



Bowen Basin Pipeline Study

Phase 2 Market Engagement

May 2023

Acknowledgement of Country

KPMG acknowledges Aboriginal and Torres Strait Islander peoples as the First Peoples of Australia. We pay our respects to Elders past, present, and future as the Traditional Custodians of the land, water and skies of where we work.

At KPMG, our future is one where all Australians are united by a shared, honest, and complete understanding of our past, present, and future. We are committed to making this future a reality. Our story celebrates and acknowledges that the cultures, histories, rights, and voices of Aboriginal and Torres Strait Islander People are heard, understood, respected, and celebrated.

Australia's First Peoples continue to hold distinctive cultural, spiritual, physical and economical relationships with their land, water and skies. We take our obligations to the land and environments in which we operate seriously.

We look forward to making our contribution towards a new future for Aboriginal and Torres Strait Islander peoples so that they can chart a strong future for themselves, their families and communities. We believe we can achieve much more together than we can apart.

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Disclaimer

This report provides a summary of KPMG's findings during the course of the work undertaken for the Department of Resources (the Department) under the terms of the standing offer arrangement contract order dated 12 May 2022. The contents of this report do not represent our conclusive findings, which are contained in our final detailed report provided to the Department.

The services provided in connection with this engagement comprise an advisory engagement, which is not subject to assurance or other standards issued by the Australian Auditing and Assurance Standards Board and, consequently no opinions or conclusions intended to convey assurance have been expressed.

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KPMG is under no obligation in any circumstance to update this report for events occurring after the report has been issued in final form. This report has been prepared at the request of the Department in accordance with the terms of the standing offer arrangement contract order dated 12 May 2022. Other than our responsibility to the Department, neither KPMG nor any member or employee of KPMG undertakes responsibility arising in any way from reliance placed by a third party on this report. Any reliance placed is that party's sole responsibility.

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Executive summary

There is potential to develop the Bowen Basin as a new upstream source of gas that—if connected to the East Coast Gas Market—could serve as a mid-term solution to assist with system-wide energy demand, strengthening security and resilience whilst supporting continued liquefied natural gas exports.

Purpose of this study

Investigation into the further unlocking of the Bowen Basin to help future proof Queensland's energy supplies is occurring in stages. This Study, Phase 2: Structured Market Engagement, complements the current understanding of the Basin's viability with a comprehensive analysis of the commerciality of a pipeline from the market's perspective.

The state of the gas market is complex

Energy demand and supply conditions have experienced a period of unprecedented upheaval in 2022. Major trends related to economic conditions, energy security and the pace of energy transformation are impacting the East Coast Gas Market (ECGM), and their influence on the future of the gas system is not yet clear. However, the Australian Energy Market Operator's (AEMO's) 2022 Gas Statement of Opportunities (GSOO) forecasts a continuing role for gas in the integrated energy system including a critical role for gas-fired power generation in the National Electricity Market (NEM) until at least 2035. Current forecasts are predicting periods of increasing peakiness and volatility where gas demand may exceed supply, with the earliest identified risk of gas shortfalls forecast for winter 2023. Further, the Queensland Energy and Jobs Plan commits to no regular reliance on coal-fired generation by 2035 and foresees a continued role for gas over the short to medium term in supporting the transition into a low to no emissions future.

There is a need for Bowen Basin gas

Gas market modelling indicates that across multiple scenarios Bowen Basin gas strengthens the resilience of the ECGM

supply chain by providing additional supply capacity that can be directed to help meet domestic supply. Nevertheless, pipeline development needs to be underpinned by the combined demands of the ECGM and liquefied natural gas (LNG) export to be economically viable.

Stakeholders see the potential for Bowen Basin gas, but timing is critical

Stakeholders identified that the development of the Bowen Basin could address the forecast ECGM gas supply shortfall, however not in the short-term. Stakeholders anticipate full pipeline development to take 6-10 years. Due to increasing environmental, social and governance (ESG) requirements, capital market appetite is decreasing and pipeline operators have shortened investment horizons for new pipeline developments to around 15 years. As such, there is a limited time window for the development of the pipeline to ensure sufficient time for the repayment of the investment. Further, significant areas of uncertainties present a barrier to developing the pipeline – foremost, uncertainty surrounding gas resources in some regions of the Basin. However, many noted that the regions within the Bowen Basin are at different stages of development, with the southern region the most prospective.

Reducing the Basin's fugitive emissions

The capture and productive use of coal mine methane (CMM)¹ in the Bowen Basin currently faces several challenges, and operators have found that many strategies are uneconomic to implement. Due to the current challenges, CMM is not suitable to underpin the development of the Bowen Basin pipeline by itself. However, many potential strategies could

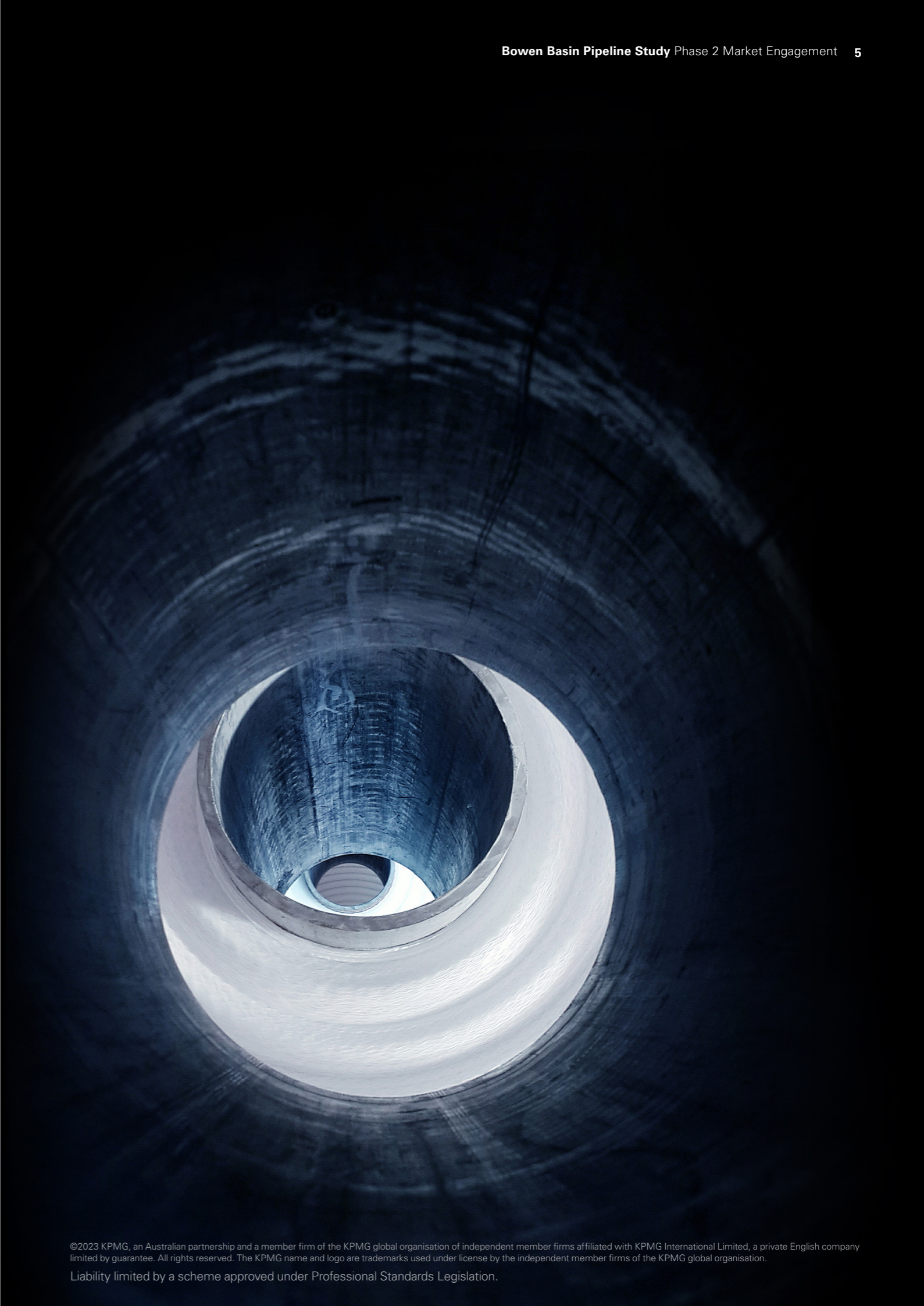
be investigated to improve the economics of CMM utilisation and in turn the increased likelihood of the beneficial use of CMM within the Basin, such as access to infrastructure, supporting power generation for local consumption, the use of emerging technology, policy changes and the development of new markets.

Bowen Basin gas benefits all levels of government

The development of the Bowen Basin has the potential to unlock benefits not only to the local Queensland economy, but also nationally through the provision of a stable source of domestic gas to meet the needs of domestic and industrial users. It may also play an important role in the transition to a low to no emissions future whilst supporting the growing global energy demand.

External factors will influence the delivery approach

Timing to meet the expected ECGM shortfalls and uncertainty surrounding the volume of reserves that can be extracted economically, specifically in the Moranbah and Blackwater regions, are the two factors that will influence the delivery approach to the development of the Basin. Acknowledging these two factors, the proposed pipeline delivery approach is staged delivery with a connection from the Mahalo region to the ECGM as the first stage.



Introduction

Background

New upstream sources of gas supply are anticipated to be required to avoid potential shortfalls in the ECGM and export markets, from as early as the mid-2020s. The Bowen Basin may have a key role to play in bridging this supply-demand gap.

Developing the Bowen Basin has the potential to bring more gas to Queensland's domestic and LNG export markets in addition to making a valuable contribution to Queensland's transition to a low-carbon economy. As such, the Queensland Department of Resources (the Department) is investigating the feasibility of further unlocking the Bowen Basin to:

- Future proof Queensland's energy supplies;
- Transition to a low carbon, clean growth economy;
- Support the Queensland Government's energy system target of 70 per cent renewable energy by 2032 and 80 per cent by 2035; and
- Make meaningful progress towards the Queensland Government's targets of 30 per cent reduction in 2005 emissions by 2030 and zero net emissions by 2050 through greenhouse gas reduction in the supply chain.

Investigation into the further unlocking of the Bowen Basin is occurring in stages.

Completed in 2021, the Bowen Basin Pipeline Study – Phase 1: Concept Study Report (Concept Study Report) established the economic and technical viability of the development of the Bowen Basin.

The next phase of the Bowen Basin Pipeline Study – Phase 2: Structured Market Engagement (this study) – sought industry participation to identify the appetite for developing and connecting the Bowen Basin to the ECGM.

The Phase 2 Study

Phase 2 of the Bowen Basin Pipeline Study has built on the analysis, modelling and stakeholder engagement undertaken in Phase 1. Phase 2 complements the current understanding of the Bowen Basin's viability with a comprehensive analysis of the commerciality of a pipeline from the market's perspective.

Phase 2's analysis is based on detailed feedback on the current state of the market obtained through structured market engagement with industry participants and government stakeholders. Importantly, the market engagement undertaken in Phase 2 directly explores the market's commercial drivers and parameters for investment which are essential considerations for the Bowen Basin Pipeline Study and connecting the Bowen Basin to the ECGM, alongside the technical and regulatory aspects.

Specifically, Phase 2 seeks to:

- **Understand market appetite and the capability of parties interested** in designing, constructing, managing, operating and owning pipeline infrastructure connecting gas fields in the Bowen Basin to the ECGM;
- **Identify key barriers** to pipeline development;
- **Identify optimal development pathways** for an open-access pipeline considering options to capture CMM, noting a desire to maximise opportunities for connecting producers to the pipeline; and
- Provide the Department with the necessary **market and commercial information** to support government consideration.

In Phase 2, KPMG consulted 31 market participants and stakeholders including gas market participants (upstream gas developers, pipeline operators and pipeline users), mine operators, investors (both domestic and international), industry bodies and government agencies.

Phase 2 complements the current understanding of the Bowen Basin's viability with a comprehensive analysis of the commerciality of a pipeline from the market's perspective.

The structured market engagement followed an iterative approach, starting with initial consultations with a broad and varied range of participants followed by more focussed and targeted follow-up sessions with key organisations to allow for more detailed and specific feedback to be provided.

Each consultation session lasted around 45 minutes and was hosted either online via Microsoft Teams or in person, with Department representation. Before each consultation session, KPMG provided market participants with a questionnaire tailored by type of stakeholder to guide the interview. Questions covered the following topics:

- Gas market demand and supply;
- The regulatory environment;
- Infrastructure options to develop and connect the Bowen Basin to the ECGM and technical challenges;
- Options and barriers in regard to capturing and utilising CMM;
- Commercial, financing and procurement considerations of developing and connecting the Bowen Basin;
- The development process and timelines for developing and connecting the Bowen Basin; and
- Requirements and appetite for investment and development.

Phase 2 market engagement encompassed 39 consultation sessions in total, with eight of the overall 31 stakeholders consulted more than once.

The Bowen Basin

The Bowen Basin covers approximately 60,000km², extending from Collinsville in the north to beyond the New South Wales border in the south. It is also overlapped in the southern region by the Surat Basin. The overlapping Surat and Bowen Basins supply a large portion of gas for both LNG export and domestic consumption along the east coast of Australia (ECGM). The Bowen Basin is Queensland's largest coal producing region with over 40 active coal mines, as well as being home to two gold mines, producing gas fields and a range of gas and coal exploration and appraisal activities. The Bowen Basin also intersects with large swathes of prime agricultural land on its western flank and near Mackay.

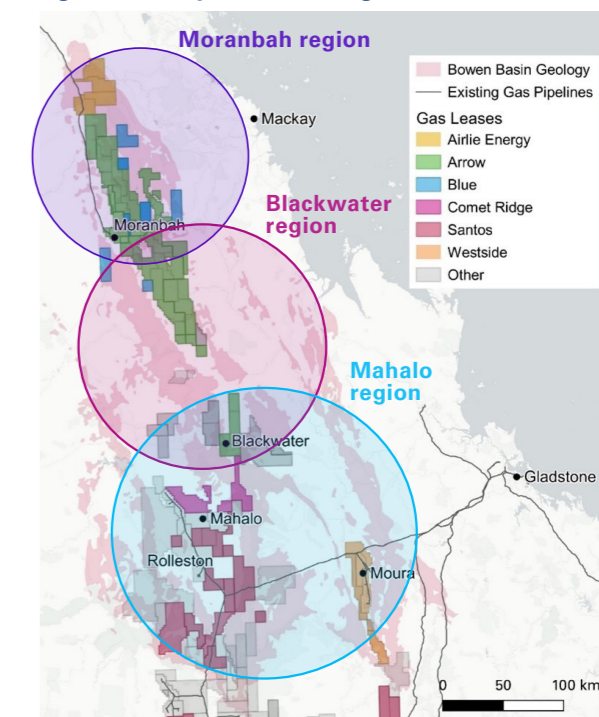
The Bowen Basin is sparsely populated, however it contains a diverse range of key stakeholders from resource companies, government organisations, agricultural companies, utility providers and gas-intensive manufacturing and power generation assets.

The scope of this Study centred on the northern portion of the Bowen Basin, forming an approximate triangle from Collinsville in the north down to Theodore and inland towards Tambo in central Queensland (referred to as the Bowen Basin (or the Basin) throughout this report).

As shown in Figure 1, the Bowen Basin can be classified into three different regions that are in very different stages of development and are referred to throughout this report:

- The **Mahalo region** in the south of the Bowen Basin, the most prospective for further development, in terms of both subsurface characteristics and route to market. Most of this region's acreage is held between Comet Ridge and Santos and is proximate to the Gladstone LNG (GLNG) pipeline owned by Santos and the Queensland Gas Pipeline (QGP) pipeline owned by Jemena that both connect Wallumbilla to the LNG export terminals at Gladstone.
- The **Blackwater region** in the central Bowen Basin, has a strong concentration of coal mining activities but is the least developed region for gas production in the Basin, largely due to the lack of proximity to any gas pipelines and limited availability of petroleum tenements in the area.
- The **Moranbah region** in the north of the Bowen Basin, is considered the second most developed region in the Bowen for gas production. This region is served by the Moranbah Gas Project (MGP) and North Queensland Gas Pipeline (NQG), capable of transporting up to 108TJ/day of gas north from Moranbah to industry in Townsville. Tenements in this region are mostly held by three gas developers that collectively have indicated that they currently hold ~230PJ of 2P reserves and have the potential to develop more.

Figure 1: Gas production regions of the Bowen Basin³



Sources: Gas Pipelines: Geoscience Australia, 2014. (National Onshore Gas Pipelines Database), Department of Resources, 2022 (Exploration and production permits - Queensland - Petroleum Pipeline Licences), Gas Leases: Department of Resources, 2022 (Exploration and production permits - Queensland), Bowen Basin Geology: Geoscience Australia, 2018 (Australian Geological Provinces 2018.01 ed)

The state of the gas market

Energy demand and supply conditions have experienced a period of unprecedented upheaval in 2022. The medium to long-term impact of the current economic conditions, energy security and the pace of energy transformation on the gas system is not yet clear.

Major trends influencing the future of the ECGM

The Bowen Basin Concept Study highlighted three main trends influencing the future of the ECGM:

- A **decarbonisation journey**, with the rise of renewables as new baseload generation;
- An **increasing need for a combination of energy storage solutions** to address intermittency; and
- **Increasing difficulty in obtaining debt financing** for fossil fuel assets, combined with activist investor pressure.

These three trends continue to drive dynamics in domestic energy markets. In addition, since the release of the Phase 1 Concept Study, two additional trends have emerged as key drivers shaping Australia's energy landscape:

- **Energy security**
- **Complex new energy policies**

Energy security

A global energy security crisis has been unfolding since early 2020 mostly driven by global geopolitical events. The resulting global shortage of gas (in the form of LNG) has forced prices to reach record highs in the European and Asian import markets.

This has, in turn, driven extreme price increases for energy commodities including gas, coal and oil. Australia is not immune to these global forces, and when combined with several domestic factors causing tightness in energy markets, domestic electricity and gas

prices have risen sharply through the Australian winter of 2022.

In June 2022, price caps were triggered for natural gas in Brisbane, Sydney and Melbourne at AUD\$40/GJ, approximately 400 per cent above the long-run average gas price of AUD\$8-10/GJ. The extreme market conditions also forced AEMO to suspend the NEM for a week in June 2022.

Three main factors caused this crisis:

1. **International supply chain pressures and prices:** Global energy prices spiked as a result of Russia's invasion of Ukraine, which has put strain on both thermal coal and gas exports and imports. As a major exporter of thermal coal and LNG, Australia has borne the brunt of these increases as our domestic market is strongly linked to our international market partners.
2. **Reduced availability in baseload coal plants:** The number of unplanned outages has been increasing steadily in coal plants across New South Wales, Queensland and Victoria since 2019. In the first quarter of 2022, unplanned outages accounted for 69 per cent of all outages, which totalled 3.7GW of capacity in the market across these three states. This is expected to occur more frequently for a variety of reasons.
3. **Unseasonably high winter demand:** The weather across the eastern seaboard has seen temperatures drop more rapidly than

previous years, reaching record lows in areas of Queensland particularly. This increases both electricity and gas demand in the system, which has flow on impacts in terms of the price of energy and the amount of capacity needed to service peak times. This is expected to occur more frequently as the climate shifts.

The effects of the crisis waned as weather improved, coal generators returned to service and LNG exporters diverted further gas to the domestic market, however the situation has highlighted the need for new sources of energy supply to meet current and future demand.

Complex new energy policies

The aforementioned crisis and energy security issues are occurring alongside efforts from state governments and the Australian Government to transition to a net-zero economy. These efforts comprise targets for emissions reduction and renewable energy for Queensland and for Australia, as shown in Figure 2, as well as policy developments to support the achievement of these targets, as illustrated by Figure 3.

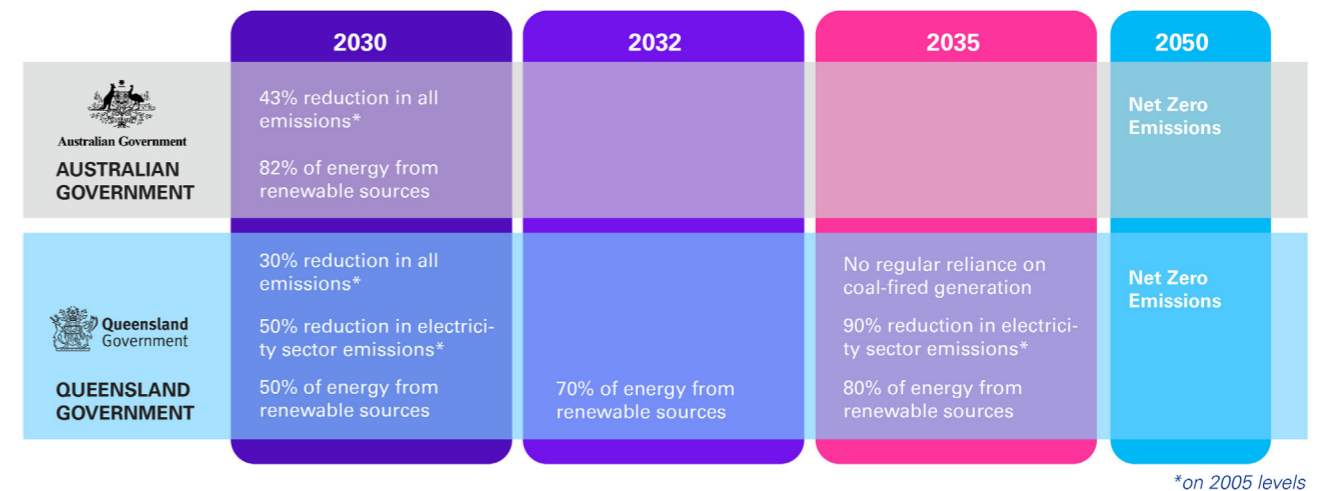
In particular, the proposed reforms to the Safeguard Mechanism is expected to drive accelerated fuel switching and emissions reduction as large industrial facilities face gradually lower direct (Scope 1) emissions limits (baselines).

The electricity transmission grid modernisation program will result in increased renewables penetration and increased electrification of industrial processes.

All of these changes will drive increased complexity in energy markets, and potentially increase uncertainty for the future of natural gas markets in Australia. The challenge is in finding a balance between

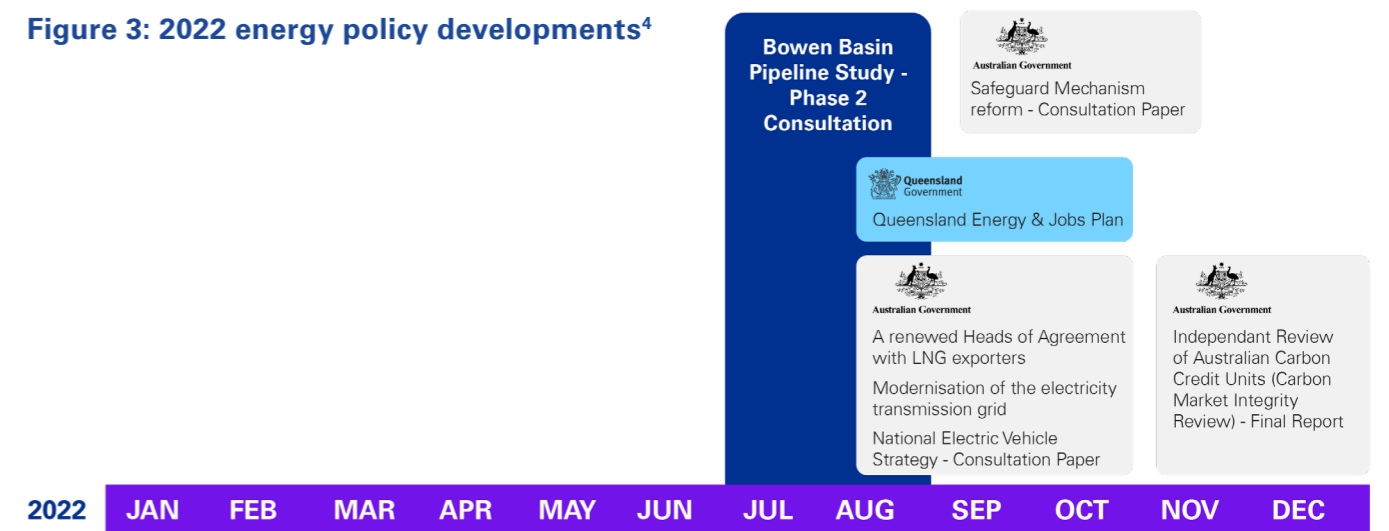
providing energy security at the same time as decarbonising energy systems to meet net zero emission targets by 2050 as well as ambitious interim goals.

Figure 2 Our emissions and renewable energy targets



Sources: Australian Government, 2022. Climate Change Act 2022 (Cth). Australian Labor Party, 2021. Powering Australia Plan. Department of Environment and Science: Queensland's 2020 greenhouse gas emissions and targets. Queensland Government, 2022. Queensland Energy and Jobs Plan.

Figure 3: 2022 energy policy developments⁴



The future role of gas

As Australia transitions to a net-zero emissions future, the type and level of gas use is expected to be impacted by consumer choice, technology advances, public policy and the expansion of the National Gas Law to include low carbon gases with the addition of hydrogen, biomethane, synthetic methane, and blends of these gases. Whilst uncertainty exists for the role of gas, it is forecast to have a continuing role in the integrated energy system, particularly in the generation of electricity:

In the **short term (before 2028)**, new infrastructure solutions, such as the Bowen Basin Pipeline, will not be operating in time for the earliest identified risk of gas shortfalls, forecast for winter 2023 as detailed in AEMO's 2022 GSOO.

In the **medium-term (2028 – 2035)**, as coal generation retires, gas generation is projected to potentially support and firm up variable renewable energy generation to help meet the NEM's energy needs. Current forecasts predict that there will be periods of increasing peakiness and volatility where gas demand may exceed supply, although this is uncertain.

Longer term (after 2035), annual domestic consumption may decline if consumers shift from gas to electricity or zero-emission fuels.

Whilst uncertainty exists for the role of gas, it is forecast to have a continuing role in the integrated energy system, particularly in the generation of electricity.



Gas plays a role in Queensland's transition to a cleaner energy future

The Queensland Energy and Jobs Plan, released in September 2022, confirmed a variety of roles for natural gas, including firming renewables, powering manufacturing and mining, boosting hydrogen production and underpinning east coast energy security.⁵

The Queensland Energy and Jobs Plan commits to no regular reliance on coal-fired generation by 2035 and foresees a continued role for gas over the short to medium term in supporting the transition into a clean energy future. Into the future, the Plan forecasts the energy system will require 3GW of installed gas generation capacity from low to no emission gas (natural gas and hydrogen) to meet peak electricity demand and to provide storage, firming and dispatchable capacity.

Specifically, the Plan includes further investigation into options to connect the Bowen Basin to the ECGM (Action 1.5c).



Forecasting under uncertainty

The global energy market is in transition – over the past 12 months, governments around the world have pulled legislative and economic levers to force transition away from the use of fossil fuels in energy generation. Both the Australian and Queensland Governments have committed to a vision of net zero emissions by 2050, with the Australian Government enshrining this net zero target in legislation. This rapid domestic and global change is expected to see Queensland's traditional mining economic base evolve.

Furthermore, demand and supply conditions in the LNG market, and energy markets more generally, have been disrupted since 2020 with the

COVID-19 pandemic and most recently, the Russian invasion of Ukraine.

Fuelled by stimulatory monetary and fiscal policy, the rebound in the global economy after the COVID-19 shock has been faster than expected. This, coupled with continuing supply chain disruptions, has caused energy demand to exceed supply, leading to higher energy prices in the recent period. The Russian invasion of Ukraine has exacerbated this situation by reducing global supply.

It is expected that higher energy prices will naturally slow the global economy and this will cool demand. In addition, supply chains will continue to normalise after the COVID-19 shock, which will help free up supply. However, uncertainty remains relating to Russia's invasion of Ukraine and how this will play out in the short and longer

term. Russia's invasion of Ukraine has impaired global gas supplies, and this is likely to continue for some time even if conflict is resolved in the near future. Gas users in Europe will seek to reduce their reliance on Russian gas supplies and, more generally, gas users around the world will seek to diversify their supply sources.

The complex dynamics playing out in energy markets at present are keeping energy prices well above their long-term, sustainable levels. Energy prices are expected to retreat from their current high levels but the speed at which this happens will depend on several uncertain factors. As such, the future path for gas is uncertain, as global factors and the pace of the transition to low emission future and its influence on the gas system is not yet clear.

Demand forecasts

AEMO 2022 Gas Statement of Opportunities

AEMO's 2022 GSOO continues to highlight the uncertainty for future gas supply and demand. To capture this uncertainty, AEMO uses scenarios and sensitivities to explore the needs of gas consumers and the adequacy of gas infrastructure to meet those needs. This study considers two scenarios identified in GSOO to explore the potential economic risk facing consumers regarding under or over-investment in gas infrastructure required for this transition – **Step Change** and **Progressive Change**. These scenarios provided a platform to build forecasts to test the need for Bowen Basin gas to support the demands of the ECGM.

What are AEMO's GSOO scenarios?

The **Step Change** scenario is consistent with meeting the emissions reduction target of 43 per cent from 2005 levels by 2030 and net zero by 2050. This is close to the recently announced target for 2030 by the Australian Government.

The **Progressive Change** scenario assumes a slower transformation and gas consumption closer to historical levels than the Step Change Scenario of the 2022 GSOO. It is consistent with some state targets and still targets net zero emissions by 2050 but the trajectory to achieve this outcome reflects slower action across the economy allowing time for technologies to develop. The Progressive Change scenario is consistent with the Queensland Government's target of 30 per cent reduction in 2005 emissions by 2030.

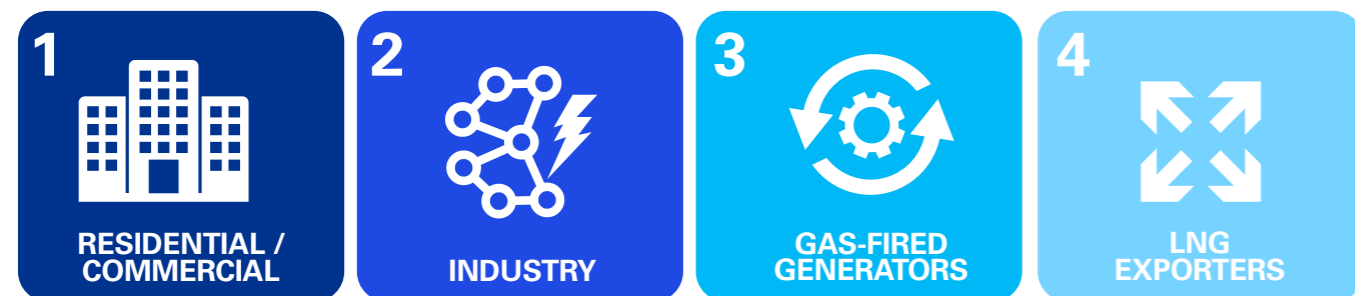
A third scenario – **Hydrogen Superpower** was also identified in AEMO's 2022 GSOO Report that may impact the gas sector. This scenario represents a world with very high levels of electrification and hydrogen production, fuelled by strong decarbonisation targets and technology cost improvements resulting in net zero before 2050. This scenario was not considered in this Study as it has been designed to understand the implications and needs of the power system under conditions that enable the development of a renewable generation export economy, rather than the economic risk of over or under-investment in gas infrastructure.

The recently released Gas Statement of Opportunities report for 2023 has highlighted continued risks of gas supply shortages in southern Australia. This is due to a reduction in gas production from this region, leading to potential short-term gas supply shortfalls and long-term supply gaps. The risk of peak day shortfalls is expected to be a concern under very high demand conditions in the southern states from winter 2023.

Despite increased production commitments, the gas supply in southern Australia is declining at a faster rate than the projected demand. However, the report states that the annual physical gas supply from existing, committed, and anticipated production will be adequate before 2027. The report emphasizes that investments are needed in the near term to ensure operational solutions from 2027, despite falling gas consumption. The report also forecasts limited gas supply to meet gas generation consumption along the entire horizon of the North Queensland Gas Pipeline, which runs from Moranbah to Townsville. Anticipated and uncertain supply must be developed before late 2024 to maintain the gas supply to consumers in that area.

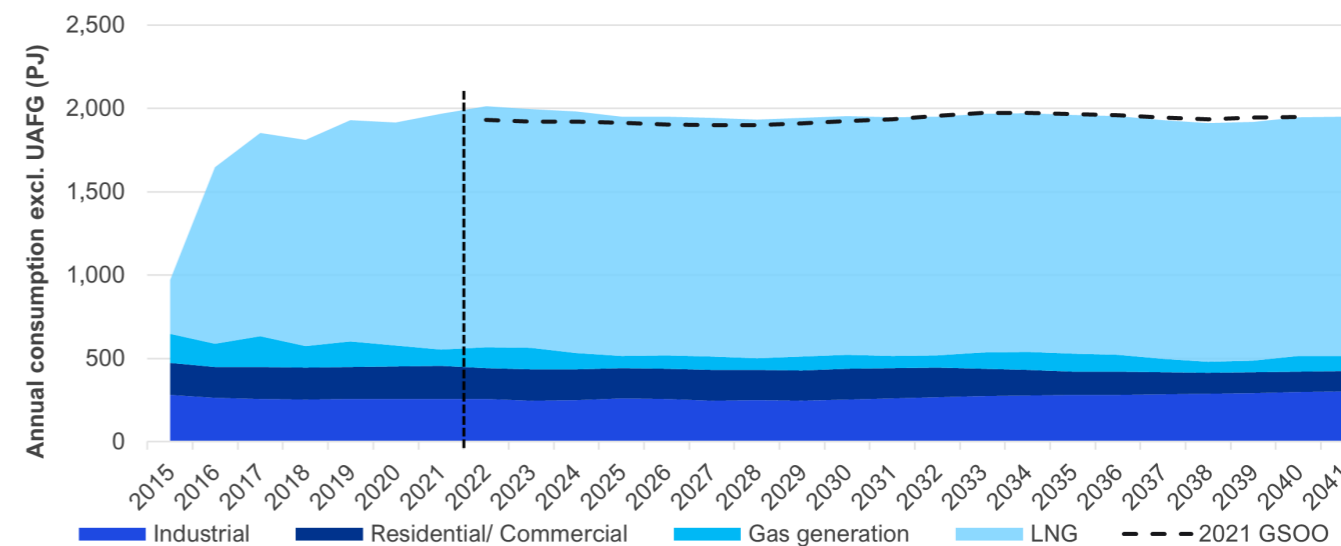
ECGM demand forecasts by users

Demand for ECGM gas can be classified into four different users:



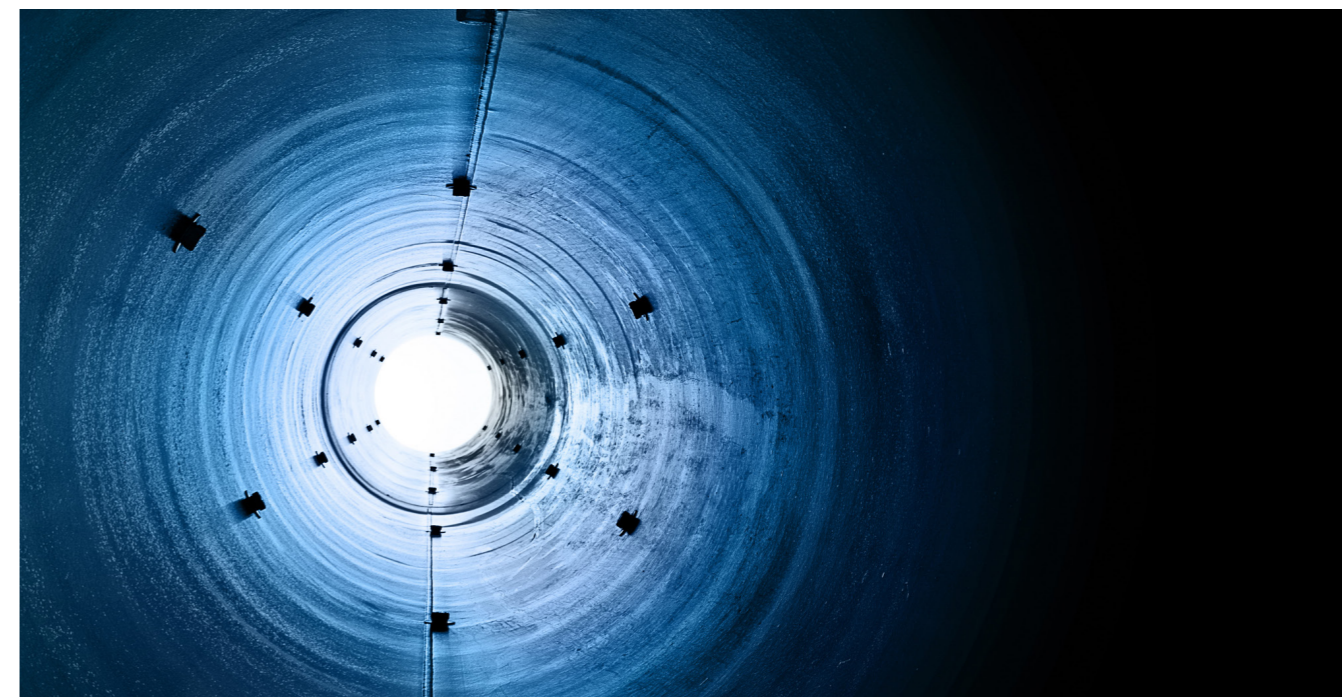
As shown in Figure 4, annualised gas demand for all users except LNG export is generally forecast to reduce as consumers embrace energy-efficient appliances and switch energy use towards electricity and potentially hydrogen. However, across both the Progressive and Step Change scenarios, gas for generation of electricity is projected to become increasingly peaky. At an aggregate level, annual gas consumption for generation in the NEM is forecast to decline, but maximum daily demands will continue to be high as gas generation plays an increasingly important role in firming renewable energy as coal-fired generation retires.

Figure 4: AEMO 2022 GSOO forecast annual gas demand, all users



Source: AEMO & KPMG analysis, Progressive Change scenario.

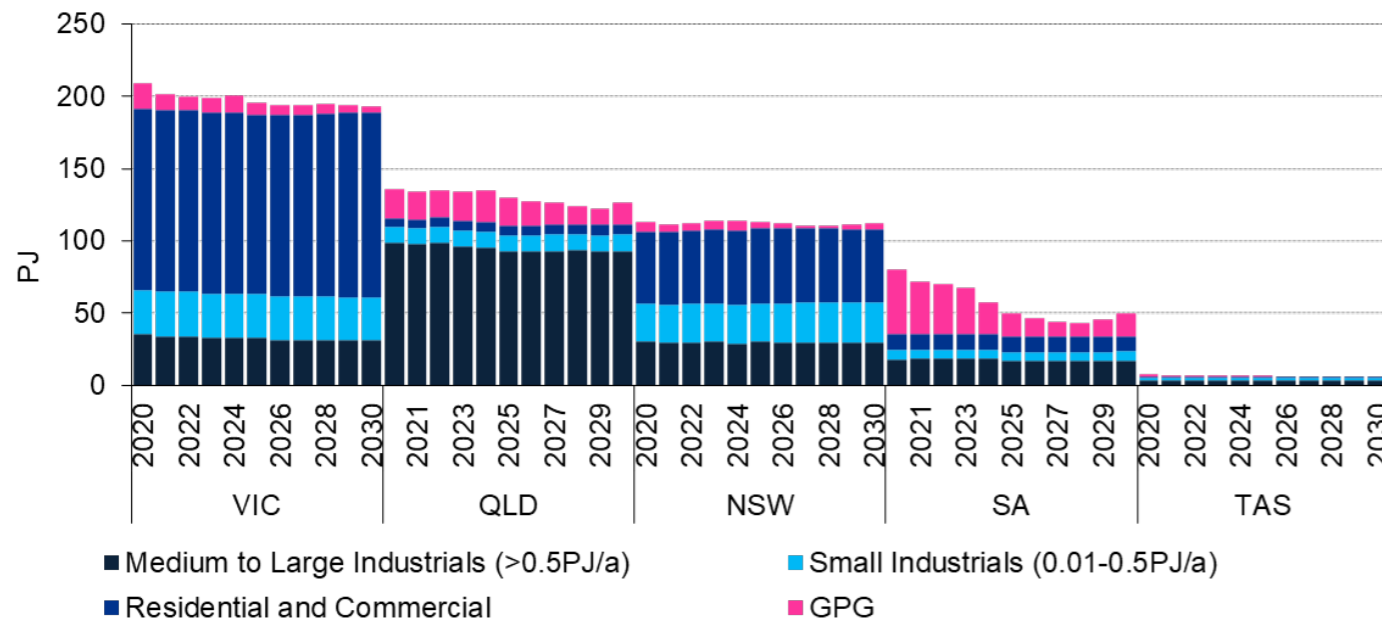
LNG export will remain the predominant user of gas in the ECGM, with export flows projected to remain in line with existing contracted commitments. Beyond contracted volumes, there remains a strong tightness in international LNG markets, meaning opportunities exist for LNG exporters to ship greater numbers of spot or uncontracted cargoes of LNG. To do this, LNG exporters must adhere to the requirements of the renewed 2022 Heads of Agreement (HoA) signed with the Australian Government, and the Australian Domestic Gas Security Mechanism (ADGSM).⁶ Both require LNG exporters to offer gas in excess of contractual volumes to the domestic market before being permitted to export it as LNG.



ECGM demand by geography

Figure 5 outlines the forecast annual gas demand by state. Victoria is expected to remain the predominant user of gas, meaning the trend of increased flows of gas from north (Queensland) to south (Victoria and New South Wales) will continue into the future.

Figure 5: Domestic gas demand in the ECGM by state



Source: AEMO & KPMG analysis.

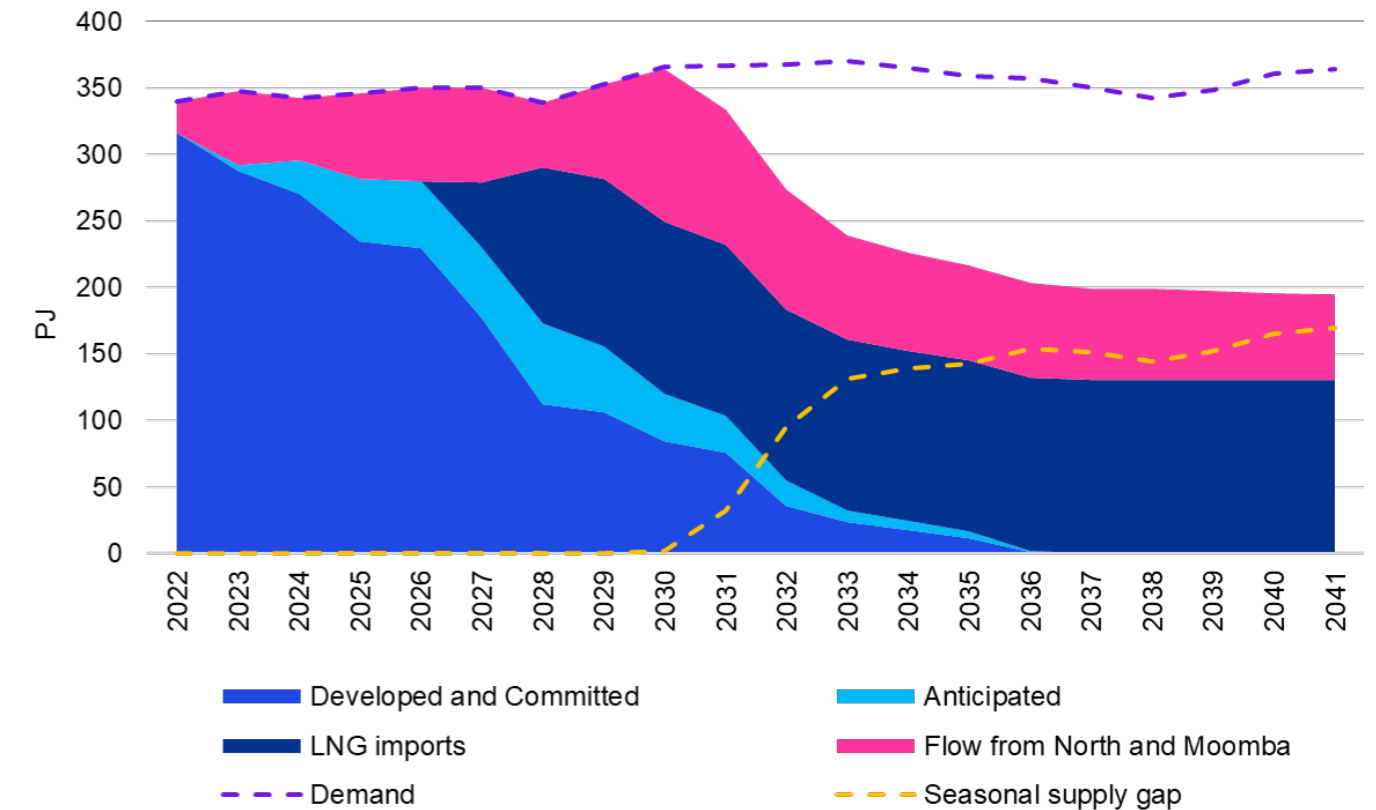


Supply adequacy

Overall, the sum of all reserves and resources remains unchanged from the Phase 1 Concept Study Report of the Bowen Basin Pipeline Study. Increases in anticipated fields have balanced reductions in existing, committed and uncertain fields. However, gas producers surveyed to support the development of AEMO’s 2022 five-year forecasts for southern available production have indicated that reserves are still declining – with existing and committed available production forecast to reduce from 487PJ in 2022 to 360PJ in 2026.⁷ There is also a potential need for further gas storage in southern states as the peakiness of gas demand continues to increase as further upstream supply and transport capacity alone will not address this.

Compared to the findings in the Phase 1 Report, gas supply adequacy is forecast to be even tighter in the short term in Southeast Australia. A potential gas shortfall is forecast to be narrowly avoided if actions to reduce gas demand included in AEMO’s Step Change scenario are taken. However, if gas transformation takes a slower pace, as in AEMO’s Progressive Change scenario, small and infrequent potential gas shortfalls are forecast in extreme one-in-twenty-year weather conditions from 2023, as illustrated by Figure 6. This is two years earlier than previously forecast.

Figure 6: AEMO 2022 GSOO gas supply forecast



Sources: AEMO, KPMG analysis, Progressive Change scenario.

Confirming a need for Bowen Basin gas

Modelling indicates Bowen Basin gas strengthens the resilience of the ECGM supply chain by providing additional supply. This capacity can be directed to help meet domestic supply and also be made available to LNG exporters to meet global energy demands.

Gas market modelling

Gas market modelling was undertaken to quantify the potential impact of a new gas pipeline connecting the Bowen Basin to the ECGM on overall east coast gas supply and demand. As noted previously, gas market modelling is subject to a large number of uncertainties on both the supply and the demand sides. Foremost of these uncertainties is the timing and outcomes of prospective southern market gas developments, which will influence the need for Bowen Basin gas to support the ECGM. The two primary southern developments considered to start supplying gas in the short to mid-term are Santos' Narrabri coal seam gas (CSG) field known as the Narrabri Gas Project, and the LNG import terminal attached to the proposed Port Kembla Energy Terminal (PKET).

Projects influencing the domestic demand for Bowen Basin Gas

Case study: Narrabri Gas Project⁸⁹¹⁰

The Narrabri Gas Project is a 95,000-hectare CSG development approximately 20 kilometres southwest of Narrabri in New South Wales proposed by Santos. The proposed Project is expected to provide up to 200TJ per day (target peak production rate) in additional gas supply to the ECGM.

The Narrabri Gas Project will connect to the ECGM via the proposed Hunter Gas Pipeline between Wallumbilla and Newcastle and the proposed Narrabri Lateral Pipeline.

The Narrabri Gas Project has faced community opposition on land use (agriculture), environmental and cultural heritage grounds. The New South Wales Government has approved the development of the Narrabri Gas Project following consent from the Independent Planning Commission in September 2020 and National Native Title Tribunal approval in December 2022. The Hunter Gas pipeline is expected to commence construction in early 2024 once the route is finalised and all secondary approvals are completed. The Narrabri Lateral Pipeline is currently entering into the New South Wales planning and approvals process.



Case study: Port Kembla Energy Terminal^{11 12}

The PKET, also known as Port Kembla Gas Terminal, is an LNG import terminal at Port Kembla, near Wollongong in New South Wales proposed by Squadron Energy. The Terminal is expected to provide up to 100PJ per year in additional gas supply to the ECGM, sourced predominantly from international suppliers.

The proposed Terminal comprises a floating storage and regasification unit – a ship storing up to 4PJ of LNG loaded from other LNG carriers. When needed, the LNG would be regasified, brought to port and input into a proposed gas pipeline connecting to Cringila. A proposed Port Kembla Power Station could convert imported gas into electricity for immediate use in the NEM.

Planning approval was received in October 2020, and final investment decision is pending as of January 2023. Construction is expected to comprise 14-16 months.



Modelling assumptions

In the light of these uncertainties, the gas market modelling tested three scenarios which used different assumptions regarding the gas market outlook.

1
Mid Case which encompasses moderate/realistic assumptions around market favourability.

Domestic demand is similar to AEMO's GSOO Progressive Change scenario.

LNG prices will decline from their current highs to a long-term average of AUD\$11/GJ delivered into Asia.

The timing of the two prospective southern developments is in line with current industry expectations with Narrabri Gas Project to start producing gas in 2028, reaching full production in 2031, and PKET coming online in 2026.

2
Low Case which represents challenging market conditions for pipeline development.

Domestic demand is similar to AEMO's GSOO Step Change scenario.

LNG declines much further to levels around AUD\$9/GJ (delivered into Asia).

The timing of the two prospective southern developments is more accelerated with Narrabri Gas Project coming online in 2026, reaching full production in 2029, and PKET coming online in 2025.

3
High Case which represents favourable market conditions for pipeline development.

Domestic demand is similar to AEMO's GSOO Progressive Change scenario.

LNG exporters operate at nameplate capacity with LNG prices settling at a long-term average of AUD\$12.60/GJ delivered into Asia.

The timing of the two prospective southern developments is slightly delayed, with both Narrabri Gas Project and PKET coming online in 2028.

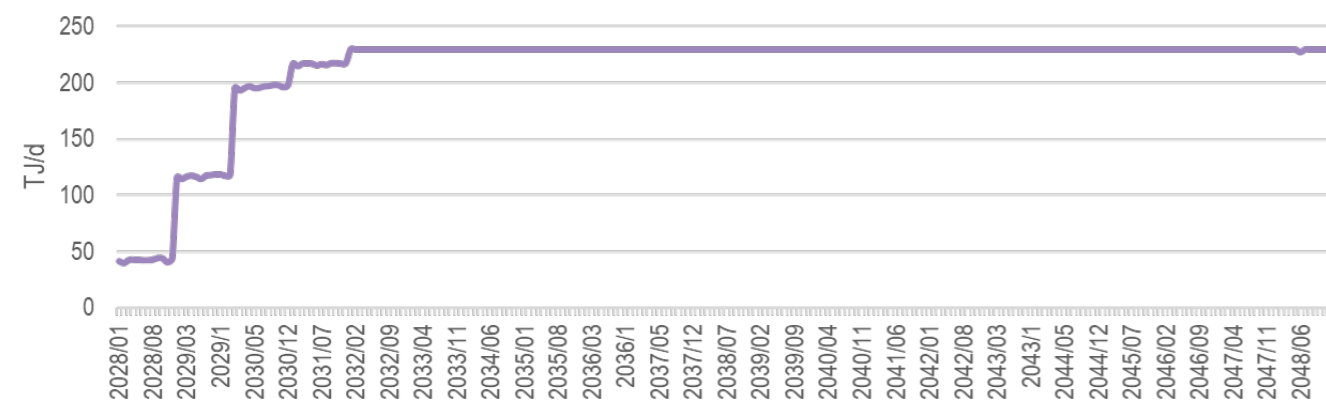
Gas market impacts of the proposed pipeline

Modelling results indicate that under Mid Case conditions, the Bowen Basin pipeline reaches capacity (230TJ/day) shortly after commissioning and remains at such a level until the end of the modelling horizon as shown in Figure 7. Modelling also indicates that the pipeline could provide additional supply of 20-40TJ/day that would net off supply from Southern Australia to address peak demand after the pipeline is operational (2028) until 2030, supporting the ECGM demand.

Post 2030, the benefit that the Bowen Basin has on the domestic market is limited if the Narrabri Gas Project and PKET proceed (along with some other smaller developments in the Bass Strait). However, if these projects are delayed or are not developed at all, the role of Bowen Basin gas supporting the ECGM demand is more significant, particularly through the peak winter months in the 2030s. This is particularly the case if PKET is not developed.

Post 2040, the modelling shows limited benefit to the domestic market given it is expected that sharp cuts to domestic gas consumption will be required to meet net-zero emission targets by 2050. The pipeline would then continue to underpin supply for the LNG plants in Gladstone.

Figure 7: Projected Mid Case pipeline flows



Source: ACIL Allen, 2022.

The pipeline will be utilised under any demand scenario



Bowen Basin gas assists both the domestic and LNG markets. However, the domestic need for the pipeline is sensitive to the timing of other potential supply sources such as PKET and Narrabri Gas Project:

- Without these projects, Bowen Basin gas could ensure the domestic market over the long term is supported. Both of these projects are facing ongoing risks of delay.
- If these projects come online, Bowen Basin gas would likely mostly supply LNG export, assisting LNG exporters in meeting their contractual demand and the growing international energy demand.

Modelling indicates that the pipeline would be utilised in any of the expected gas demand scenarios, benefiting the Queensland economy either through domestic pricing or increased export earnings.

However, the pipeline development needs to be underpinned by the combined demands of the ECGM and LNG export – Queensland demand alone is not sufficient.

There is a short window of opportunity



Modelling indicates that the pipeline is required to be operational by no later than 2028 to support the domestic market. The sooner the pipeline can be built, the greater the impact it will have on the domestic market.

The pipeline's economics are likely to be robust



- Modelling suggests that the economic rationale for developing the pipeline would be challenged if long-term LNG realised prices decline below AUD\$9-9.50/GJ (delivered to Asia) over the project life.
- Based on current trends a long-term LNG price of less than AUD\$9/GJ delivered to Asia is considered unlikely.

Market feedback

The Bowen Basin was seen by interviewed stakeholders as a potential alternative source for gas. Given the uncertainties in the role of gas post 2030, there is a window of opportunity to develop a pipeline.

Stakeholder consultation

Engaging with stakeholders was a critical step in building the understanding and market knowledge required to successfully achieve the objectives of Phase 2 of the Study. Specifically, the Phase 2 stakeholder engagement sought to:

- Confirm the market need for the development of the Bowen Basin pipeline;
- Understand market appetite and capability of parties interested in planning, designing, constructing, managing, operating and owning pipeline infrastructure connecting gas fields in the Bowen Basin to the East Coast Gas Market;
- Identify key barriers for development of the pipeline from the market participants' perspective; and
- Identify triggers for the development of a new pipeline.

A broad and varied range of stakeholders across industry and government were consulted via individual face to face interviews between July and August 2022 to build a detailed understanding of the requirements and preferences of the market. Stakeholders were asked a range of questions focussed on market and capacity, technical solutions and development processes, commercial considerations and timeframes. A total of 31 stakeholders, over 39 sessions were consulted, and each participated on a voluntary basis.

As stakeholder engagement sought to determine the commerciality of a potential pipeline, community and environmental stakeholders were not consulted as part of this phase.

The structured stakeholder engagement followed an iterative approach comprising four waves, starting with initial consultations with a broad and varied range of participants (**Waves A through C**), followed by more focussed and targeted follow-up sessions with key organisations (**Wave D**). Initial stakeholder consultations were designed to allow future sessions to build on the initial feedback to assist in forming a comprehensive understanding of the market appetite for the pipeline.

WAVE A: GAS MARKET PARTICIPANT STAKEHOLDERS

Wave A encompassed industry participants directly involved in the ownership, operation and use of gas pipelines. This included retailers, infrastructure operators, and users (both domestic and international) to explore appetite for pipeline operation and foundation offtake contracts.

WAVE B: INVESTOR AND MINING STAKEHOLDERS

Wave B consisted of market participants directly involved in the funding of energy and gas infrastructure. This included mine operators, investors and financial institutions.

WAVE C: GOVERNMENT AND REGULATORY STAKEHOLDERS

Wave C comprised market participants responsible for market design, function and regulation. This included regulatory bodies and government entities.

WAVE D: TARGETED FOLLOW-UP ENGAGEMENT WITH KEY STAKEHOLDERS

Based on engagement findings obtained from participants in Waves A through C, targeted follow-up discussions were held with key stakeholders to provide further insight into refined information. This included major upstream and midstream gas market participants.

Stakeholder feedback

Stakeholder feedback highlighted the complexity of the current state of the gas market - there is a need to quickly accelerate development to meet the potential shortfalls in the ECGM, however, uncertainty was expressed around gas resources in some regions of the Bowen Basin and around the future role and use of gas domestically more broadly.

Based on stakeholder feedback, KPMG has identified considerations for next steps for each theme for the Queensland Government to consider. It is important to note that the key Australian Government policy changes such as the Safeguard Mechanism Reform and renewed HoA were released after this Study's stakeholder engagement process and any impacts of these changes to stakeholders are not reflected.

Gas resources (supply)

Stakeholders noted that gas reserves vary widely across the Bowen Basin, although generally they are not classified as proved¹³ and/or are held by a small number of market participants. The regions within the Bowen Basin are at different stages of development:

- **Northern Moranbah region:** Stakeholders noted uncertainty around reserves and whether their quality, flow rate and duration will be sufficient to provide confidence for field development and to reliably meet demand. Additional time would be required to prove reserves and ensure that the expected production profile could warrant a pipeline.
- **Central Blackwater region:** Stakeholders shared minimal information about this region.
- **Southern Mahalo region:** Stakeholders viewed this region as the most prospective.

There are diverging views on the technical and commercial feasibility and achievable production rates of CMM.

Despite its challenges, stakeholders deem the Bowen Basin as competitive relative to the Beetaloo and Galilee Basins which are considered have a 10 to 15 year longer lead time. Nevertheless, the development of the PKET or the Narrabri Gas Project could impact the domestic demand for the Bowen Basin development.

Considerations for next steps

Proving sufficient contingent resources in the region to provide more resource certainty could de-risk the development of the pipeline. For this reason, it is important to consider hurdles and opportunities to encourage further gas exploration and upstream development in the northern Bowen Basin, while also facilitating timely development of the southern Bowen Basin given it is currently economical to develop.

Market capacity (demand)

Stakeholders anticipate the gas demand in the ECGM and international markets to remain strong until 2035. Whilst it is widely accepted that international demand levels will most likely be sustained to 2050, stakeholders noted increasing uncertainty in domestic demand as 2050 approaches.

Stakeholders noted that demand in the Townsville region north of the Bowen Basin is at risk of facing undersupply by 2026, whilst flow rates of pipelines south of Wallumbilla in peak demand periods restrict the ability for the pipeline to meet southern peak demand.

Stakeholder feedback indicated the potential for new industrial development in the Mackay region in the medium term, which could represent additional gas demand. Development of industry (traditional and non-traditional) has the potential to introduce substantial electricity or gas demand uplift. Given the region already has a strong traditional resources industry, stakeholder feedback noted a focus on the future development of alternative industries. However, a spur pipeline connecting Mackay to the existing Northern Gas Pipeline or to Moranbah would be of material distance at 100-150km and thus any pipeline development would require sufficient material demand in Mackay to justify its development from a commercial perspective.

Considerations for next steps

The necessity for the development of a pipeline in the Bowen Basin is largely driven by demand for gas in the ECGM, Townsville and LNG export markets, as well as demand for electricity from gas-fired generation to provide energy security. It is important to consider the liquidity, sizing, off-take length and timing for servicing one or all of these markets.

Policy and regulatory considerations

Uncertainty in the implementation of a domestic gas reservation policy or tightening of approvals processes is currently discouraging new upstream developments in the Bowen Basin, with market participants proposing potential roles for government to overcome this. CMM is currently considered commercially uneconomical to capture and use, however opportunities to increase its use have been identified.

Uncertainty is also prevailing on the implications of the Decision Regulation Impact Statement (RIS) on pipeline regulation, agreed by the Energy National Cabinet Reform Committee in 2021. The RIS has led to uncertainty around the ability for a pipeline operator to obtain a greenfield exemption and thus increased the likelihood that full regulation would be applied to a newly developed pipeline. Under full regulation, the pipeline operator would have no control over the pipeline's tariff and returns and therefore no control over the ability to recover the capital spend for the pipeline's development. Considering the current timeframe pressure and returns expectations from pipeline operators, consulted pipeline operators noted they have little incentive to develop a new pipeline if it is at risk of becoming fully regulated.

Considerations for next steps

The policy and regulatory environment could significantly affect the development of the pipeline. Consideration should be given to the approvals process and ease of upstream development to reduce investment risk and provide certainty around the return that the pipeline operator could consider as a component of any investment decision.

Technical options

Given planning for the pipeline is at an early stage, stakeholders do not have a clear view of the pipeline's technical specifications or optimal route.

Some parties preferenced a route to the west of mining tenements whilst some parties suggested the use of existing easements. However, there was a strong preference in the market to avoid a route directly to Gladstone.

Stakeholders have indicated that if the pipeline is not rightly sized to accommodate the entire Basin, compression infrastructure may be required in the future. They also raised that whilst multi-user access is an important aspect of the pipeline, it could require different supporting infrastructure, increasing the capital expenditure.

Stakeholders also stated that future-proofing the pipeline for alternative gases such as hydrogen could potentially be critical for the social licence and commerciality of the pipeline.

Considerations for next steps

Whilst multiple stakeholders highlighted that technical design is best left to the pipeline operator, many acknowledged the importance of aligning key aspects of the design (such as the pipeline route or future proofing) with outcomes that are optimal for the overall development of the Bowen Basin, market and community beyond the individual pipeline operator's requirements. This will ensure efficiency in the design and suitability of the final development.

Commercial considerations

There was a broad consensus across market participants that uncertainty around the future state of the gas market was a significant factor in the pipeline investment decision-making. Market participants identified several hurdles, including domestic market volatility driving shorter gas offtake agreements than required for investment and increasing uncertainty in the investment horizon of the pipeline. Pipeline operators have shortened investment horizons for new pipeline developments to around 15 years.

Capturing and utilising CMM to reduce fugitive emissions was discussed, with many stakeholders considering it as uneconomic in the current market.

Considerations for next steps

A key risk to the pipeline's development is the uncertainty in the degree of available underwriting from offtake agreements and the investment horizon from both an equity and debt perspective. Consideration could be given to how these risks could be mitigated or reduced.

Financing

There were varying responses to the ability to access to finance, however there was broad consensus that opposition to fossil fuel developments and increasing requirements for ESG-compliant investment mandates are decreasing capital market appetite. Most projects are currently required to demonstrate a transition plan, and developments are subject to increased constraints generated by shorter investment horizons. Some stakeholders noted there is material uncertainty around the capacity to secure funding for a future pipeline project (both debt and equity). Whilst some equity and debt funders currently involved in gas projects noted that they are no longer allowed to invest in midstream infrastructure due to ESG mandates imposed by their shareholders.

Considerations for next steps

Whilst some investors are yet to instigate ESG mandates, the pool of accommodating financial institutions is likely to become a critical hurdle for the development of the pipeline. A strong government position reflecting the pipeline's ability to enable Australia's energy transition and provide energy security and regional economic benefits should be carefully considered alongside commercial models to distribute risk.

Timeframes

Stakeholders widely agree that the full pipeline could not be developed before 2030 with development time expected to take between six to ten years split evenly

Based on stakeholder feedback, KPMG has identified considerations for next steps for each theme for the Government to consider.

between approvals and construction. Streamlined approvals could accelerate development, as could developing the pipeline in two stages to connect some of the Bowen Basin's proven reserves to market more quickly.

Considerations for next steps

The timeline for the pipeline's development in the broader picture of gas shortages in the ECGM could be a key enabler for the pipeline, particularly given the uncertainty of other gas development projects. In the medium term, Bowen Basin gas could be part of the solution to assist in supplying NEM-wide demand and to support continued LNG exports which are facing critical undersupply, while Queensland transitions to a low-carbon economy. Consideration could be given to how the development of the pipeline could be expedited through streamlined approvals processes and/or staging.

Development options

Market participants suggested various options to facilitate the construction of the pipeline, such as the creation of a multi-use corridor, pipeline could be designed hydrogen ready or the staging of its development. Both would assist in increasing the likelihood of pipeline development and expediting its development timeframe.

Considerations for next steps

Innovative development options, such as staging the pipeline's development, could be considered to expedite the approvals process, accelerate the connection of gas to market and reduce the overall investment risk of the pipeline.

Minimising the Basin's fugitive emissions

The capture and beneficial use of coal mine methane in the Basin currently faces several challenges. Cross-sector collaboration across the private and public sector will be critical to achieving a reduction in fugitive emissions.

Current challenges to increased use of coal mine methane

Little incentive

Coal mine operators, CSG companies, government, and other third-party market makers have studied the management of CMM in the Bowen Basin. To date, some CMM utilisation projects have been successfully implemented, mostly related to localised power generation for mine use. Other uses, including export by pipeline, or use as fuel for trucks and other equipment, have mostly been found to be uneconomic.

Whilst companies can undertake emission avoidance offset projects or sequestration offset projects to receive Australian Carbon Credit Units (ACCUs) under the Australian Emissions Reduction Fund (ERF), the method limits the scope of eligible projects.



Gas quality and reliability



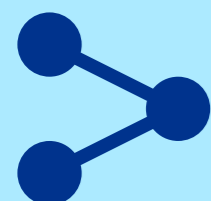
CMM is typically highly variable in type, volume, pressure, quality and flow, hence it can be a challenge to provide to market consistent supply of suitable quality gas that is also economic to produce. This leads to variable production of CMM that makes the sale of the gas under firm Gas Supply Agreements difficult.

Access to infrastructure

The lack of proximal export pipelines and required infrastructure to meet pipeline quality and pressure requirements is a key barrier to exporting CMM to the commercial market.



Overlapping tenure



Overlapping tenure creates several barriers to the beneficial use of CMM, including complexities surrounding the rights to commercialise CMM, uncertainties on timeframes and risk of cross-lease contamination.

These restrictions may prevent coal mining companies from capturing and utilising CMM, causing them to vent or flare it instead.

Improving the utilisation of coal mine methane

Due to the current challenges, CMM is not suitable to underpin the development of the Bowen Basin. CMM is likely to supplement the traditional gas production in the Bowen Basin.

However, many potential strategies could be investigated to improve the economics of CMM utilisation, and therefore enable the capture and use of CMM within the Basin. These are likely to be crafted around the following key focus areas:

Infrastructure

Access to a pipeline and upgraded transmission systems may encourage or enable the use CMM, driving the development of common use infrastructure.



Power generation for local consumption



Utilising CMM for on-site power generation, particularly in underground mines where existing infrastructure requires little augmentation to gather gas and generate power.

Policy changes

Review of existing policies or development of new policies to ensure resources are maximised, barriers to the use of CMM are minimised and adoption of emerging technologies are encouraged.



New markets



Considering new energy supply chains utilising either CSG and low-quality gas associated with its production or CMM that has been treated to a suitable quality.

Emerging technology

Developing and incorporating the use of emerging technology, such as membrane separation of methane to improve gas concentrations to useable levels, has the potential to change the dynamics of CMM utilisation in the Basin.



Project beneficiaries

Bowen Basin gas will be unable to come to market in the short term. However, it may be a mid-term solution to assist with system-wide energy demand, providing security and resilience to the ECGM whilst supporting continued LNG exports.

Benefits across all levels of government and regional communities

This Study has further demonstrated the criticality of pipeline infrastructure to the unlocking of the Bowen Basin, providing benefits across all tiers of government and to regional communities. Although the development of the Bowen Basin pipeline is unlikely to support the potential short-term gas shortfalls (pre-2028) in the ECGM due to development timeframes, it is anticipated to:

- Fill the mid-term ECGM imbalance (post-2028), which the delay or failure of either PKET or the Narrabri Gas Project could exacerbate;
- Support Queensland's transition to net-zero in the medium term by contributing to the supply of around 3GW of low to no emission gas to support storage and dispatchable energy generation;¹⁴
- Provide certainty for industry to invest in Queensland's regions due to the availability of a secure and stable energy source;
- Deliver significant regional development opportunities for communities through investment into regional supply chains, regional service hubs and direct employment opportunities;
- Secure future royalties in a low carbon economy; and
- Support global energy demands through backfilling LNG supply.

Developing the Bowen Basin can contribute to achieving the system-wide energy, security and resilience needed during this period of global energy transition. Table 1 identifies the four key beneficiaries of unlocking the Basin.



Table 1: Pipeline beneficiaries

BENEFICIARY	NEED	BENEFITS
National	East Coast Gas Market	ECGM is facing potential gas shortfalls from the mid 2020s, driving up costs of living. <ul style="list-style-type: none"> • Provides a sufficient and stable source of gas to meet the needs of domestic and industrial users. • Provides domestic energy security without the need to rely on imports. • May help to address cost of living pressures through a potential reduction in ECGM gas prices.
	Queensland's energy transition	Gas will be critical in the development of low to no emission energy generation. <ul style="list-style-type: none"> • Provides a reliable energy source to meet peak demand as Queensland decreases reliance on coal-fired power generation. • May help to address cost of living pressures through a potential reduction in ECGM gas prices. • Provides a domestic demand source to support the development of a low carbon hydrogen industry.
Queensland	Queensland's regional development	There is a need to strengthen and diversify Queensland's regional economies as the resource sector evolves. <ul style="list-style-type: none"> • Supports regional development and industrial diversification. • Supports ongoing jobs and creates new economic opportunities. • May help to address cost of living pressures through a potential reduction in ECGM gas prices.
	Global energy demand	Gas is critical in the transition to a low to no emissions future whilst supporting the growing global energy demand. <ul style="list-style-type: none"> • Provision of gas as a form of energy supply to meet global demand. • Alternate source of royalties as Queensland decreases reliance on coal for power generation.

Pathway forward

There is potential for the Bowen Basin to be further developed and connected to the ECGM as a material upstream source of gas. However, timing is critical.

Factors influencing delivery approach

Stakeholder feedback obtained through Phase 2 market engagement highlighted the complexity of the current state of the gas market, influencing the proposed delivery approach for the pipeline:

1. Timing to meet mid-term demand

There is a need to quickly accelerate development to meet the potential mid-term shortfalls in the ECGM.

2. Reserve uncertainty

There is a lack of information about the volume of reserves that can be extracted economically, specifically in the Moranbah and Blackwater regions. This is a key driver of uncertainty and potential commercial risk amongst stakeholders.

Acknowledging these two factors, the **proposed pipeline delivery approach is a staged delivery:**

- The Mahalo region is the most prospective region for future development and is close to existing gas transmission infrastructure. Connecting southern reserves to the ECGM first would provide additional time to prove up and develop northern reserves without slowing the pipeline development process.
- During this time, gas from reserves in the northern Bowen Basin can continue to flow to local industry in Townsville, whose supply is at risk beyond 2026. The later development of a pipeline connecting the northern Bowen Basin to the ECGM means, in the short and medium term, Townsville local industry will be less exposed to the more expensive LNG netback prices, supporting the economic growth of the region.

Timing to meet mid-term demand

Timing is critical to the delivery of the pipeline and the successful development of the entire Bowen Basin. Both the gas market modelling and market engagement feedback indicate that there is only a short window of opportunity to progress the development of the pipeline. To meet the near-term window for domestic demand, the critical milestones are:

- **Stage 1: Mahalo region to ECGM** – proposed as the first stage of the development of the Bowen Basin with a pipeline operational by 2028 to support the potential mid-term gas shortfalls in the ECGM; and
- **Stage 2: Moranbah region to Mahalo region** – pipeline connecting the Moranbah region to the Stage 1 pipeline, to be operational by no later than 2030 to allow maximum payback period of 15 years.

Next steps

Phase 2 of this Study has further demonstrated the criticality of pipeline infrastructure to the unlocking of the Bowen Basin. However, analysis based on structured market engagement findings has identified that the barriers faced by the private sector are currently prohibitively high for market-led development of a pipeline connecting the entire Bowen Basin. As such, **there is opportunity for government to support industry to enable the development of a pipeline that unlocks the Bowen Basin.**

Glossary

ACCU	Australian Carbon Credit Unit
ADGSM	Australian Domestic Gas Security Mechanism
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
CMM	coal mine methane
COAG	Council of Australian Governments
CSG	coal seam gas
ESG	environmental, social and governance
ERF	Australian Emissions Reduction Fund
GLNG	Gladstone Liquefied Natural Gas
GSOO	Gas Statement of Opportunities
HoA	Heads of Agreement
LNG	liquefied natural gas
MGP	Moranbah Gas Project
NEM	National Electricity Market
NQGP	North Queensland Gas Pipeline
PKET	Port Kembla Energy Terminal
QGP	Queensland Gas Pipeline
RIS	Regulation Impact Statement
GJ	gigajoule
TJ	terajoule
PJ	petajoule
GW	gigawatt
2P	total of proven and probable gas reserves



Endnotes

- 1** Coal mine methane (CMM) refers to methane gas released as an incidental by-product from coal mining. CMM is usually not utilised and instead vented or flared, producing fugitive emissions.
- 2** Total of proven and probable gas reserves
- 3** Gas Leases refer to Petroleum Leases, Potential Commercial Areas (Petroleum) and Exploration Permits for Petroleum.
- 4** Note that many of these policy developments had not been published or finalised at the time of the Bowen Basin Pipeline Study – Phase 2 Market Engagement and stakeholder views on these policy developments may not have necessarily been covered or captured.
- 5** Note: the Queensland Energy and Jobs Plan was made public after market consultation undertaken as part of this Study. Therefore this report does not capture market participants' views on the Plan.
- 6** Australian Government, 2022. Heads of Agreement (HoA): The Australian East Coast Domestic Gas Supply Commitment.
- 7** Australian Energy Market Operator (AEMO), 2022. Gas Statement of Opportunities (GSOO).
- 8** New South Wales Government, 2016. Narrabri Gas Project – Secretary's Environmental Assessment Requirements.
- 9** Hunter Gas Pipeline, 2023. Hunter Gas Pipeline.
- 10** Santos, 2022. Narrabri Gas Project Community Consultative Committee Meeting – Feb 2022.
- 11** Squadron Energy, 2023. Port Kembla Energy Terminal: About the Project.
- 12** Squadron Energy, 2018. Port Kembla Gas Terminal: Volume 1 Environmental Impact Statement.
- 13** i.e. probable or possible
- 14** Gas-fuelled generators provide dispatchable generation - they can generate at peak periods or during extended renewable generation drought conditions. The Queensland Supergrid Infrastructure Blueprint notes that strategic use of low capital cost gas-fuelled plant (such as gas turbines or gas reciprocating engines using either gas or hydrogen blends in the short-term and/or 100 per cent renewable hydrogen in the longer term) may be an effective way to reduce the cost of meeting Queensland's total storage/peaking capacity requirements. Source: Queensland Government, 2022. Queensland Supergrid Infrastructure Blueprint.

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