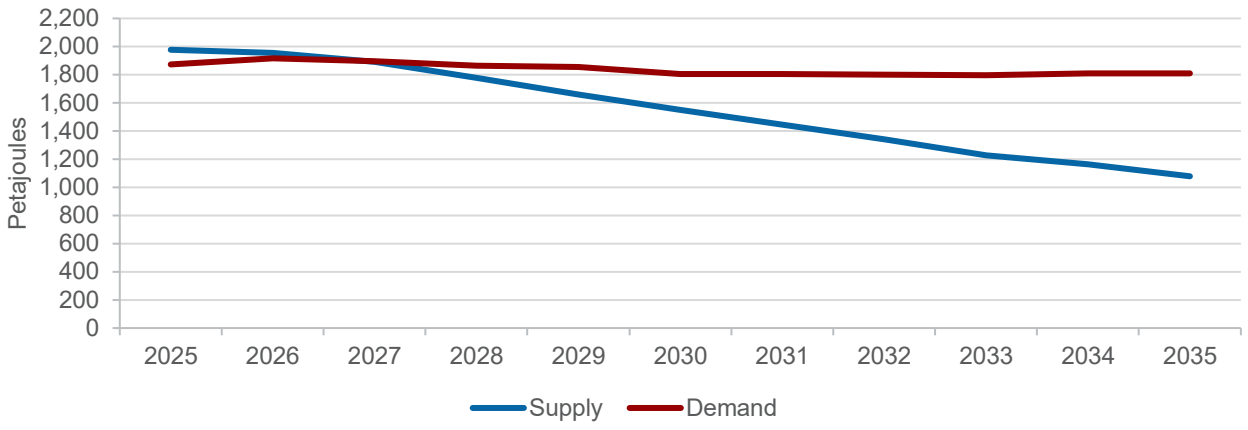


Calendar Year 2022. Source: Analytical Report, Figure 5.7

Future gas gaps

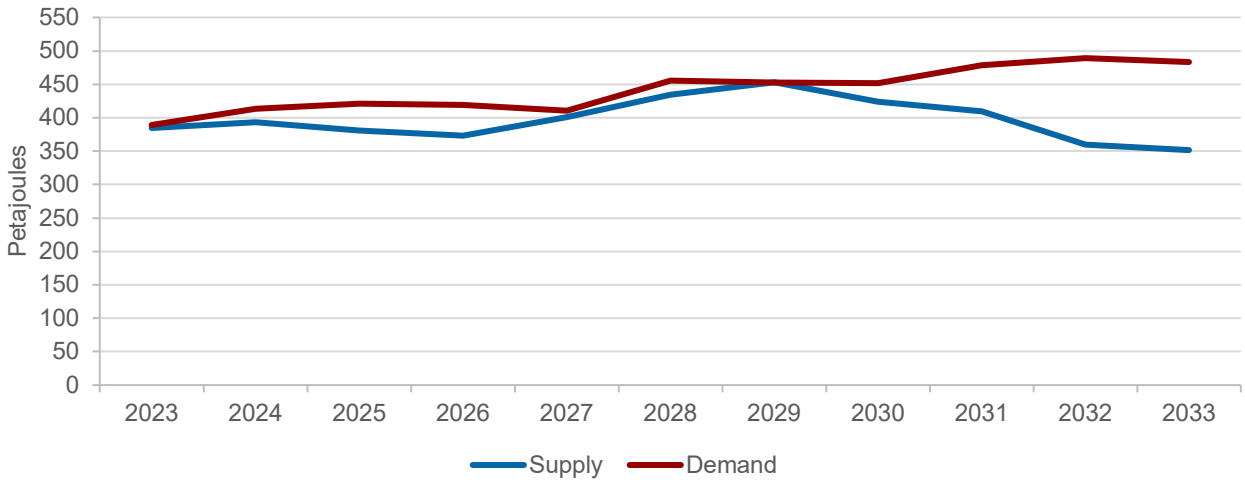
Without further gas projects or development of gas currently under retention lease, an annual gas supply gap is forecast to emerge by 2028 on Australia's east coast and grow over time (figure 9). On the west coast, a gas supply gap is expected to emerge around 2030 (figure 10) and grow substantially from 2030 due to a forecast increase in GPG demand from coal-fired stations closing.

Figure 9: East coast gas supply and demand outlook, 2025–2035



Source: Analytical Report, Figure 5.1

Figure 10: West coast domestic gas supply and demand outlook, 2023–2033



Notes: Does not account for gas sold as LNG from offshore basins due to data limitation. Both gas supply and demand are based on AEMO's Expected scenario from WA GSOO (2023).

Source: Analytical Report, Figure 5.2

AEMO and the ACCC update their forecasts regularly and have forecast shortfall risks in the past. However, we avoided these shortfalls thanks to new supply being brought on by the market. Due to factors covered under Principles 1 and 4, the future of gas consumption in Australia is increasingly uncertain. This creates investment uncertainty which potentially reduces new supply.

Exploration and investment in the gas industry has been low over recent years. Stakeholder consultation has indicated the following, unranked range of factors that might contribute to low investment levels:

- global developments, such as cyclical (and structural) movements in oil and gas markets and prices as well as international government policies
- uncertainty over low-emission gas demand, particularly demand required to achieve net zero
- government project approval processes
- legal challenges which delay projects
- concentration of the titleholders of undeveloped reserves contributing to 'gas hoarding' behaviour
- government interventions that affect investment conditions
- the decline in the social license required for the gas industry to operate in Australia
- the decline in access to project finance from financial institutions
- commercial decisions to postpone capital expenditure to give greater dividends to gas company shareholders in the short term.

Possible sources of additional domestic supply

The east coast gas market could have sufficient gas supply to meet domestic and export demand at least out to 2035. According to estimates prepared by the ACCC, supply could be met if discovered resources and reserves are developed. The potential locations of gas supply in the east coast gas market could include the Bowen, Surat, Galilee, Cooper, Gippsland, Bass, Otway, McArthur (Beetaloo) and Gunnedah basins.

Most projects located in these basins are yet to reach final investment decisions. Because of this, they are subject to various contingencies including commercial factors, regulatory approvals and infrastructure constraints. Many projects are in the early stages of exploration and appraisal.

Gas transport and storage infrastructure is constrained in south eastern states

In contrast to the southern states, only around one-third of current gas reserves in Western Australia and Queensland have been produced, and the Northern Territory has only used 4% of its gas reserves. Current transmission infrastructure linking northern supply to the south is, however, limited. As a result, more investment in pipelines and storage capacity would be needed for northern gas to provide a long-term solution to southern gas needs.

While the capacity of the major pipeline that connects Queensland and the Northern Territory to southern gas markets has been increased. AEMO forecasts this north-south transportation will be increasingly relied on to meet southern gas demand, with gas flows approaching capacity limits under high demand conditions, for around 10-20% of the year from 2026. AEMO (2024) further forecasts that storage levels will require increasingly careful management, and may not meet gas demand during temperature extremes.

We have mechanisms to divert uncontracted gas to the domestic market through the Australian East Coast Domestic Gas Supply Heads of Agreement, and contracted export gas to the domestic market through the ADGSM, which is a measure of last resort. These are, however, only able to ensure gas supply for the southern states within the limits of existing infrastructure constraints to transport the gas to market.

There are options to meet the west coast's potential supply shortfalls

In the near term, AEMO identifies a number of near and longer-term solutions to prevent gas shortfalls. Gas storage could help manage fluctuations in demand, subject to storage availability and the duration of supply needed from storage.

Over the medium and long-term, a combination of supply from undeveloped gas fields and reductions in gas demand may reduce shortfall pressures. For instance, on 9 January 2024, WA's largest gas user, Alcoa, announced the closure of its Kwinana refinery. While this resulted in hundreds of job losses in the region, the plant consumed approximately 5% of domestic west coast gas demand.

The Western Australian Government has continued to release onshore gas acreage in the Canning, Northern Carnarvon, Amadeus and Perth Basins, which, if developed, would improve the state's supply outlook through its Domestic Gas Policy. Developments in the Perth Basin are the most likely, near-term solutions to Western Australia's forecast gas shortfalls. AEMO (2023) has considered the Bonaparte, Browse, Canning or Roebuck Basins will not contribute to domestic supply to 2035. However the Domestic Gas Policy will ensure these resources, along with the Scarborough LNG project, will contribute to WA supply in the long term.

The Western Australian Parliament is reviewing Western Australia's Domestic Gas Policy to ensure it remains fit for purpose and is being adhered to.

New gas supply is … critical to meet the needs of the WA market in both the short and long-term, [to] displace high-emitting energy sources such as coal and diesel and provide a flexible energy source to support renewable generation, ensuring an orderly energy transition. On the demand side, the WA Government expects gas demand to increase into the 2030s, particularly as coal-fired generation is retired and new mining and mineral processing projects are developed.
Government of Western Australia

Sources of gas supply from outside Australia's oil and gas sector

Low-emissions gases, such as hydrogen and biomethane, make a small contribution to Australia's current energy mix. Scaling alternative sources of gas supply is a critical opportunity for Australia.

Once commercialised, low-emissions gases can complement or replace natural gas. Low-emission gases include biomethane and hydrogen. Combusting biomethane releases the carbon absorbed by the biogenic material from the atmosphere during its life. On this basis biomethane is often considered to have net-zero carbon emissions. This is consistent with the approach used by the Intergovernmental Panel on Climate Change (IPCC) in guidelines for national greenhouse gas inventory reporting and accounting for bio-based energy sources.

Over time the low-emissions gas sector in 2050 could grow to compete effectively with natural gas producers. This would occur where the production costs of low-emissions gases can match or outcompete incumbent fossil fuels. As an international example, in 2022, almost 40% of Denmark's gas consumption came from biomethane. In the same year, Denmark's total energy consumption was 560 PJs, with 75 PJs met using natural gas and 50 PJs from bioenergy and waste, which includes biomethane. Denmark's ambition is to use 100% biomethane in space heating by 2030.

Australia has different challenges to Denmark, but important lessons apply. Denmark needed further investment in its gas networks to support the growth of its biomethane sector as well as cooperation and buy-in from its agricultural sector. Biomethane supply locations in Australia will be driven by suitable feedstock availability, proximity to transmission and distribution infrastructure, and the cost competitiveness of supply. Additionally, competition for bio-feedstocks will occur from other biofuel producers, such as companies who would produce sustainable aviation fuels.

Biomethane, which is fully interchangeable with conventional methane produced by the oil and gas sector, can be used in the same end applications as natural gas. In 2021–22, biogases contributed 18 PJ of energy and was mostly used in electricity generation. Most biomethane in Australia is consumed where it is produced. Where possible, biomethane developments would be best located in southern regions to support the high local seasonal demand and avoid pipeline constraints. However, even a rapid expansion of biomethane production cannot completely close the forecast gas supply gap.

Biomethane is an internationally mature technology and operating at scale … The global biomethane industry is also anticipated to generate $5.5 billion by 2032, having achieved a value of $3.1 billion in 2022.
Bioenergy Australia

Hydrogen is a high potential fuel for producing high-temperature heat and is a useful source of molecules for industrial processes. For production of ammonia, a critical ingredient of fertiliser, hydrogen is the only known pathway to decarbonise production. Australia's National Hydrogen Strategy is being reviewed to develop a pathway which will position Australia's hydrogen industry as a major global player by 2030.

Gas-to-hydrogen switching is expected to be most suited to industrial/mining and power generation sectors. Most hydrogen production today uses fossil fuels, particularly natural gas and coal.

There are significant challenges in supplying these gases economically at the scale needed by industry and power generation. As well as scale, the cost of the hydrogen and effectiveness in industrial processes may place limits on its use. Biomethane can directly supply and substitute natural gas and therefore may be deployed sooner than hydrogen.

Another source of natural gas supply, which is difficult to quantify, could come from Australia's coal industry. Australia's coal sector produces and sells natural gas. Natural gas is drained from coal seams for safety reasons and to reduce the emissions intensity of coal mining. About 90,000 homes in Queensland are powered from captured natural gas produced from underground coal mining operations in Queensland.

Coal miners are expected to produce more natural gas to reduce the emission intensity of coal production under the incentive created by the Safeguard Mechanism. Most natural gas produced during coal mining is consumed on site. Incentives created by the Safeguard Mechanism will encourage greater capture of fugitive methane from Australia's coal sector. This will create a new source of natural gas supply that could be directed into our gas market.

Our regulatory systems seek to balance the benefits and costs from gas production

Oil and gas activities are regulated by all levels of government with multiple government agencies in each state or territory playing a role. All levels of government are also committed to reducing greenhouse gas emissions to achieve their climate targets and address dangerous climate change.

State and territory governments primarily regulate the onshore production of oil and gas resources. These regulations cover the lifecycle of a project from explorations tenements to site closures and offshore facility decommissioning. The Commonwealth regulates offshore oil and gas in Joint Authorities with the relevant state or territory.

Across all levels of government, regulatory approvals processes seek to protect the rights and interests of the people and communities that gas development impacts. This includes the environment, water resources, Traditional Owners, landholders, and local communities.

First Nations people and regional communities

Whether onshore or offshore, gas exploration and production often takes place in areas of cultural significance to First Nations people. In some cases, First Nations people have legislated rights in relation to lands and waters. In the Northern Territory, Aboriginal land held under the *Aboriginal Land Rights Act 1976* provides a right of veto to Traditional Owners in relation to exploration. Nationally, Native Title holders and registered Native Title claimants have different procedural rights (such as the right to negotiate) relating to oil and gas interests.

In some cases, Native Title holders and claimants oppose future gas development. In others, gas companies and First Nations people have developed positive relationships, supporting

economic development. Successful projects occur when gas proponents engage with First Nations landholders and peoples with interests in the project. This often involves considering opportunities for partnerships, agreement making and benefit sharing, strong consultative mechanisms, appropriate cultural heritage protections, support for informed decision making, and facilitating real opportunities to develop pathways and opportunities to participate in the transition to net zero. In some instances, First Nation's people may also co-invest or co-own a project.

Djaara want to ensure renewable energy developments on Djandak benefit Djaara and avoid negatively impacting Country, Native Title, Cultural Heritage, land rights and Dja Dja Wurrung's Recognition and Settlement Agreement (RSA). ... Together we can create a sustainable and clean energy future that elevates Djaara biocultural knowledge and connection to Country and through genuine partnerships with Djaara can heal people, Country and our climate.
Dja Dja Wurrung Clans Aboriginal Corporation (trading as DJAARA)

Offshore project proponents must consider the connection of Traditional Owners with sea country during activity planning. The government released a discussion paper in January 2024 on the consultation requirements for offshore petroleum and greenhouse gas storage activities. The government is developing options to clarify the requirements and ensure consultation is appropriately targeted to the needs of people or organisations who may be impacted by the activity. This process forms part of a broader, three-year review of the offshore environmental management regime.

Many of Australia's Traditional Owners may agree that there are significant social benefits in seeing an Australian gas industry that can support the nation's transition to a ultimate net zero economy. Some may not. Those that do, are entitled as rights holders to also seek to ensure that any development on their traditional lands and waters also supports their own community's economic prosperity and cultural integrity.
National Native Title Council

The government is working with Aboriginal and Torres Strait Islander people to achieve a better future by identifying ways to make a practical difference and help close the gap. The government has set up a First Nations Reference Group to work in partnership with the government to design and carry out the Remote Jobs and Economic Development program. The Remote Jobs and Economic Development program will create 3,000 jobs in remote Australia, to help close the gap in employment outcomes and boost economic opportunities. The program is part of the government's plan to replace the Community Development Plan and give Aboriginal and Torres Strait Islander people in remote communities access to real jobs, proper wages and decent conditions.

The gas production industry can provide a valuable basis to support Australia's transition to a net zero economy. In doing so the industry can also provide an important vehicle for recognition of the rights of Traditional Owners and a foundation for the future economic prosperity and cultural integrity of Australia's First Nations.
National Native Title Council

Regional communities in Australia can rely on a single company or industry to support community wellbeing and prosperity. Both climate change and the economic transformation needed to reach net zero are already impacting these communities through adverse weather events as well as both the growth and destruction of local industries.

To manage and respond to long-term structural shifts in Australia's economy resulting from the energy transition, the Australian Government is establishing the Net Zero Economy Authority to promote orderly and positive net zero economic transformation for Australia, its regions and communities. It will do this by coordinating effort, brokering investments that create jobs in the regions, and working with the Department of Employment and Workplace Relations to support workers through change.

> The Central Highlands region will encounter some economic decline associated with the energy transition … and seeks to smooth that impact with transformational opportunities – one such opportunity is the construction of the Bowen Basin Gas Pipeline, connecting the Bowen Basin gas fields to the Curtis Island LNG facilities, and enabling longer term gas production and export from this region.
> **Central Highlands Regional Council**

We need new sources of gas supply to meet demand during the economy-wide transition to net zero and beyond. As discussed, gas consumption is not uniform across Australia, and new sources of supply are likely to be most economic when production is close to existing infrastructure. Gas development and depletion of existing gas fields impact the surrounding regional economies. This needs to be managed to maximise the benefit of gas production, while minimising emissions and the impact on First Nations people and local communities. Robust approval processes are key to the social license for new gas supplies.

Principle 4: Gas use will shift to higher-value and non-substitutable uses over time.

> **Principle 4:** Reliable gas supply will gradually and inevitably support a shift towards higher-value and non-substitutable gas uses. Households will continue to have a choice over how their energy needs are met.

Summary

Forecasting future gas consumption is difficult due to a wide range of variables that affect demand for gas. Based on currently available data, the analytical report forecasts that:

- gas consumption is forecast to continue beyond 2050 in its critical role for peak loads and firming in power generation
- for the industrial sector, gas use will continue beyond 2050 where electrification, other renewable technologies and low-emissions gases are not available or are too expensive
- households and small businesses will have, for the most part, electrified by 2050, although this will differ across the nation. Low-emissions gases may continue to be used in some locations.

Read Section 3 of the analytical report for analysis of the domestic supply outlook.

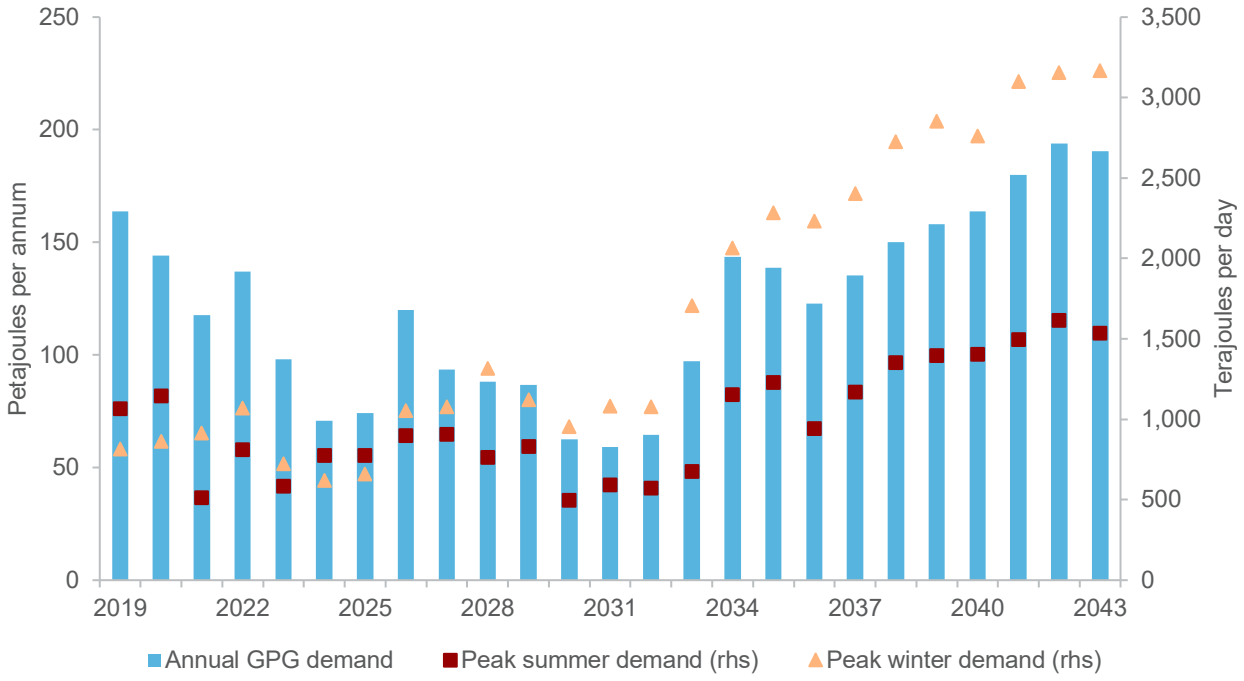
Gas-powered generation

GPG will underpin Australia's electricity supply in the transition to a net zero economy. It is likely that gas will still play a role in electricity generation up to and beyond 2050.

On the east coast and in the Northern Territory, GPG will be used to firm up the supply of electricity as coal-powered generators are retired. It will also be used to manage short, daily periods of peak demand which cannot be met by alternative sources.

Projections from the AEMO show east coast GPG will decline then stabilise as more renewable sources of generation enter the grid in the near term. While *annual* GPG demand is expected to fall in this period, peak *daily* demand is expected to increase by three times what it is today (figure 11). As coal generators retire and the need for electricity increases, both *annual* and peak *daily* demand is projected to increase after 2033.

Figure 11: Annual and peak day GPG demand, step change scenario, 2019–43



Notes: 1000 Terajoules is equal to 1 Petajoule. Source: Analytical Report Figure 3.11

Peaking and firming GPG is an important component of the National Energy Market (NEM) to 2050 and beyond. Demand for natural gas by the GPG sector will depend on the availability of low-carbon alternatives such as hydrogen, energy storage and the ability to abate natural gas safely and effectively.

On the west coast, GPG will continue to be an important source of electricity generation. It will continue to provide firming and peaking support as more renewables enter the system and low-carbon alternatives become economically viable through to 2050 and beyond. Small-scale generation on mine sites could switch to GPG or to renewables firmed by GPG.

Across Australia, the future demand for natural gas for GPG to 2050 and beyond will be highly dependent on the speed and timing of technological development and commercialisation of low-carbon alternatives. These alternatives include hydrogen powered generators, pumped hydro, batteries, biomethane and other biofuels.

The Australian Government, in partnership with the states and territories, is active in supporting this transition. The $20 billion Rewiring the Nation program will modernise Australia's electricity grids and deliver new and upgraded transmission infrastructure. The Capacity Investment Scheme will encourage new investment in new renewable capacity nationally. Building on the National Energy Transformation Partnership framework, these measures will deliver the Australian Government's 82% renewable electricity by 2030 target.

Why will Australian industry and manufacturers still need gas in the future?

Gas demand from Australian industrial users is likely to remain stable to at least 2035. Demand reduction by east coast industrial and mining consumers is expected to be modest. The west coast and the Northern Territory have a high concentration of industries which use high heat, as well as large mining and minerals processing sectors. The modest overall projected declines in gas consumption reflect how industrial and mining uses offer the most challenging prospects for abatement.

Reducing demand may require:

- advancement in a range of different technologies
- changes in industry operations that switch from carbon-based feedstocks to alternative inputs
- electrification of high-heat processes or switching to low-emissions gases.

The need for gas in high-heat manufacture of products such as concrete, glass and steel, will likely persist. Low and some medium heat applications are expected to be electrified as commercial alternatives scale up, and become more cost competitive and operationally reliable. Higher heat applications require technologies that need further research, development, and operational testing. Some users may also need to turn to gas to replace more polluting fossil fuels on the pathway to net zero.

Gas as a chemical feedstock to manufacturing processes cannot be electrified and will require direct substitution. Altering the feedstock used in a process is not straightforward, as chemical processes are typically fully integrated into the facility. This means investment in new infrastructure and supply chains will be required. Transition is likely to require a change to the whole operation rather than a gradual change to the facility. Such changes involve significant capital outlays and require extensive testing and planning.

The pathway to decarbonisation is likely to involve increased demand for gas for some users. The steel industry provides a good demonstration of this. Today's steel production involves passing inputs of iron ore, coking (metallurgical) coal and limestone through a blast furnace and basic oxygen furnace to produce steel. Emissions per tonne of steel are 2.2t CO_2. Replacing coal with natural gas in direct reduced iron and electric arc furnaces significantly reduces emissions to 1.4t CO_2. As a result, the natural gas demand from steelmaking will increase, but emissions will reduce.

Our current Australian domestic consumption of network gas is around 4PJ. In addition, BlueScope also uses 28PJ of indigenous gas produced as a by-product of the steel blast furnace and coke ovens at the Port Kembla facility. Gas is also used at midstream sites in New South Wales and Victoria such as paint lines and coating lines where it is used to fire furnaces and ovens and support high heat processes above 800 degrees Celsius. Technology to electrify these processes is nascent and not currently viable. Biomethane could potentially fill this demand if sufficient volumes were commercially available. However, BlueScope will continue to be a significant gas user into the future ...
BlueScope Steel

The pathway to decarbonisation is complex for gas use associated with LNG facilities. These facilities consume large volumes of gas; Australia's emissions from the production and extraction of LNG are estimated to account for 37 million tonnes of CO_2 equivalent, amounting to around 8% of Australia's total emissions.

The economic viability of electrifying LNG facilities is determined by a number of factors including the remaining facility life, and the emissions intensity of the connected electricity supply. Electrification, while offering significant efficiencies and operating cost reductions, would require significant capital expenditure and security of supply of electricity to the facilities. Electrification is, however, becoming more cost-effective and could offer a significant reduction in gas demand in the future.

Chevron's WA facilities … require reliable generation to avoid plant upsets and trips resulting in large emissions increases from venting or flaring … There are also technological challenges in developing large power electrical drives capable of replacing existing gas turbine drivers.
Chevron Australia

Through the Resources Sectoral Plan for Net Zero additional actions will be recommended, including dedicated sectoral decarbonisation targets across Australia's LNG value chain. The Resources Sectoral Plan for Net Zero offers an opportunity to provide certainty through a long-term plan that helps drive investments in low-emissions technologies and in emissions abatement in the gas sector, including CCS.

Decarbonisation of the Ichthys LNG facilities and its progress to net zero emissions remains a significant challenge …The key decarbonisation opportunities that are currently being pursued by INPEX in relation to the Ichthys LNG facilities are, (1) carbon capture and storage … (2) import of power with a high percentage of renewables … and (3) fuel-switching from gas to hydrogen for currently gas-fired turbines …
INPEX

In all cases, businesses will weigh facility-level infrastructure investments and end-of-life value against the cost of reducing their emissions intensity. In that calculation, businesses are more likely to switch if alternatives are reliable and cost effective. Initiatives that de-risk alternatives by quantifying whole-of-life price, performance, reliability, and safety will support industries make informed choices during the transition.

In some cases, supply-side shortages will have a flow-on effect on consumer goods. For instance, the cost of urea (a nitrogen fertiliser manufactured using natural gas) rose sharply with global gas prices in 2021-22. Gas supply shortfalls are likely to lead to further price spikes and higher import reliance for this key input to agricultural production. If sustained, these higher input costs will impact farm profitability and put upward pressure on consumer food prices.

Overall, this means some gas use may continue to 2050 and beyond. Industrial consumers may need to offset their emissions until it becomes commercial to replace natural gas with low-emission gases.

Why will Australian households still need gas?

Energy efficient electrical appliances already exist and are readily available to replace the main household uses of natural gas: stovetops, hot water heating and space heating. Most households are likely to embrace opportunities to reduce their energy bills and emissions by switching from gas to electric appliances when existing appliances need replacing. This switch may not be technically or commercially practical in all situations.

In some locations, the low-emissions gas market may provide a gas alternative where electrification is not feasible. This assumes that this gas can be delivered to where users need it at an affordable price.

The rising cost of remaining on the reticulated gas network can provide the economic incentive to transition for those able to control – and afford – the cost of switching. However, renters, those in community and social housing, and low-income households, have limited or no control over whether they electrify, even where they might want to transition.

> For households who use gas, shifting off gas and improving energy efficiency is the best way to lower bills, gas demand and emissions. … Our recent research report … found low-income households were supportive of shifting off gas but faced a number of barriers including those related to capital, information and trust.
> **Brotherhood of St Laurence**
>
> New migrants and low-income families will need additional time and support to transition off gas. Recovering the cost of ageing network infrastructure from residential customers will leave them in a precarious situation of being stuck in a highly unaffordable energy system … which will leave a disproportionate burden on low-income households.
> **Voices for Power – Sydney Community Forum**

State and territory governments are active in providing information, incentives and direct support for households and small businesses. The Australian Government has a range of programs to support both households and businesses improve energy efficiency and transition from gas. The recently announced Household Energy Upgrades Fund, provides $1 billion to help finance household energy upgrades, and a further $300 million to support upgrades for social housing.

Across GPG, industry and households, gas consumption is forecast to continue beyond 2050. It will take time to develop and commercialise new technologies and processes to abate current gas consumption. In the meantime, gas is needed to support the net zero transition including in industries such as critical minerals processing. While many gas-reliant households and small businesses are able to electrify using current technology, vulnerable households and communities will require support to transition, and some households may choose to continue to use gas.

Principle 5: Adapting the gas and electricity markets.

> **Principle 5:** Gas and electricity markets must adapt to remain fit for purpose throughout the energy transformation.

Summary

Australia's gas market can be broadly divided into three segments:

1. An upstream segment, which comprises companies that explore, produce and process gas from a variety of sources. These include fossil fuel sources, such as underground gas reservoirs and from coal mining operations, and non-fossil fuel sources, such as biomethane and synthetic methane.
2. A midstream segment, which includes gas storage facilities and a pipeline network that transports and distributes gas to homes and businesses. The network comprises larger, high-pressure pipes to move gas vast distances and smaller, lower pressure pipes to deliver gas to individual consumers. It also includes LNG import terminals.
3. A downstream segment, comprising homes and businesses which use natural gas for heating, cooking, and manufacturing.

This section considers the midstream section as upstream is discussed under Principle 3, and downstream under Principle 1 and Principle 4.

Pipelines link all states and mainland territories in Australia, except Western Australia. The Australian Energy Regulator regulates pipelines in all jurisdictions except Western Australia, where the Economic Regulation Authority (a WA state regulator) performs this role.

As gas production in Commonwealth waters and processed in Victoria reaches end of life, the ability to move gas from where it is produced in the north to where it is needed in the south, is becoming increasingly necessary. Gas pipelines are already a critical feature of Australia's gas infrastructure, but have capacity limits. Gas storage plays an increasingly important role, particularly during high-demand periods in winter, and import terminals may play a role in the future. However, as observed earlier, gas from LNG import terminals may be more expensive than gas extracted closer to demand centres.

Existing gas infrastructure may be able to be used for low-emission gases in some cases.

Read Section 6 of the analytical report for more information on competition, costs and pricing, and Section 7 for more information on pipelines and import terminals.

Moving gas is expensive

Gas development and transportation has high fixed costs. Ongoing production, however, has lower, short-run marginal costs. As a result, gas is more affordable in locations where:

- gas is consumed where it is produced, or
- the significant fixed development costs is spread across a large user base consuming a large volume of gas.

Both exploration for, and development of, gas resources is expensive. This increases barriers to entry for new market participants and tends to lead to market concentration, where a few market participants control a large proportion of the market.

Pipelines, storage and re-gasification terminals

Australia's gas infrastructure is critical to delivering reliable and affordable energy to households and businesses. This infrastructure has expanded and adapted over time to meet the growing energy needs of Australia and changing sources of supply.

Gas pipelines allow the transport of gas from where it is produced and processed to where it is used. Gas storage facilities are vital for managing demand and supply fluctuations. These facilities store surplus gas produced in summer for use in winter, when the demand is higher.

Gas storage plays a crucial role in balancing supply and demand. Adequate storage near high-demand areas ensures timely delivery during peak times and helps to address peak day gas supply shortfalls (see Table 1).

Table 1: Australia's gas storage facilities

Site	Location	Primary purpose	Storage capacity
The Iona Gas Storage Facility	Warre near Port Campbell, Victoria	NEM peaking	24.5PJ
Roma Underground Storage Facility	Roma, Queensland	GLNG operational flexibility	>50PJ
Newcastle Gas Storage Facility	Newcastle NSW	NEM peaking and firming	1.5PJ
Dandenong LNG Storage Facility	Dandenong, Victoria	Wholesale/ industrial gas market, NEM	0.7PJ
Silver Springs Gas Storage Facility	Central Queensland	NEM balancing	35PJ
Moomba Gas Storage Facility	Moomba, South Australia	NEM peaking and firming	85PJ
Mondarra Gas Storage Facility	Dongara, Western Australia	Network support, wholesale gas management	18PJ
Tubridgi Gas Storage	Near Onslow, NW Western Australia	Network support, wholesale gas management	60PJ

Source: AEMO

LNG import terminals, also known as re-gasification terminals, are an alternative way to store and supply gas to consumers instead of traditional pipelines and storage infrastructure. There are four potential LNG import terminals at various stages of development in south eastern Australia (Table 2). However, there is still regulatory and commercial uncertainty around the development of re-gasification terminals in Australia.

Table 2: Proposed LNG Import Terminals

Company	Name	Current Status	Capacity	Earliest assumed timing
NSW				
Australian Industrial Energy (AIE)	Port Kembla Energy Terminal (PKET)	Construction Underway	130PJ/y	2026
SA				
Venice Energy	Port Adelaide	Pre-FID	80 PJ/y	2026
VIC				
Viva Energy	Geelong	FEED completed	80 - 140 PJ/y	2027
Vopak	Port Phillip Bay	Pre-FEED	150 - 200 PJ/y	2028

Notes: Figures are based on estimates and/or upper range.

Source: Analytical Report, Table 7.4

One of these terminals, operating at maximum capacity, could partially bridge the gap between expected supply and expected demand over the longer term. The combination of two import terminals operating at maximum capacity would be nearly able to bridge the gap between expected supply and expected demand out to 2042, and should be considered alongside other avenues to improve supply or reduce demand. While import terminals can provide supply to reduce the supply gap, this will expose south-eastern markets to the international LNG price.

Australia's west coast infrastructure is not subject to capacity constraints

The most important gas pipeline which delivers gas from WA's main gas fields to Perth and other gas users on the network is the Dampier to Bunbury Natural Gas Pipeline (DBNGP). Built in the 1980s and spanning 1,530 kilometres, the capacity of the pipeline is far beyond WA's forecast daily gas supply gap. In addition, the DBNGP was connected to another important transmission pipeline, the Goldfield Gas Pipeline, in July 2023. This provides an alternative gas supply route for consumers in the southern goldfields region. Infrastructure is not anticipated to be a barrier to meeting potential west coast gas shortfalls.

Australia's gas markets in transition to 2050

For the physical gas market, the current gas transmission infrastructure may not be suitable for gas needs in the future.

The current local gas distribution network is understood to tolerate a low percentage of hydrogen without adverse effects to infrastructure or end-user appliances. This marginally reduces the carbon intensity of the supplied gas. The IEA estimates that burning green hydrogen in boilers would require three-to-five times more renewable energy than highly efficient heat pumps to deliver the same amount of heat in a home.

In some low-pressure networks, different infrastructure may tolerate greater percentages of hydrogen. While transporting hydrogen in high pressure pipelines remains uncertain, Australia has reformed its national gas regulations to allow testing of hydrogen blending. Several tests are underway across Australia.

Biomethane is chemically identical to natural gas, and can be used in the existing natural gas infrastructure. While biomethane production may occur at the same location as its end use, it is also likely to develop in multiple locations close to available feedstock, particularly where it is also close to transmission and distribution infrastructure. This will need changes to the network to allow multiple input points.

Several projects across the world are exploring the potential of other low-emission gases to replace natural gas. Japan, for example, has set targets for synthetic methane – produced through combination of green hydrogen with carbon dioxide – to replace unabated natural gas. As an identical substitute, synthetic methane can enter existing gas infrastructure and appliances. This may create more opportunities for Australia's LNG industry to continue supplying gas into Asia. Successful deployment would need cost effective green hydrogen production, a rigorous carbon management solution and a deeply decarbonised LNG supply chain.

Read Section 2 of the analytical report for more information about alternative clean fuels.

Forecast gas shortfalls in south-eastern Australia can be mitigated by moving gas across significant distances, using pipelines and/or import terminals, and by carefully managing storage. This infrastructure may also be adaptable for low emissions gases in the future, particularly with regard to chemically similar products such as biomethane and synthetic methane, and may create opportunities for clean energy exports in the future.

Principle 6: Remaining a reliable trading partner for gas and low-emissions gases.

Principle 6: Australia is, and will remain, a reliable trading partner for energy, including Liquefied Natural Gas (LNG) and low emission gases. Australia's ambition to become a renewable energy superpower will involve developing new, low emissions energy exports to support the energy security and decarbonisation efforts of our trade partners.

Summary

Australian gas, exported as LNG, plays a central role in energy security and supports living standards in our region. It supports a reliable electricity supply and provides gas for cooking and cooling or heating homes in cities like Tokyo, Beijing, Seoul, Singapore, and Taipei. It will also support regional electricity grids as they transition from coal-fired power generation towards renewables.

We have seem large scale investment from regional partners in Australia's LNG industry over recent decades. This has benefits both to our trade partners, who rely on LNG for energy and as an input to many basic goods and services, and to Australia's economy.

During the transition to net zero, our trade partners' economies will change and the pathways they take to get there will differ. Ultimately, many of our trade partners will have a harder task compared to Australia because of their limited availability of cheap, reliable energy. Australian LNG will play a vital role in providing a reliable supply of electricity as renewable power sources become a larger part of the energy mix in our region, and as we work together to make low-emission gases like hydrogen more cost effective and readily available.

In all the scenarios considered in this strategy, Australia's LNG exports decline by 2050 (note this is not a policy setting). However, LNG still has a clear role to play in 2050 and beyond. By remaining a reliable LNG supplier and responsible climate actor, Australia can build new partnerships in emerging energy industries like hydrogen and clean energy exports. These relationships are important to Australia's national prosperity and to our domestic energy transformation.

While reductions in LNG demand are forecast over time, Australia is acting now to reduce LNG-related emissions. Reducing the emissions intensity of LNG and gas production in Australia advances our region's climate and energy goals. It also presents opportunities to scale carbon management solutions such as carbon capture and storage.

Continued supply of LNG can reduce the carbon intensity of our region's energy mix, including by replacing more emissions intensive fuels like coal. It will also support security and stability in energy markets as our trade partners to meet their climate commitments. Our LNG industry understands that this does not mean business as usual. Emissions from the extraction of gas and production of LNG are estimated to account for around 8% of Australia's total greenhouse gas emissions. These emissions must reduce for Australia to achieve net zero.

Scenarios are used to help shape forecasts in this section. Learn more about these scenarios in Appendix A.

Read Section 2 of the analytical report for more information about Australia's gas emissions, and Section 4 for more information about the international demand for natural gas.

How are Australia's LNG exports consumed today?

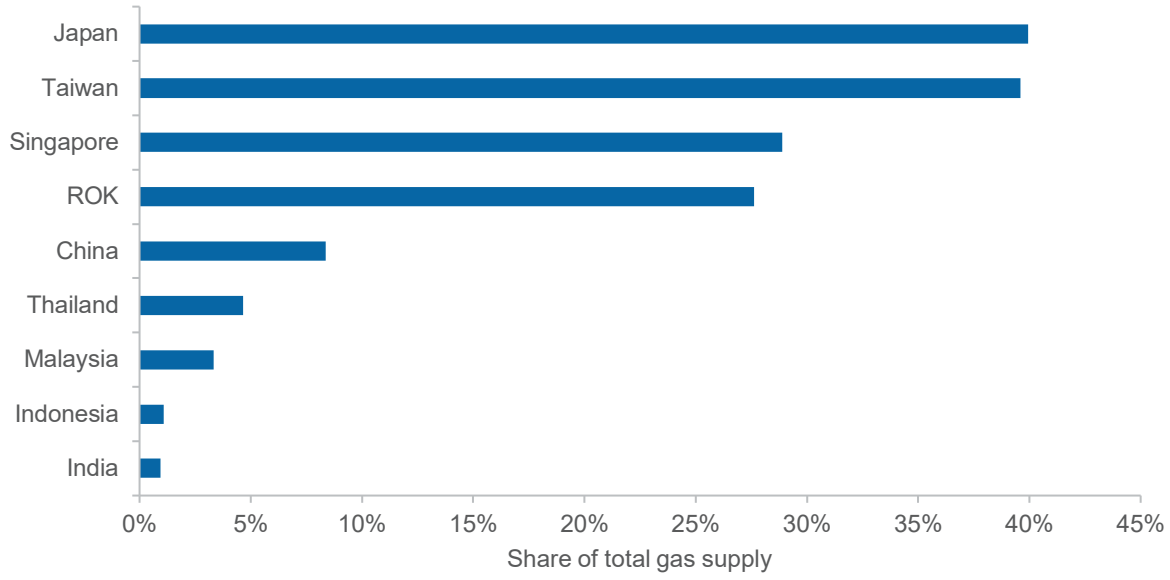
Australia accounts for a fifth of the global LNG trade. In 2022–23, Australia exported 81Mt of LNG, which is similar to the volumes exported by the US and Qatar. Australia has been a trusted and reliable energy export partner for many years. This trust is founded on a framework of long-term investments and contracts with Northeast Asian consumers, which provides price and volume security over a long-term time horizon. Between 2010 and 2022, the cumulative investment in Australia's oil and gas sector was more than $398 billion (DISR 2024).

Nearly 90% of Australian LNG exports go to Japan (36%), China (28%), the Republic of Korea (ROK) (14%) and Taiwan (11%). Japan, the ROK and Taiwan rely on imports to meet most of their energy needs. The lack of energy self-sufficiency in these economies means they must depend on other economies for access to reliable and affordable energy supplies.

Australian LNG meets industrial energy needs and generates electricity for major cities across Asia

Australian LNG ensures a reliable electricity supply in cities like Tokyo, Osaka, Seoul, Singapore and large cities in China, complementing the broader energy mix in each economy. Figure 12 shows Australia's share of total gas supply to key international trade partners. To put this into perspective, of the 12 million people live in Tokyo's metropolitan area, more than half of them are supplied by LNG imported from Australia.

Figure 12: Australian LNG as a share of total gas supply, selected economies, 2022



Source: Analytical Report, Figure 4.5.

As well as electricity generation, Australia's LNG is used by trade partners for their industrial sector. The Japanese, ROK and Chinese economies are heavily industrialised with globally significant, export-oriented manufacturing sectors. Australian households and businesses import and benefit from many of these products, made using Australian gas.

Despite the key role that gas plays in our trading partners' economies, coal dominates energy production in our region. In China and India's energy mix, coal makes up 61% and 74% respectively. Coal continues to be an affordable and abundant source of energy that has met rapidly expanding demand.

What role will Australian LNG play in 2050?

Demand for Australian LNG beyond 2050 could vary widely. The modelling indicates demand in 2050 could vary as much as 80 billion cubic meters, or about 58 million tonnes between scenarios. The actual amount of LNG needed will depend on a complex combination of choices made by governments, industry, consumers, and investors. In 2022–23, Australia exported 81 million tonnes of LNG. By 2050, this could fall to:

- 66 million tonnes in the STEPs scenario (or reduce by 19% based on 2022–23 production)
- 20 million tonnes in the APS scenario (or reduce by 75%)
- 7 million tonnes in the NZE scenario (or reduce by 90%).

In all scenarios we examined, LNG exports decline to 2050. However, LNG still has a clear role to play in 2050. There are crucial differences in demand for Australian LNG in 2050. In all scenarios, Australia maintains a large share of LNG trade with existing trade partners. This is because of existing trade relationships, proximity to Asia and reliability of supply based on Australia's low sovereign risk compared to other countries. The most notable absence in 2050 is ASEAN demand under more ambitious emissions reduction scenario. This is because of other LNG exporters and local gas production in the region fulfilling demand. However, it remains possible Australian LNG will play a role in ASEAN's energy mix as southeast Asia transitions away from coal.

LNG demand could be higher than these scenarios for the same reasons that apply to Australia's economy. Industrial gas demand is expected to remain high if commercial alternatives do not become affordable and available. GPG's long-term role will be to provide firming and peaking support for an increasing renewable electricity generation system.

In addition, developing nations in our region will experience substantial growth in energy demand to lift the standard of living for their population.

Although there is variation in how much Australian LNG our partners will need beyond 2050, demand is still expected to be primarily driven by China, Japan, the ROK, and ASEAN.

> Natural gas has a critical role to play in the energy transition pathway. Under all the International Energy Agency's modelled scenarios, demand for natural gas will remain through to 2050. Across most of its scenarios, additional investments in natural gas production are nonetheless required to meet natural gas demands. … Furthermore, many consultancies have predicted that natural gas demand will increase especially in Asia despite a net zero emission goal by 2050 because operating and sanctioned projects are not enough to satisfy such increasing demands. Therefore, new LNG projects will be required to meet the increasing natural gas demand.
> **Japan Australia LNG (MIMI) Pty Ltd**

Australian LNG in an orderly energy transition

To support an orderly energy transition in our region, Australia is committed to remaining a reliable supplier of LNG. Honouring long-term LNG contractual obligations is essential to maintaining trusted relationships with our international partners, and to providing the energy security necessary to progress decarbonisation plans.

At the same time, Australia must reduce emissions associated with the production of LNG while ensuring new developments meet all other necessary approvals. This includes the need to genuinely consult with First Nations groups and other local communities on matters that affect them.

Most emissions are generated from Australia's LNG when it is used. While decisions about how to manage these emissions are a matter for our trade partners, Australia is committed to reducing the full value chain emissions associated with LNG production, transport, storage and end-use.

We have a shared responsibility in the Indo-Pacific region to collectively reach net zero while growing our economies.

Australia is committed to meeting our long-term contracts

As of 2024, there are 51 contracts in force for Australian LNG. The volumes of gas exported under these contracts will decline as contracts expire by 2040. Unless Australian producers enter into new contracts, Australia's share of the global LNG trade will decline as other major producers invest in significant additional export capacity and as LNG facilities reach their end of life. Some contracts are expected to be extended over time.

As well as contracted gas volumes, Australian LNG facilities can also sell gas on to the global spot market. The amount of global spot sales Australia can make is the difference between long-term contracts and total export capacity. As contracts end, the gas industry may move into a different ratio between contracted and uncontracted supply.

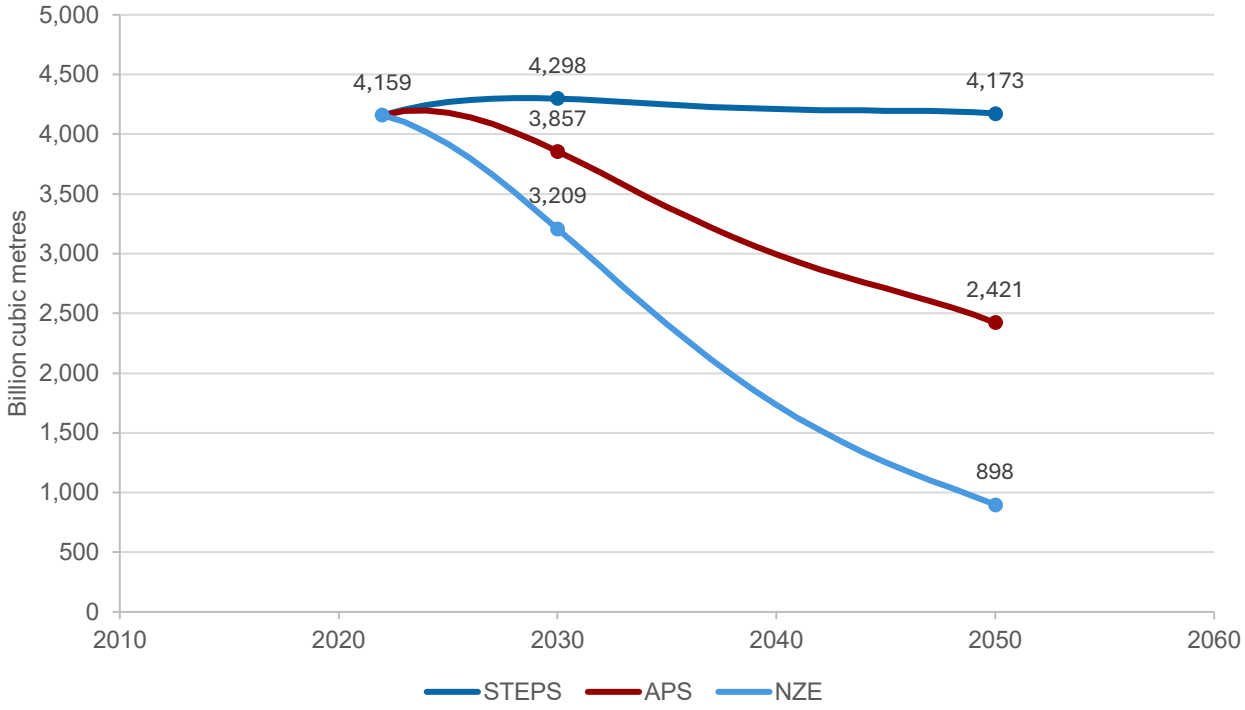
Demand for LNG in the medium-term will create sustained interest in Australian LNG

Many Asian economies, including Japan, the ROK and southeast Asian nations, view gas as a crucial component of their pathway towards net zero and their energy security. Even in the most ambitious decarbonisation scenario gas will continue to play a role in economic activity all the way to 2050 and beyond. Demand for LNG is also growing in several Asian countries that have historically produced enough domestic gas to meet their own demand. China, Malaysia and Indonesia are the region's largest producers, with other economies such as Thailand, India and Vietnam also producing gas for domestic purposes. Declining domestic production and reserves have led these countries to import LNG to maintain their gas supply balance. It is in Australia's strategic interests that our trading partners have access to secure and reliable energy during the energy transition. Australian gas can play an important role in these economies in supporting economic growth and energy security as they transition to net zero.

The Japanese Ministry of Energy, Trade and Industry (METI) believes that there is a significant risk for Japan—a relatively small country with few natural resources—to immediately give up fossil fuels, including natural gas. METI has therefore positioned natural gas (LNG), which has the lowest GHG emissions among fossil fuels, as an important 'transition energy' and has decided to further promote independent development of oil and natural gas by acquiring overseas interests and promoting domestic resource development…
INPEX

Global gas demand for the three IEA scenarios is shown in figure 13. All three scenarios show pathways that involve a non-zero level of gas demand, notably even in the scenario where net zero CO_2 emissions are successfully achieved by 2050.

Figure 13 Global natural gas demand by scenario, 2020–2050



Source: Analytical Report, Figure 4.10

Supporting the potential for higher LNG trade, global LNG import capacity is also in a phase of significant upswing. This has been accelerated by Western European countries switching away from Russian pipeline gas after Russia's illegal invasion of Ukraine. Import terminals are also being built across the ASEAN region. Many Asian economies view gas as a crucial component of their pathway towards net zero.

Supply from other large LNG exporters is also likely to continue throughout and beyond the climate transition period. In 2022, a large number of contracts (with an average duration of 20 years) were signed by large exporters. These included the United States (39 contracts with annual contract quantities of 64 Mt), Qatar (3 contracts) and Russia (2 contracts). Papua New Guinea and Canada are also developing LNG export capability. Regardless of Australia's actions, other exporters will continue to increase global supply.

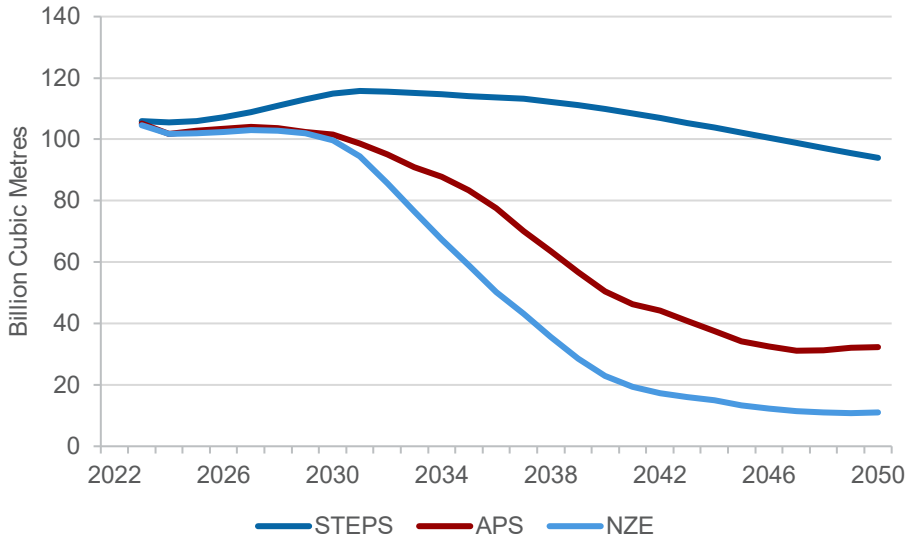
Other suppliers are joining the market as well. For example, Canada is carrying out the Kitimat project, which was described by Canadian Prime Minister Justin Trudeau as 'the single largest private-sector investment project in Canadian history.' The Kitimat project is expected to start in 2025 and provide Canada with an annual LNG export capacity of 26 Mt when its second stage is completed.

Recent movements in LNG contracting reflect the relative maturity of Australia's LNG industry and available resources compared to other suppliers. This also reflects Australian LNG facilities operating at close to nameplate capacity and the general low levels of domestic exploration and investment in recent years.

Australia is expected to continue exporting LNG

Projections for Australia's LNG exports differ. Under low-climate-ambition (STEPS), exports are stable, in contrast to a gradual decline (APS) and a greater decline (NZE) from 2030 (figure 14). In nearly all cases, Australia maintains a large share of LNG trade with existing partners over the medium term (to 2035). Australia's relative share of the global LNG market will continue to diminish over time.

Figure 14: Australian LNG export volumes to 2050, by scenario



Note: This is an aggregation of Figures 4.13 and 4.14 in the analytical report. Source: Future Gas Strategy Analytical Report

Australia can become a low-carbon supplier of LNG and grow clean exports

The Australian Government has an ambition for Australia to become a renewable energy superpower. Low-cost renewable energy will underpin new, internationally competitive, clean industries that can secure Australia's long-term prosperity in a decarbonising world. These new industries – such as renewable hydrogen, green metals, critical minerals processing, and manufacturing of power generation and storage technologies offer major economic opportunities and will reduce domestic and global emissions.

Australian LNG remains attractive for Asian buyers because of lower transport costs and non-price factors. These factors include geopolitical relationships, secure trading routes, transparent institutions, and openness to foreign investors taking majority ownership stakes in gas. Australian LNG is, however, characterised by high direct capital costs and an aggregate emissions intensity above the global average. There is uncertainty around the CO_2 intensity of future resources because not all Environmental Impact Statements and gas drilling results include this information.

Low methane emissions may be a potential advantage for Australian gas as countries consider upstream emissions through carbon border adjustment mechanism policies. The uncertainty about emissions intensity may affect the venting emissions that are needed to remove CO_2 before liquefaction or refining. This will need to be taken into account as resources are further assessed.

Maintaining trading relationships through continued, reliable exports of LNG may prove valuable in securing incoming investment from these trading partners in the new industries that Australia has ambitions to develop. This could use the expertise and core skills of Australia's gas industry. For example, several critical minerals and green metals facilities may need gas in the medium term, while renewable hydrogen and direct electrification of processes reach technological maturity or become affordable.

Where Australia goes from here

Action 1: Prevent gas shortfalls.

A reliable supply of gas is essential for energy production, and industrial and residential use. Forecast shortfalls are expected to put upward pressure on prices.

The government is currently managing shortfall risks through a mix of policy and regulatory settings by:

- utilising the powers of the Australian Energy Market Operator, the supply commitments under the Mandatory Code of Conduct, and the Heads of Agreement to address forecast shortfalls ahead of time
- using the Australian Domestic Gas Security Mechanism (ADGSM) as a measure of last resort to limit exports and ensure an adequate and secure supply of gas.

In light of the findings of the analysis to support the Strategy, the government will also:

- continue investing in pre-competitive geoscience data
- update Commonwealth retention lease policies to encourage more timely development of existing gas discoveries and consider a firmer 'use it or lose it' policy
- reframe any future Commonwealth offshore exploration acreage releases to focus on optimising existing discoveries and infrastructure in producing basins, prioritise energy security, and align with our net zero emissions targets
- work with gas producers under the Gas Market Code exemption framework to increase gas supply committed for future domestic supply
- continue to work with state and territory governments to improve the efficiency of the regulatory regime.

Action 2: Reduce gas-related emissions.

The government is committed to reducing greenhouse gas emissions by 43% below 2005 levels by 2030 and achieving net zero by 2050. The Government will accelerate the reduction of gas-related emissions through:

- the Safeguard Mechanism which obligates Australia's largest emitters, including gas and LNG producers, to reduce emissions
- the 6 sectoral decarbonisation plans which will cover all major components of the economy to produce decarbonisation pathways that are robust, ambitious and achievable.

In light of the findings of the analysis to support this strategy, the government will also:

- work with regulators and industry to reduce and where possible eliminate venting and flaring of gas, unless required for safety purposes
- apply a technology neutral approach to data acquisition in Commonwealth waters to minimise the use of marine seismic surveys where possible
- consider gas demand reduction measures in the government's 6 decarbonisation sector plans, including the Resources Sector Plan. The Resources Sectoral Plan is also considering how to promote electrification of fuel gas used in compressors, pumps, and liquefaction in gas production
- the Australian Government's Future Made in Australia Agenda will help decrease gas emissions in specific sectors over the medium to long-term and contribute to making Australia a renewable energy superpower.

Action 3: Support households and businesses through the transition to net zero.

Helping Australians with the cost of living is the government's number one priority. The cost of living is an important element of community wellbeing and prosperity. Short-term affordability challenges will be managed through targeted intervention, such as:

- working closely with states and territories to manage pricing impacts
- the Gas Market Code, including statutory reviews to refine or strengthen aspects.

This is in addition to the existing:

- Energy Price Relief Plan
- $1.3 billion Household Energy Upgrades Fund to provide concessional finance to more than 170,000 households for home upgrades that save energy and contains $300 million to support energy performance retrofits for social housing.

Action 4: Empower First Nations people to benefit from the transition to net zero.

The government recognises the importance of our First Nations people's connection to country and is committed to improving social and economic outcomes through future energy projects. To achieve this, the government will introduce reforms that:

- clarify consultation requirements for offshore petroleum and greenhouse gas storage activities – this is part of a broader three year review of the offshore environmental management regime
- pursue an appropriate level of benefit sharing that ensures First Nations people are partners in the transition to net zero. This includes new job opportunities, improved education programs and direct community investment.

Action 5: Promote geological storage of CO_2 and support our region's transition to net zero.

Australia's gas industry can assist our region to decarbonise through the permanent, safe geological storage of CO_2. To enable this, the government will:

- continue to release offshore acreage for greenhouse gas storage
- ensure future Commonwealth offshore exploration acreage releases consider the energy security and transition needs of our region
- finalise the review into the offshore regulatory regime to realise opportunities associated with the geological storage of CO_2 for Australian industry and our trade partners
- grow our clean energy exports and connect Australia to new clean energy supply chains through the Hydrogen Headstart and Regional Hydrogen Hubs programs.

In light of the findings of the analysis to support this Strategy, the government will also:

- establish a new initiative on regional cooperation on transboundary carbon capture and storage which will provide options for energy security and carbon management solutions for our regional partners.

Action 6: Update the strategy.

The Future Gas Strategy has a long-term outlook. The government is closely monitoring the evolving role of gas as the energy transformation progresses and will update the strategy as needed. This includes:

- reviewing and, where needed, updating near-term policy levers, such as the Gas Market Code, Heads of Agreement and the ADGSM
- providing tailored policy responses for emerging issues
- ensuring the strategy continues to support Australia's commitments under the Paris Agreement.

Appendix A: Net Zero Scenarios

Scenarios are an essential tool for exploring and understanding the future gas outlook depending on global emissions reductions pathways, based on varying assumptions. Scenarios are not predictions. Instead they allow comparisons of potential future versions of the energy landscape to support decision makers to understand potential trade-offs.

This strategy relies on quantitative scenarios and qualitative information received through the public consultation process and continued discussions to understand the future of gas in Australia and in our region. The Analytical Report has built on existing scenarios produced by the International Energy Agency (IEA) and the Australian Energy Market Operator (AEMO). These scenarios are well known and tested, and reflect policy decision and intentions both globally and in Australia. Read more about the scenarios used in the analytical report in Section 4 and Appendix B of the report.

LNG modelling

The IEA produces three main scenarios that have been used alongside our in-house modelling, which uses the *Nexant World Gas Model*. The three IEA gas and LNG scenarios used in the strategy are:

- Net Zero (NZE) (1.5°C), which sets out a pathway for the global energy sector to achieve net zero CO_2 emissions by 2050. This normative scenario shows what actions could be taken for the world to achieve net zero by 2050. The scenario presents a narrow but achievable pathway to Net Zero by 2050.
- Announced Policy Steps (or Announced Pledges – APS) (~1.8°C), which assumes climate commitments made by governments around the world will be met in full and on time. This exploratory scenario shows how close current commitments get the world to limited global warming to 1.5°C and highlights the 'ambition gap' that needs to be closed to achieve the 2015 Paris Agreement goals.
- Stated Policies (STEPS) (~2.6°C), which reflects current policy settings based on the assessment of sector and country-specific policies that are presently in place around the world. This exploratory scenario investigates existing policy settings, as opposed to current commitments, highlighting the 'implementation gap' between commitments and actions.

In addition to these three scenarios produced by the IEA, we used the *Nexant World Gas Model* to forecast longer-term forecasts for gas production, exports and consumption to 2052 that are specific to our region and major trade partners. The assumptions that create the results for the three IEA models are used to produce the analysis from the *Nexant World Gas Model*.

AEMO has developed scenarios for Australia's domestic gas markets that broadly align with the IEA's scenarios. The AEMO gas market scenarios can be aligned to IEA scenarios for Australia's east coast gas. West coast scenarios reflect supply and demand with reference to emissions, so do not align to IEA scenarios.

West coast gas market modelling

AEMO west coast gas market scenarios that outline WA's gas supply, demand and infrastructure needs out to 2033. AEMO uses three main west coast scenarios:

- *Low*. This scenario includes only existing gas supply and demand sources and therefore represents a conservative forecast.
- *Expected scenario* (medium). This scenario is considered most likely or expected.
- *High*. This scenario builds from the expected scenarios and includes more uncertain supply and demand sources, including backfill gas fields for existing production facilities. The scenario assumes coal fired power station that leads to higher gas demand and the addition or renewable power after 2030 that slowly brings down gas demand slowly.

East coast gas market modelling

AEMO East coast gas market scenarios outline gas supply, demand and infrastructure needs out to 2043. AEMO uses several scenarios with additional sensitivity analysis to capture the complexity and uncertainty of Australia's east coast gas market.

- *Green Energy Exports* (1.5°C) assumes very strong decarbonisation activities, contributing to limiting temperature increases to 1.5°C, in alignment with IEA's NZE. Main drivers are rapid changes in Australia's energy sectors, including strong use of electrification, green hydrogen and biomethane.
- *Step Change* (1.8°C) scenario is the central scenario that achieves a scale of energy transformation consistent with Australia's contribution to limit global temperature rises to below 2°C compared to pre-industrial levels. Electrification is a key enabler of change, with consumer actions
- *Progressive change* (2.0+°C) meets Australia's current Paris Agreement commitment of 43% emissions reduction by 2030 and net zero emissions by 2050. The scenario has higher gas consumption that reflects more challenging economic conditions, reduced investment in decarbonisation and supply chain challenges.

Sensitivity analysis helps explores specific circumstances where gas demand or supply is impacted by particular events such as changes in the weather or market conditions. These sensitivities build on the above AEMO scenarios and help examine the impact on gas use if that specific circumstances were to happen. For example, prolonged droughts affect large hydro generation. The re-occurrence of the 'millennium drought' of 2006–2007 would see annual GPG forecast to be 60% higher compared to the Step Change scenario, depending on deployment of variable renewable energy.

Glossary of key terms

Term/acronym	Definition
AAU	An assigned amount unit (AAU) means an assigned amount unit issued in accordance with the Kyoto rules.
Abated gas	To qualify as 'abated', fossil fuel plants must achieve: near total containment of methane emissions associated with extraction, processing and transport; near total containment of end-use combustion carbon dioxide emissions both for fuel production and use; and permanent storage of the captured carbon dioxide.
ACCU	The units in which transactions between the Buyer and Seller take place. Transactions of ACCUs occur through the ANREU. ACCUs are credits that represent one tonne of verified carbon emissions or equivalent abatement achieved by eligible offsets projects. ACCUs are created and issued by the Clean Energy Regulator in accordance with Section 147 of the CFI Act.
ADGSM	Australian Domestic Gas Security Mechanism
AEMO	Australian Energy Market Operator
ANREU	Australian National Registry of Emissions Units The registry in which all transactions of Australian carbon credit units take place. A Seller must have an Australian National Registry of Emissions Units account to participate in the Emissions Reduction Fund.
ANREU Act	Australian National Registry of Emissions Units Act 2011
ANREU Regulations	Australian National Registry of Emissions Units Regulations 2011
Bagasse	Bagasse is the fibrous waste left from the crushing of sugar cane, which is used as a fuel source to generate renewable energy under the Renewable Energy Target.
Baseline	The baseline is the amount of electricity above which an accredited large-scale renewable energy power station can begin to create large-scale generation certificates. We determine baselines under the Renewable Energy (Electricity) Regulations 2001.

Term/acronym	Definition
Baseline determination	Umbrella term for all baseline determinations made by the Clean Energy Regulator, as opposed to 'default baselines' which exist in the absence of a determination.
Baselines	Baselines is the umbrella term used for all Safeguard baseline numbers. Emissions baselines represent the limits that are placed on the net emissions of covered Safeguard facilities.
Bcf	Billion Cubic Feet (of gas)
BF-BOF	Blast Furnace-Basic Oxygen Furnace
Biomass	Biomass is a consolidation of several fuel types including agricultural waste, bagasse, biomass-based components of municipal solid waste, black liquor, energy crops, food processing waste, food waste, landfill gas, sewage gas and biomass-based components of sewage, waste from processing agricultural products and wood waste.
BOE	Barrels of Oil Equivalent. The barrel of oil equivalent (BOE) is a unit of energy approximate equal to the energy released by burning one barrel (158.9873 litres) of crude oil.
Carbon abatement	Carbon abatement refers to both reducing carbon emissions released into the atmosphere or reducing carbon already in the atmosphere through carbon sequestration.
Carbon dioxide equivalence (CO_2-e)	A measure of greenhouse gas emissions. Carbon dioxide equivalence is estimated by multiplying the amount of gas by the global warming potential of the gas.
Contingent resources	Discovered resources which are potentially recoverable but not yet commercial, due to one or more contingencies.
Covered emissions	For the purposes of the Safeguard Mechanism covered emissions are defined as scope 1 emissions, including direct emissions from fugitive emissions and emissions from fuel combustion, waste disposal and industrial process such as cement and steel making. Some scope 1 emissions are not covered by the Safeguard Mechanism. These include: • legacy emissions from the operation of a landfill facility (that is, emissions from waste deposited at the landfill before 1 July 2016) • emissions which occur in the Greater Sunrise unit area or Joint Petroleum Development Area

Term/acronym	Definition
	• emissions from the operation of a grid-connected electricity generator in a year covered by the sectoral baseline • emissions not covered under the National Greenhouse and Energy Reporting (Measurement) Determination 2008.
CCS	Carbon, Capture and Storage
CCUS	Carbon, Capture, Use and Storage
CSG	Coal seam gas
DCCEEW	Department of Climate Change, Energy, the Environment and Water
Exploratory scenario	Exploratory scenarios describe how the future might unfold, according to known processes of change or as extrapolations of past trends.
Fugitive emissions	The release of emissions that occur during the extraction, processing, and delivery of fossil fuels.
Gigajoule	1 gigajoule = 1,000 megajoules
Gigawatt (GW)	A gigawatt is a unit for measuring power that is equivalent to one thousand megawatts.
Gigawatt hour (GWh)	A gigawatt hour (GWh) is equal to 1,000 megawatts of electricity used continuously for one hour.
Global warming potential (GWP)	GWP is a measure of how much a given mass of greenhouse gas is estimated to contribute to global warming. It is a relative scale that compares a gas with the same mass of carbon dioxide and is calculated over a specific time interval. Emissions factors and methods, as described in the NGER (Measurement) Determination 2008, take the GWP of different gases into account. More information on GWP values and how they are used with prescribed methods for calculating greenhouse gas emissions is provided in the NGER Technical Guidelines.
Greenhouse gases	Carbon dioxide (CO_2), carbon dioxide equivalent (indirect), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).
GSOO	Gas Statement of Opportunities
Hydrocarbon	Organic compounds consisting entirely of hydrogen and carbon. Hydrocarbons are the principal constituents of oil and natural gas.

Term/acronym	Definition
LNG	Liquefied natural gas
Low-emissions gases	Refers to gases that are consistent with net zero and do not contribute to climate change when they are produced or used. This includes biomethane, hydrogen and certain synthetic gases.
LPG	Liquefied petroleum gas
Megajoule	1 megajoule = 1,000 kilojoules
Megawatt (MW)	A megawatt is a measurement of power. Power is the rate at which the energy is generated or used. One megawatt is equal to 1000 kilowatts.
Megawatt hour (MWh)	A megawatt hour is a measure of electrical energy equivalent to a power consumption of 1000 kilowatts for one hour.
Methane	Primary component of Natural gas. Methane is a Hydrocarbon, which is a family of molecules consisting entirely of hydrogen and carbon. Methane is one carbon molecule surrounded by four hydrogen molecules (CH4).
NEM	National Electricity Market. The NEM interconnects five regional market jurisdictions (Queensland, New South Wales, Victoria, South Australia and Tasmania). Western Australia and Northern Territory are not connected to the National Electricity Market.
NGER	National Greenhouse and Energy Reporting
NGER Act	National Greenhouse and Energy Reporting Act 2007
NGER Regulations	National Greenhouse and Energy Reporting Regulations 2008
NZEA	Net Zero Economy Authority
Normative Scenario	Normative scenarios depict preferable future visions without transgressing the possible.
Permeability	The degree to which gas or fluids can move through a porous material, such as rocks.
Petroleum	Liquid, gaseous, and solid hydrocarbons, including oil, natural gas, gas condensate, ethane, propane, butane, and pentane.
Plugged and abandoned	When all the reservoir and high-pressure zones in a well are sealed with cement so that no fluid can escape.

Term/acronym	Definition
Proved and Probable reserves (2P)	The best-estimate or most likely volume of gas expected to be recovered. There should be at least a 50 per cent probability of recovery. Sometimes known as 2P or P50 reserves. By definition, reserves are commercial.
Proved, Probable and Possible reserves (3P)	A high-side or upside volume of gas expected to be recovered. There should be at least a 10 per cent probability of recovery. Sometimes known as 3P or P10 reserves. By definition, reserves are commercial.
Proved reserves (1P)	A low-side or high confidence volume of gas expected to be recovered. There should be at least a 90 per cent probability of recovery. Sometimes known as 1P or P90 reserves. By definition, reserves are commercial.
Reservoir	A rock or geological formation that holds petroleum within the pore spaces between individual grains.
RET	Renewable energy target
Retention lease	A retention lease encourages the timely development of petroleum resources and provides security of title for those resources that are not currently commercially viable but are likely to become so within 15 years.
Scope	The strategy specifically relates to these abated, natural and renewable gases and the industries involved in their use and production.
Scope 1 emissions	Scope 1 emissions are emissions released into the atmosphere as a direct result of the activity or activities that make up the facility, such as fuel combustion for electricity generation or cement production.
Scope 2 emissions	Scope 2 emissions are emissions released into the atmosphere as a direct result of one or more activities that generate electricity, heating, cooling, or steam that is consumed by the facility but do not form part of the facility. National Greenhouse and Energy Reporting scheme reporting covers both Scope 1 and scope 2 emissions.

References

The *Future Gas Strategy Analytical Report* is an essential companion to this document. The list of references below are key sources directly referenced in this strategy. For the complete list of sources supporting the detailed analysis underpinning the strategy, see Appendix A of the analytical report.

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