

Attachment I

Energy demand and market statement



ENERGYQUEST

East coast market study

Viva Energy

A Discussion Paper

14 September 2021



Review of the east coast gas market: contents

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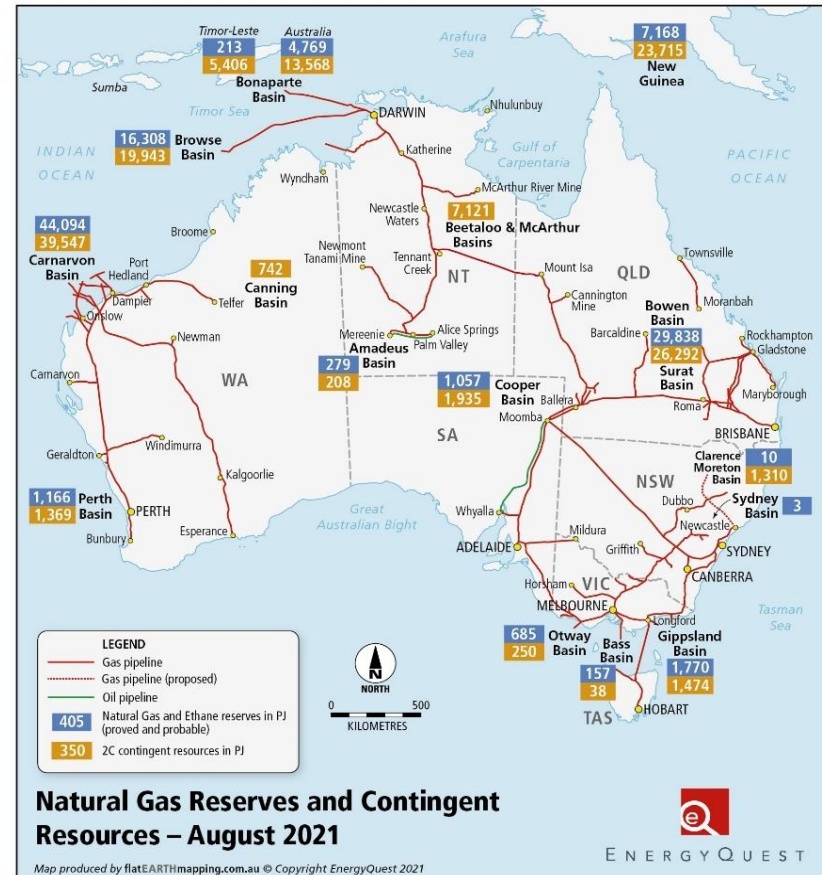


1. Supply: East coast gas resources – where are they?

East coast gas reserves are either committed to LNG projects (81.7%)...

East coast gas reserves are concentrated in the Queensland coal seam gas (CSG) fields, leaving Victorian markets with 8.2% of the total 2P reserves.

- East coast resources:
 - 2P Reserves 33,520 PJ
 - 2C Resources 34,681 PJ
- Victorian/Tasmanian resources:
 - 2P Reserves 2,613 PJ (7.8% of total)
 - 2C Resources 1,727 PJ (5.0% of total)
- CSG
 - 2P Reserves 29,529 PJ (88.1% of total)
 - 2C Resources 27,434 (87.7% of total)
- LNG projects operate 27,370 PJ of the 2P Reserves (81.7% of total)

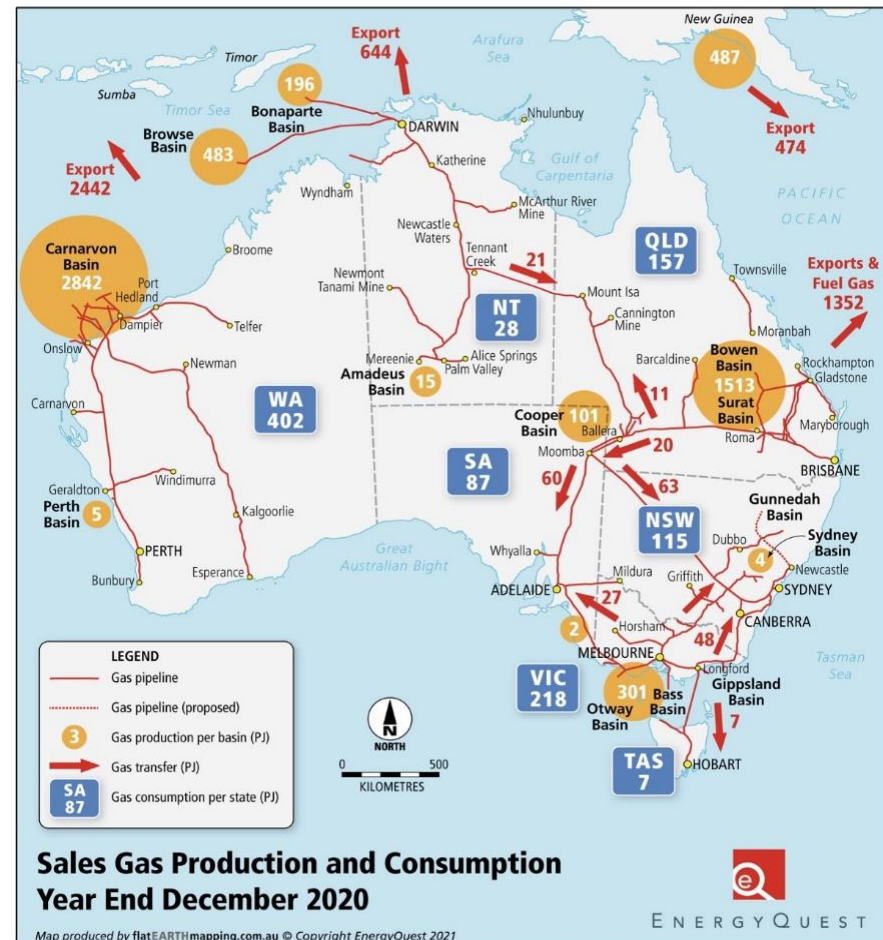


Note: Proven and Probable (2P) Reserves are proven commercial, Mid-case (2C) Contingent Resources are discovered, but not commercial to develop.
Source: EnergyQuest analysis based on company reports and industry information

1. Supply: East coast gas resources – where do they go?

... in declining basins, or are long distances from domestic gas markets

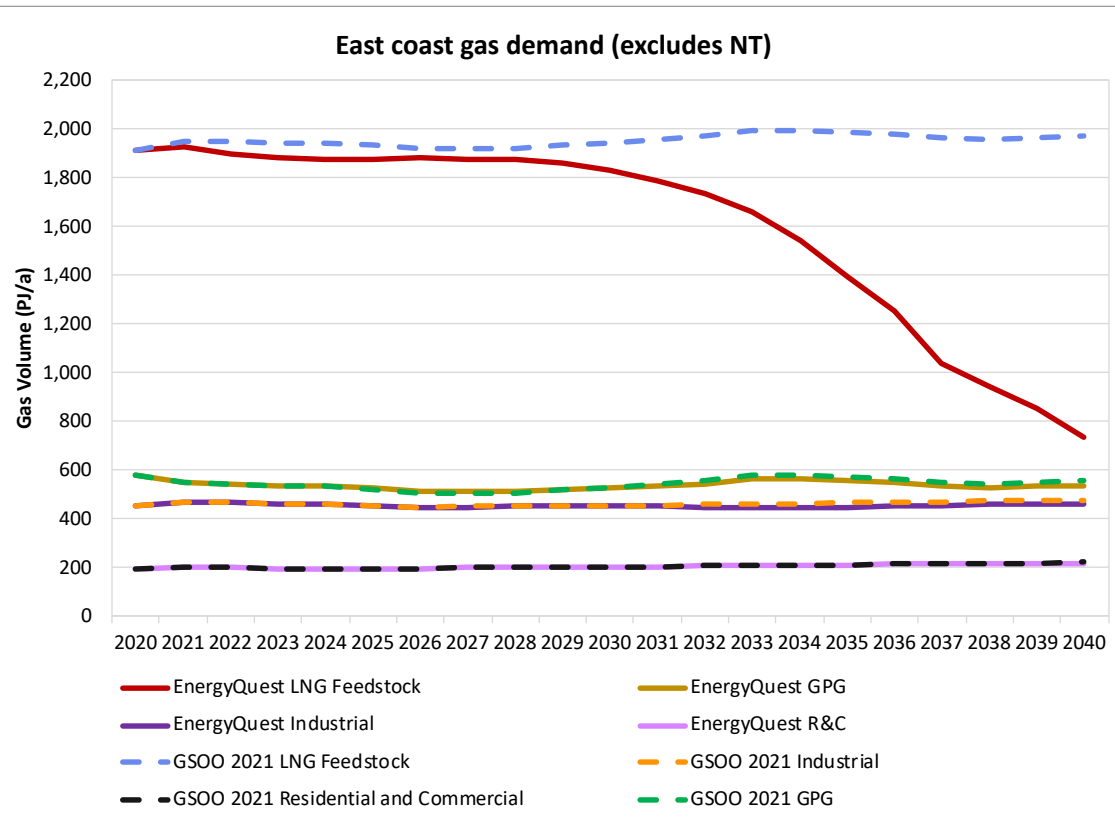
- Three key areas supply the east coast
 - Gippsland/Otway/Bass basins in Bass Strait
 - Cooper Basin
 - Surat/Bowen Basin
- ...with additional gas from the Northern Territory (NT)
- The Cooper and Gippsland Basins have been the primary gas suppliers to Victoria, Tasmania and NSW...
- ... but both are now in decline.



Source: EnergyQuest analysis based on company reports and industry information

2. Demand: East coast gas demand outlook by sector

- Despite strong LNG global demand, LNG feedstock outlook demand declines with gas supply constraints...
- ... with extensions beyond current LNG contracts (2035-37) limited
- Increased gas prices to play a role in domestic gas demand reduction
- Gas-fired power generation (GPG) is losing market share to renewables
- Industrial, Residential and Commercial gas consumption to remain flat

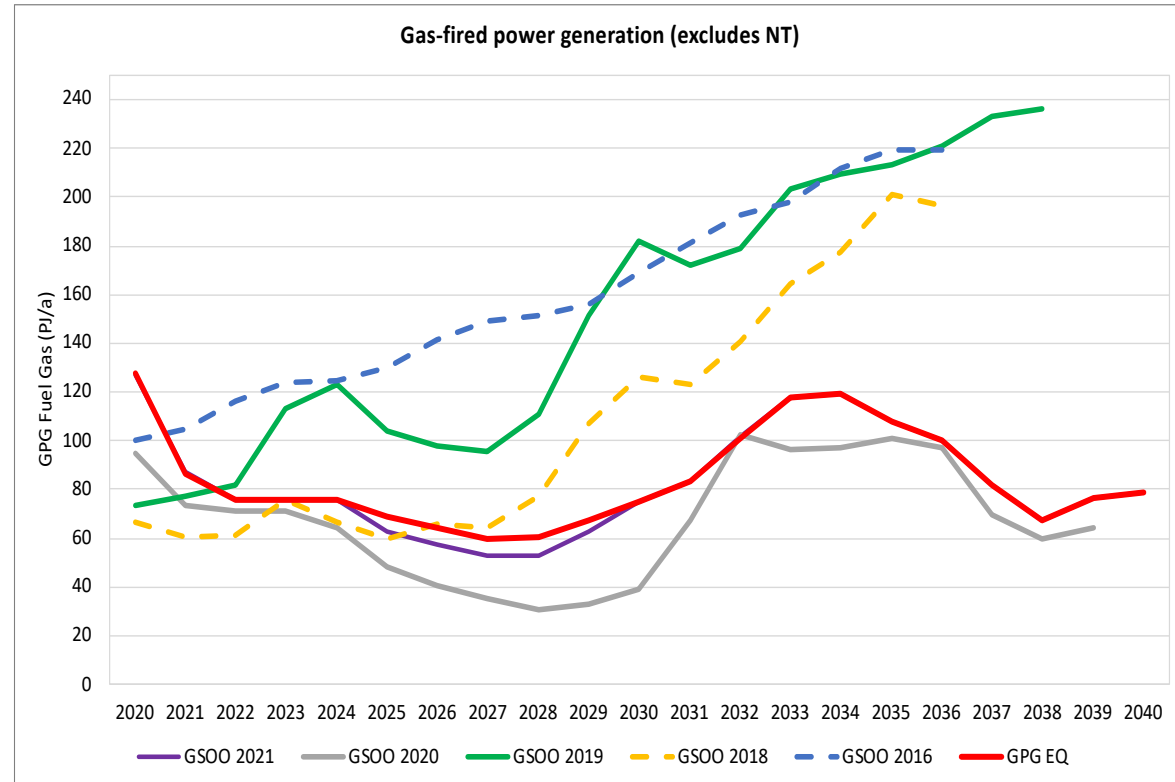


Note: AEMO GSOO shown for comparison against EnergyQuest (EQ) outlook

Source: AEMO 'Gas Statement of Opportunities' (GSOO) 2021; EnergyQuest (EQ) analysis, East Coast gas Outlook (ECGO) 2021

2. Demand: Gas-fired power generation

- Gas-fired power generation (GPG) outlook has varied widely, as large renewable projects are expected to enter production.
- GPG is expected to come off past highs...
- ... losing market share to renewables,
- but augmenting generation for coal-fired supply shutdowns
- EnergyQuest's GPG outlook is higher than GSOO 2021, with the recent announcement of the earlier closure of Yallourn coal fired generator in 2028, requiring more support of dispatchable firm GPG

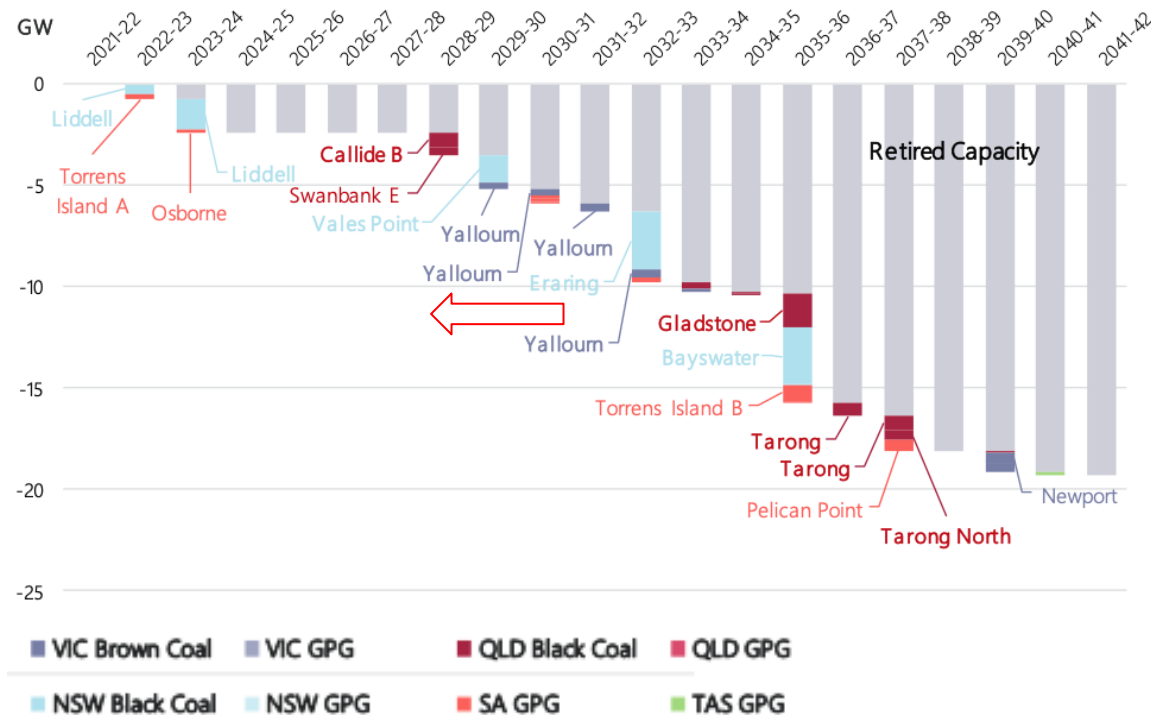


Source: AEMO 'Gas Statement of Opportunities' (GSOO) 2021-2016; EnergyQuest (EQ) analysis, ECGO 2021

2. Demand: Gas-fired power generation

- The GPG forecast reflects expected coal-fired power generator closures around 2023, 2028 and later dates, and requirements for dispatchable power
- The closure of Yallourn has recently been brought forward to 2028 (from 2029-2032), indicating a trend for earlier coal-fired generation closures

Coal-fired generation and GPG retirements

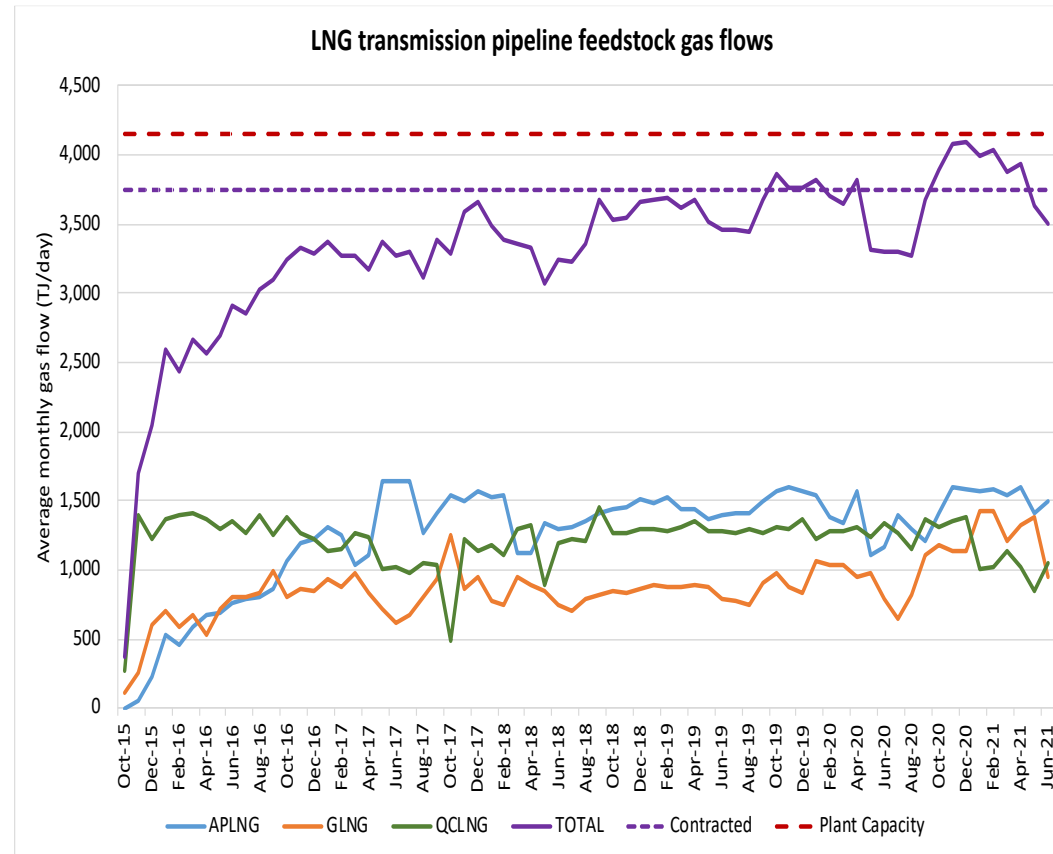


Source: AEMO 2020 Integrated System Plan p44

2. Demand: LNG feedstock gas

Current Queensland LNG feedstock demand is strong, despite international LNG volatility

- Queensland LNG was running close to contract quantities from October 2019 to April 2020
- Volume dropped approx. 10% in May 2020, and offtakers exercised rights to decrease contract volumes (“Downward Quantity Tolerance”)
- This reversed to record levels at plant capacities, in the October-December quarter, with a cold northern winter
- 2020 finished as a record year for Queensland LNG in a very difficult market...
- ...indicating good support by for Queensland LNG by the respective joint venture partners and offtakers

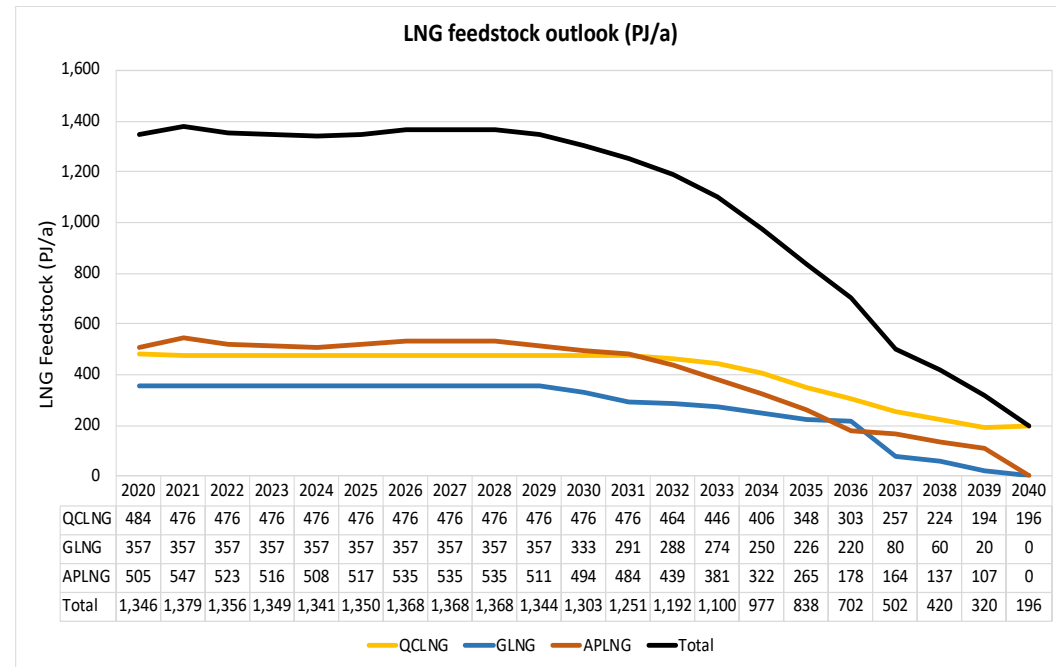


Note: Gladstone, Queensland LNG projects: APLNG (operated by Origin Energy/ConocoPhillips, QCLNG (operated by Shell) and GLNG (operated by Santos)
Source: AEMO Gas Bulletin Board; EnergyQuest analysis

2. Demand: LNG feedstock gas

Long term (20 year from start ups in 2015/16) LNG contracts underpin feedstock demand, but it is eventually constrained by gas supply

- Queensland LNG feedstock demand is expected to hold up to around 2029...
- ...at this point the east coast market runs short of gas, reserves constraints on gas available for LNG projects become apparent, and diversion of gas to the higher priced domestic market will limit gas feedstock supply

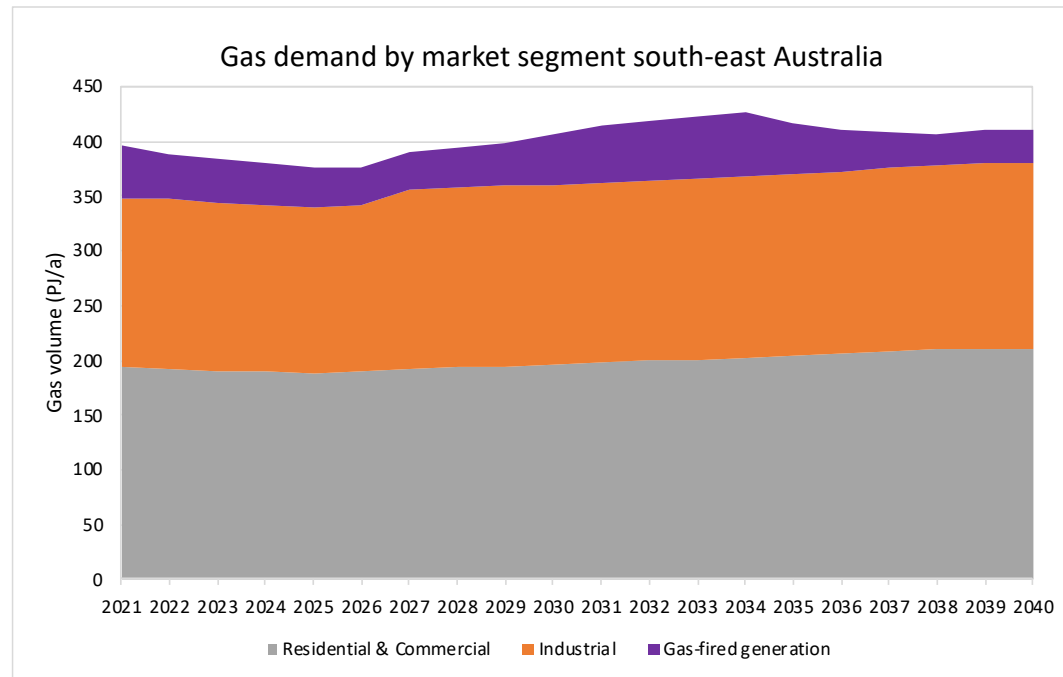


Source: EnergyQuest analysis; ECGO 2021

2. Demand: South-east Australia

South-east* Australian demand is expected to be relatively flat

- GPG is the most variable demand as renewables gain market share
- Industrial demand is more lumpy, with large loads reconsidered as plants undergo refurbishment
- Residential demand is flat with population growth increasing demand and being offset by more efficient appliances and loss of market share to electricity
- Higher gas prices may also dampen future demand longer term



Source: EnergyQuest analysis; ECGO 2021

Note: * South-east Australia (or Southern region) includes NSW, ACT, Victoria, Tasmania and NSW

2. Demand: South-east Australia demand uncertainties

South-east Australian demand is subject to uncertainty and risks:

■ Price

- GPG has a reasonably close relationship with gas prices and despatch i.e. the higher the gas price the harder it is to be economic for mid-merit and base load generation.
- Industrial sector is impacted by gas costs and things like government support, but in a lumpy way wherein decisions to close large loads come in the relevant capital cycle.
- Residential demand is relatively stable, once gas appliances are installed, but longer term market moves against gas may build e.g. suburbs which do not provide reticulated gas, and more efficient electric appliances e.g. reverse cycle heating/cooling.

■ Government policy

- An aggressive move to net zero emissions must see a lower demand for gas in the long term – and leading countries (e.g. Japan, Korea, Europe) are already targeting net zero by 2050.
- Infrastructure investment in renewables, power transmission and control systems will facilitate entry of non-gas energy.
- Hydrogen is expected to be a bigger part of the gas stream.



2. Demand: South-east Australia demand uncertainties

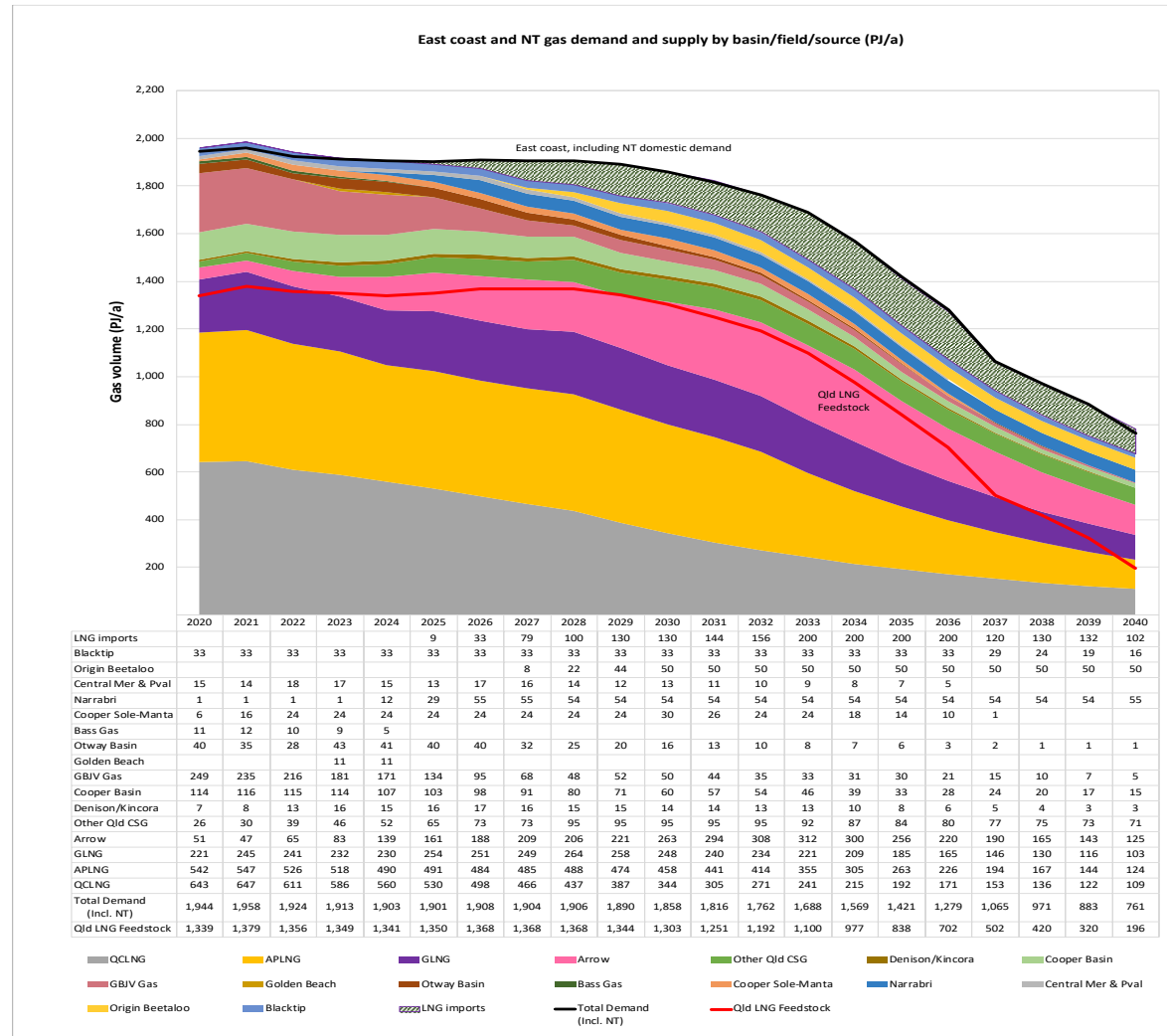
South-east Australian demand is subject to uncertainty and risks (continued):

- Capital is increasing the risk discount on gas, and moving to longer term renewables.
- Community and other forms of organized opposition to new gas development and activities is a point of uncertainty for gas demand outlooks.



3. Supply/Demand Outlook: by major source

- EnergyQuest has modelled gas supply by gas field in order to meet the demand profile.
- APLNG, GLNG, QCLNG and (most of) Arrow are gas producers linked to the Gladstone LNG projects, and account for most of the east coast gas production.
- By around 2025, the east coast is unable to meet 'business as usual' demand profile...
- ... and LNG imports are required. By 2033 gas demand still exceeds the planned capacity (100 PJ/a each) of the two LNG projects (AIE, Port Kembla and Viva Energy, Geelong)



Source: EnergyQuest analysis; ECGO 2021

3. Supply/Demand Outlook: Gas reserves and resources trends

- A shortfall in supply several (7+) years out is not unusual in gas markets, and relies on normal reserves replacement from exploration and appraisal activity, to replace production and “push back the gap”.
- However, this is not the case for the east coast, as reserves (2P) have continued to decline faster than production rates. This means the supply gap is approaching faster.

Table A.3: Changes in 2P reserves in the east coast and onshore Northern Territory by basin, 30 June 2019 to 30 June 2020 (PJ)

| Basin | 2P 30 Jun 2019 | Sources of change in 2P Reserves | | | | | | 2P 30 Jun 2020 | % Change |
|--------------|----------------------|----------------------------------|-----------|------------------------|---------------------|-----------------------|-------------------|----------------------|-------------|
| | | Production | Extension | Net Acquisi tion | Reserves Upgrade | Reserves Downgrade | Other Revision | | |
| Bowen | 6,459 | 333 | 0 | 0 | 130 | 329 | 121 | 6,048 | -6% |
| Surat | 25,885 | 1,192 | 0 | 23 | 876 | 1,015 | -105 | 24,472 | -5% |
| Cooper | 978 | 102 | 16 | 0 | 179 | 9 | 2 | 1,064 | 9% |
| Gippsland | 2,648 | 283 | 0 | 0 | 84 | 398 | 20 | 2,071 | -22% |
| Otway | 622 | 46 | 10 | 0 | 7 | 13 | -4 | 575 | -7% |
| Bass | 111 | 11 | 0 | 0 | 2 | 0 | 0 | 102 | -8% |
| Sydney | 9 | 4 | 0 | 0 | 0 | 0 | 0 | 6 | -39% |
| Gunnedah | - | 1 | 0 | 0 | 9 | 0 | 0 | 9 | n.a. |
| Amadeus | 235 | 17 | 0 | 0 | 42 | 0 | 0 | 260 | 11% |
| Total | 36,947 | 1,989 | 26 | 23 | 1,331 | 1,765 | 34 | 34,606 | -6% |

Notes: Totals may not add up due to rounding.

Source: ACCC, 'Gas inquiry 2017-2025 Interim Report' January 2021; Published 16 Feb 2021.



3. Supply/Demand Outlook: by major source - low case

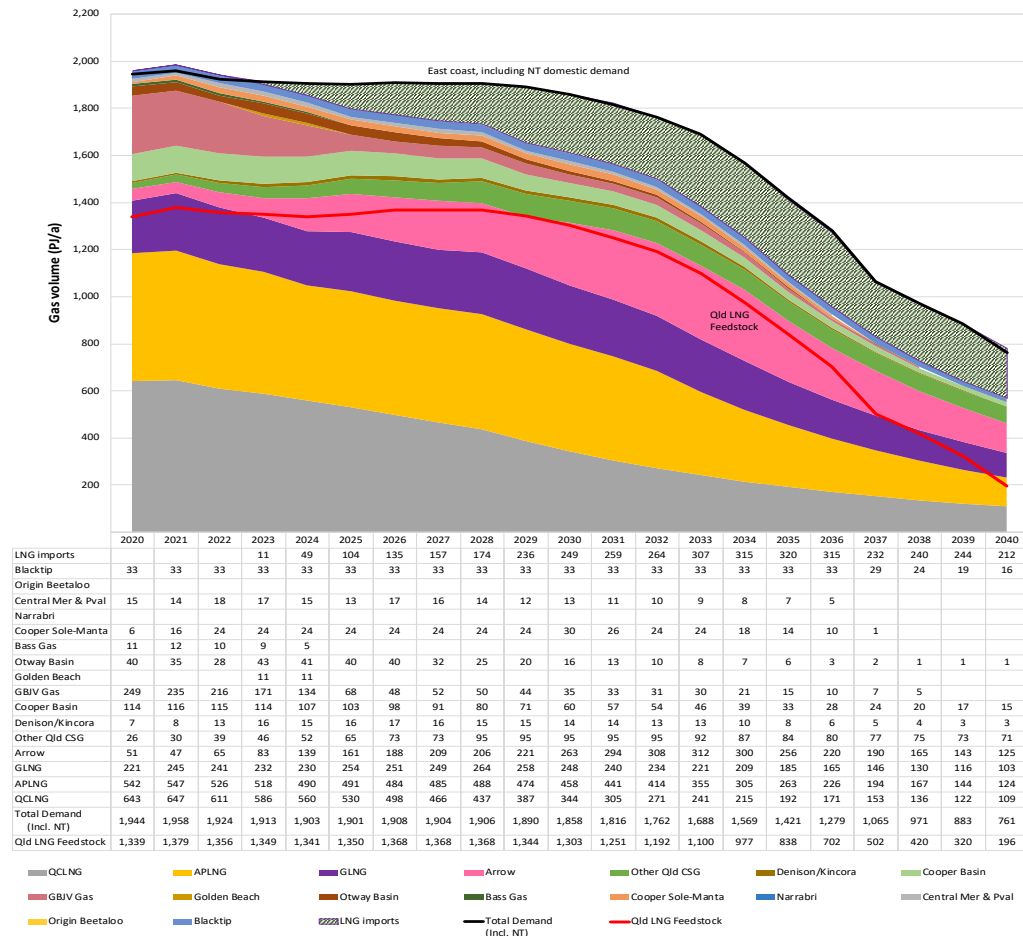
The loss of just a few projects, makes a supply/demand gap appear as early as 2023...

Low case assumptions; if:

- Narrabri, NSW does not reach 'Final Investment Decision' and
- Gippsland legacy assets 'water out' 2 years early. Early depletion has already occurred in one Gippsland field and
- Beetaloo, NT exploration is not successful. Exploration is still in early stages for this area with only a few wells drilled. Economic production has not been demonstrated.

...with LNG import terminals filling the short fall against BAU, with up to 320 PJ/a of gas.

East coast and NT gas demand and supply by basin/field/source (PJ/a) - Low Case



Source: EnergyQuest analysis

3. Supply/Demand Outlook: period analysis

Gas demand and supply outlook will go through distinct periods – from Balanced to unresolved Shortfall, to eventually a Post-LNG period

2020-2025: Balanced

- Balanced period where gas supply meets demand.

2025-2029: Transition - LNG imports are required

- Gippsland Basin decline commences. Exploration in deeper water is high cost and has been unsuccessful to date. Later fields have higher CO₂ (e.g. Kipper) requiring new CO₂ removal plant at Longford. This may lead to the decommissioning of legacy processing capacity – a vital source of seasonal swing capacity to south-east Australia.
- LNG imports are required to supply demand, initially into Port Kembla NSW, then Victoria (Viva Energy Geelong). With only a few years to the shortfall, there are few options other than LNG net back and imports to meet demand. This supply will be needed in both NSW and Victoria.
- The LNG may be sourced from international or distant Australian fields (virtual pipelines).

2029-2037: Shortfall

- LNG contracted and domestic demand exceeds supply with the decline of CGS fields, and LNG exports are curtailed due to supply constraints.
- This period requires one or all of the following to maintain a balanced market – domestic gas or LNG demand curtailment, greater LNG import volumes, acceleration of reserves, and/or new large domestic gas discoveries and development.

2038+: Post-LNG

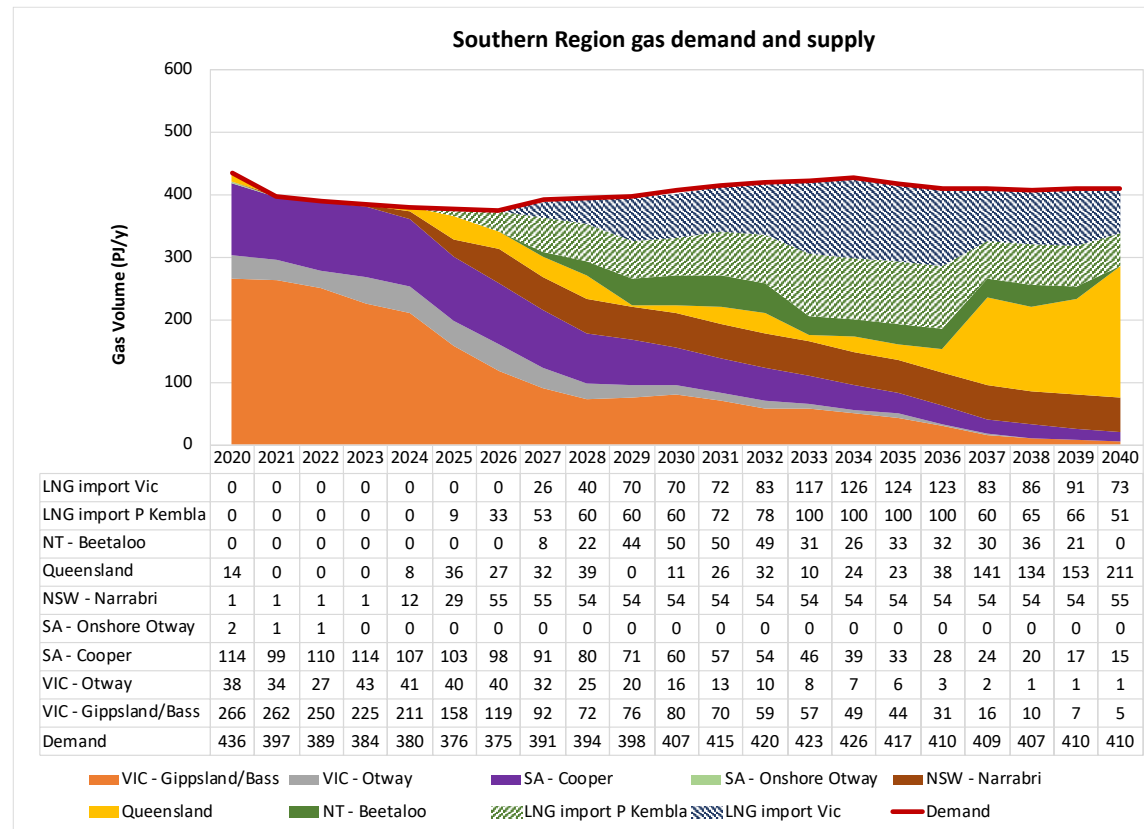
- Existing LNG contracts are complete, and LNG activity drops to a single train* or two depending on remaining gas availability and economics.

Note: *An LNG train is a single processing unit of approx. 4 million tonnes pa. Each Queensland LNG project has two trains
Source: EnergyQuest analysis



3. Supply/Demand Outlook: Southern region

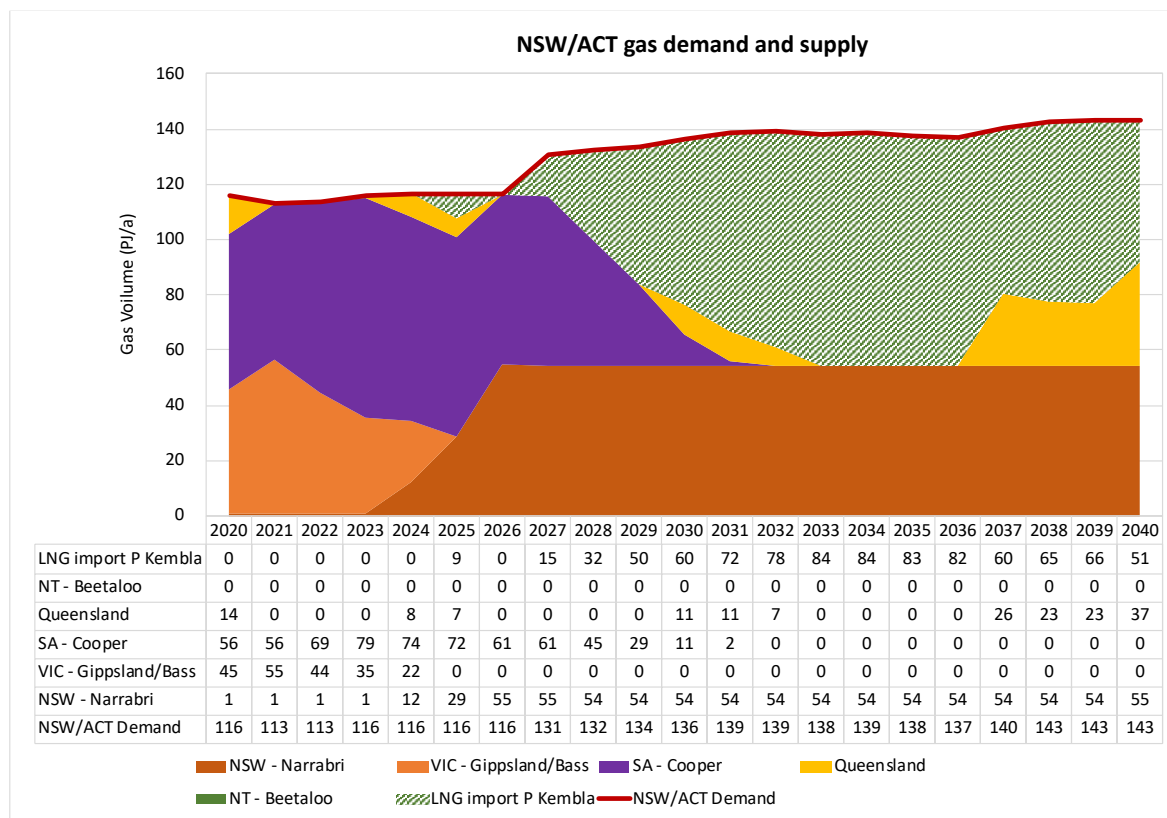
- The decline of the Bass Strait and Cooper Basins from around 2025, leaves the Southern Region short of gas...
- ...even with some available gas from Queensland and NT,
- requiring LNG imports to meet the 'business as usual' demand profile.



Source: EnergyQuest analysis, ECGO 2021; Southern Region = NSW, ACT, Victoria, Tasmania and South Australia

3. Supply Demand Outlook: NSW/ACT by major source

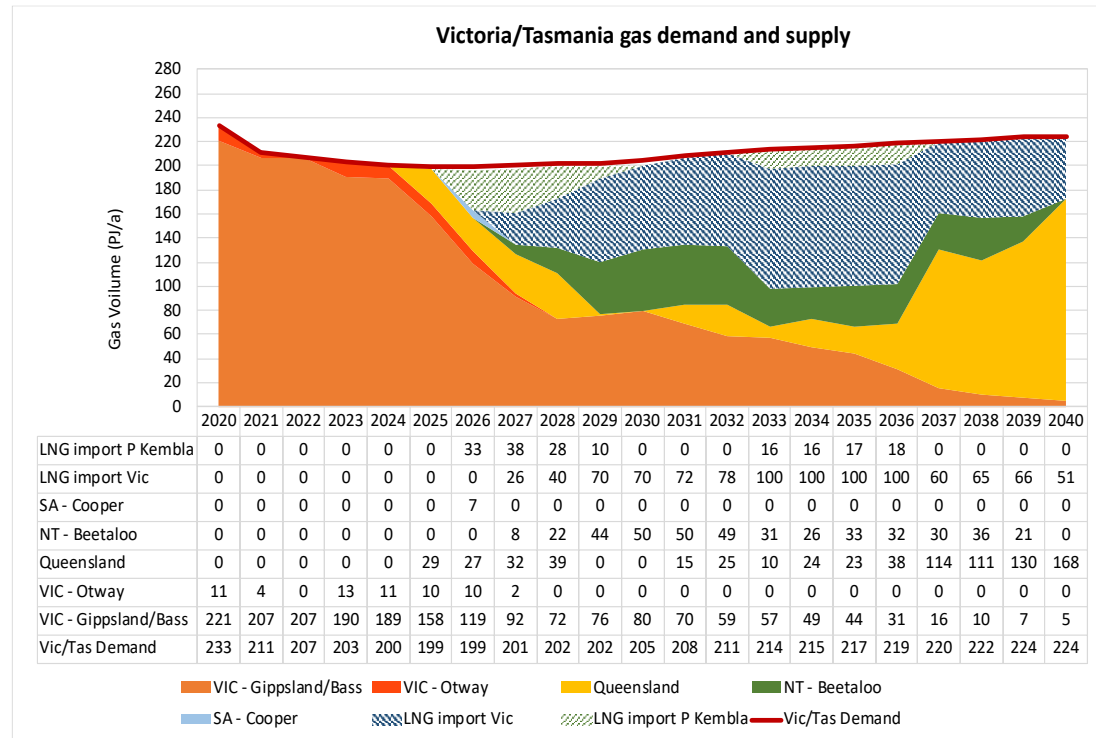
- NSW/ACT is very dependent on AIE's Port Kembla LNG imports to meet demand from 2025 (earlier when peak day demand is considered).
- Also uncertain is the contribution / timing of Narrabri, NSW which still does not have a 'Final Investment Decision' from the operator, Santos.



Source: EnergyQuest analysis, ECGO 2021

3. Supply/Demand Outlook: Victoria/Tasmania by major source

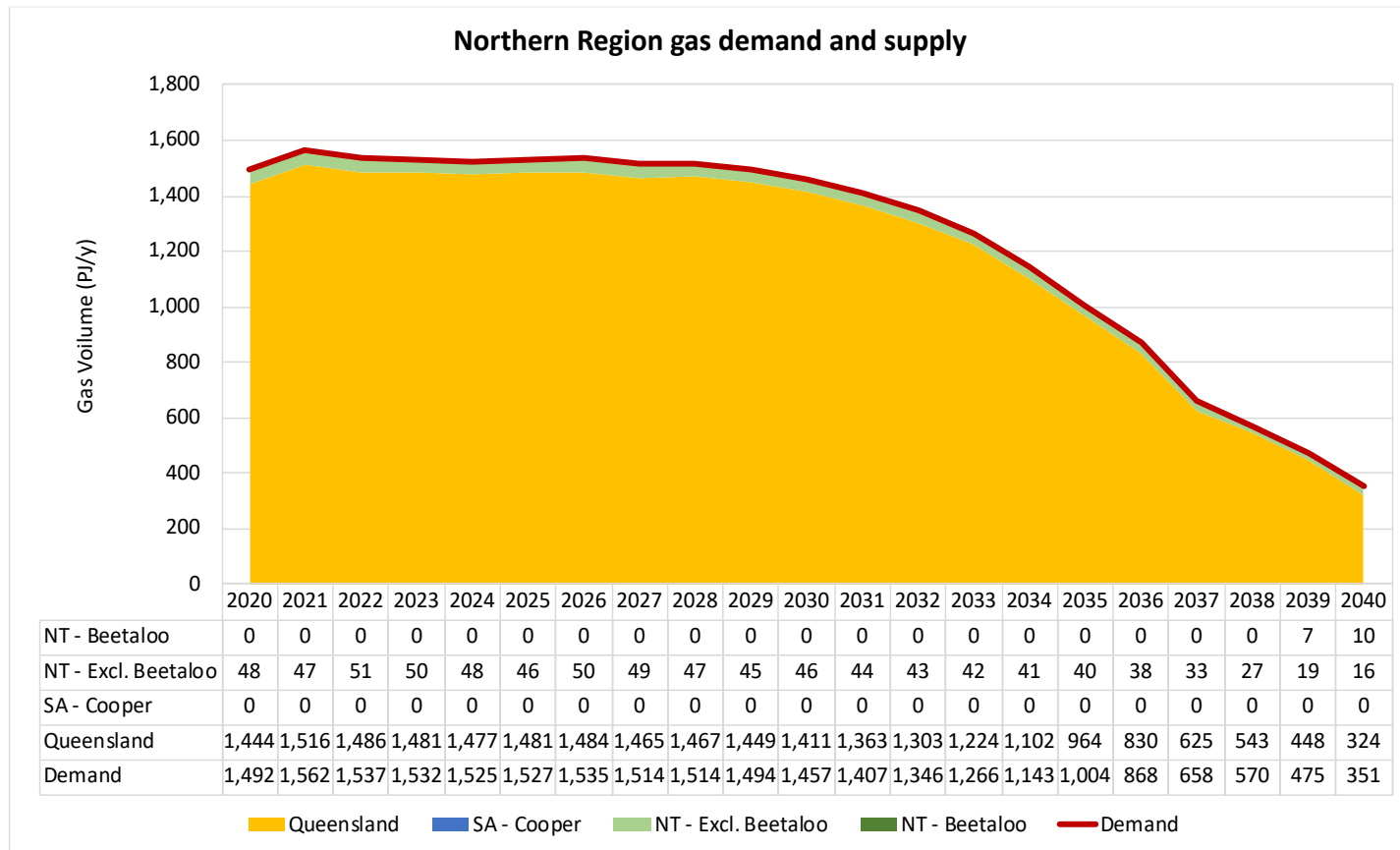
- The decline of the Gippsland/Bass Basins leaves Victoria/Tasmania seasonally short by 2026 (earlier when peak day demand is considered).
- Some gas may make its way south from the north, but this is also an opportunity for additional local LNG import volumes to displace the long distance gas.
- Based on just Victoria/Tasmania demand, an LNG import terminal in Victoria will reach capacity by 2033, with the opportunity to expand to meet demand



Source: EnergyQuest analysis, ECGO 2021

3. Supply/Demand Outlook: Queensland and NT

Queensland LNG and northern region domestic demand will exceed supply by 2029, with the decline of the CSG fields, and even with Beetaloo gas, LNG demand will be curtailed.

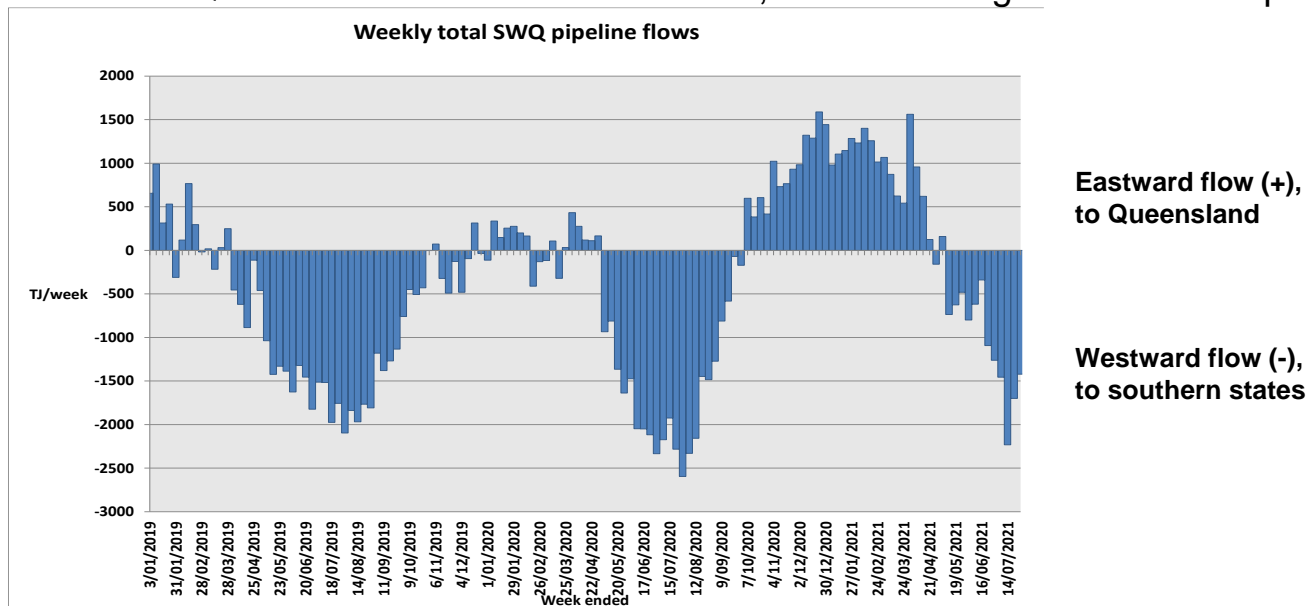


Source: EnergyQuest analysis, ECGO 2021

3. Demand/Supply: Gas flows to southern states from Queensland

The southern states are more becoming more reliant on Queensland/NT gas, but this is becoming more constrained by infrastructure, and then gas supply

- Flows from Queensland to the southern states, are increasing in volume and peak flows



- Winter peaks of 2,000 TJ/week westward or 286 TJ/d are approaching current pipeline capacity of 340 TJ/d.
- APA has announced expansion plans to increase capacity for pipelines from Queensland to NSW by 25% by 2023, but it still leaves a gas supply issue.

Source: AEMO Bulletin Board; EnergyQuest analysis

3. Supply/Demand Outlook: existing pipeline infrastructure

Shipping gas from the current and potential NT gas fields to the east coast adds material costs to the delivered price of gas

Existing cost to deliver gas from NT fields to markets and east coast transmission grid

| \$/GJ | Receipt Point (source): | | | |
|------------------------|--------------------------------|--------------------|-----------------|----------------|
| Delivery Point: | Blacktip | Petrel-Tern | Beetaloo | Amadeus |
| Darwin | 0.94 | 0.00 | 0.58 | 0.35 |
| Mt Isa | 3.54 | 2.91 | 3.16 | 2.91 |
| Ballera | 4.73 | 4.10 | 4.35 | 4.10 |
| WGSB | 6.09 | 5.46 | 5.71 | 5.46 |
| Gladstone | 7.24 | 6.61 | 6.86 | 6.61 |
| Moomba | 5.00 | 4.38 | 4.62 | 4.38 |
| Sydney | 6.25 | 5.63 | 5.87 | 5.63 |
| Melbourne | 6.63 | 6.00 | 6.25 | 6.00 |
| Adelaide | 5.88 | 5.26 | 5.51 | 5.26 |

Note: 110% load factor

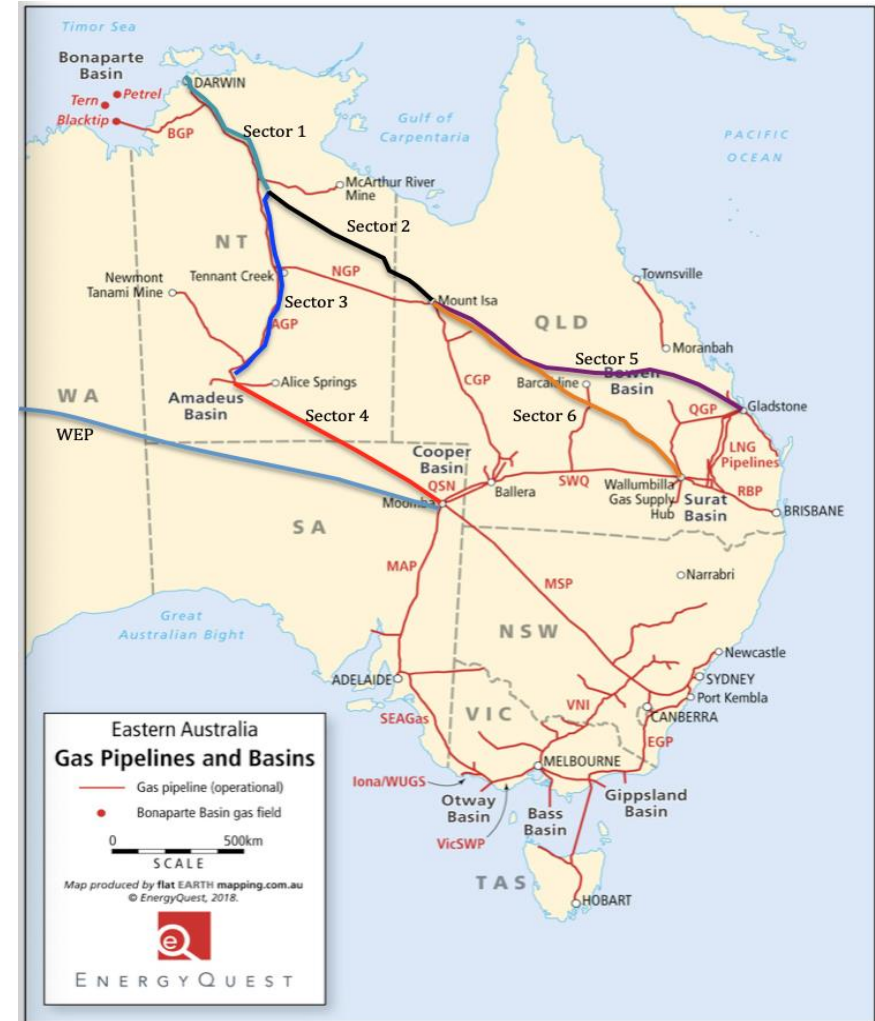
Source: Published tariffs; EnergyQuest analysis



3. Supply/Demand Outlook: potential new high volume gas pipelines

- If additional large volumes (indicatively more than 2,000 PJ) of gas are found and approved for development, then this may lead to large pipeline infrastructure developments to either Darwin for gas based export or for NT manufacturing, or south to the increasingly short east coast markets.
- EnergyQuest has reviewed six large pipeline development sectors.
- Typically these large pipelines would have a capacity of 300 to 600 TJ/d (High cost vs Low cost respectively) to realise the necessary economies of scale to justify the investment.
- New pipeline tariffs from NT gas fields could lower gas costs by up to \$2.78/GJ to Melbourne or Sydney, depending on the field and pipeline used, but this would still be more than current tariffs from Queensland.

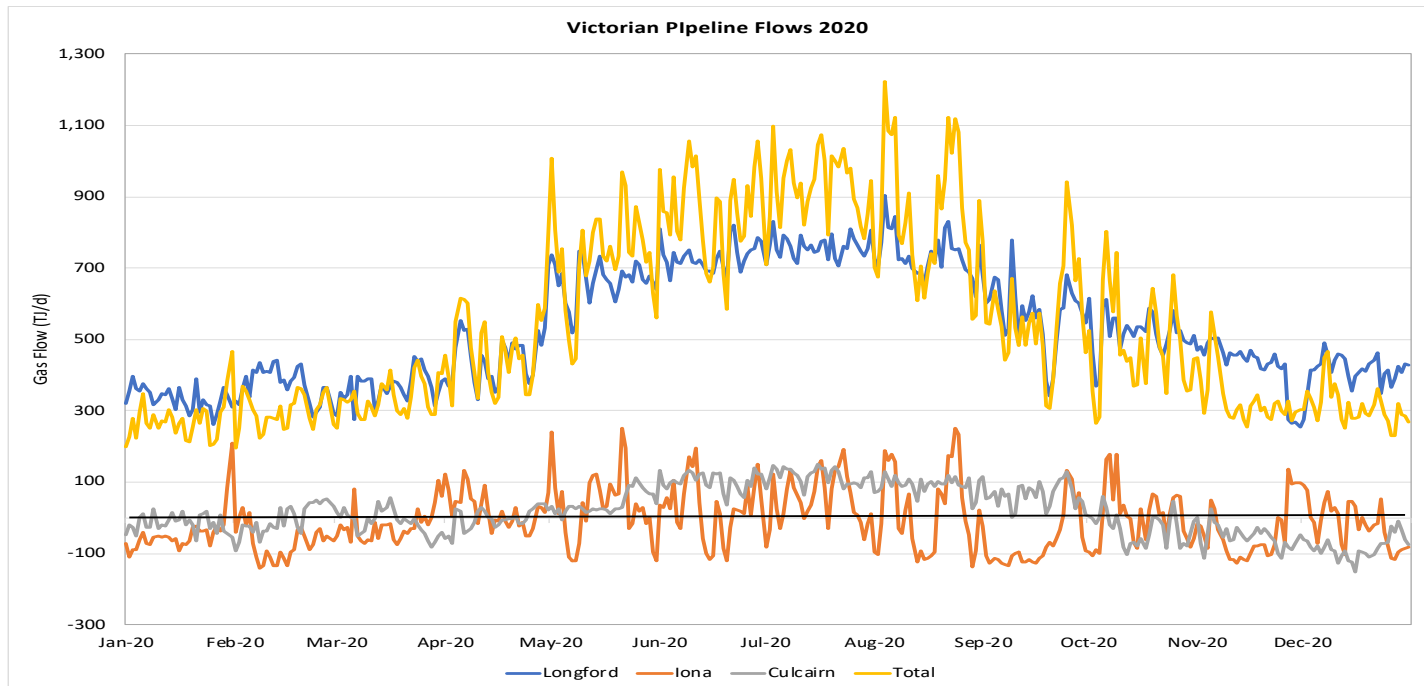
Potential large pipeline sectors for NT and other gas



Source: EnergyQuest analysis

3. Supply/Demand Outlook: peak days Victoria

- For 2020, Victoria swung from a winter peak monthly average of 928 TJ/d in July to a summer low in January of 274 TJ/d. Seasonal swing supply was primarily provided by the Gippsland Basin, and to a much lesser extent from the Culcairn interconnect.
- Victorian peak capacity is expected to decline by 38% by 2025, with the Gippsland producers advising a peak capacity reduction of 58%, from 1,012 TJ/d to 428 TJ/d for this period.
- Daily peak supply swing is provided primarily by Iona storage. In August, Iona contributed a maximum of 253 TJ/d to supply on 24 August, and injected 137 TJ/d into its storage on 29 August, just five days later.
- LNG import terminals are well suited to meeting seasonal and peak daily swing requirements.



Source: Victorian Gas Planning Report March 2021; AEMO Gas Bulletin Board; EnergyQuest analysis

4. LNG imports: advantages

LNG import terminals have a number of benefits for the gas market:

- Add to supply options when facing a supply shortfall by 2024.
- Very good peaking capacity for daily peaks and seasonal swing.
- Can supply long term contracts without reserves risk.
- Built close to demand centres, with less reliance on long distance pipelines decreasing risk, potentially cost and environmental impact.
- Competition for monopoly pipelines.
- Price options - link to oil or international gas hub/spot prices and/or with long term futures markets
- Cap high side gas prices.



4. LNG imports: European analogue

East coast future network:

- The east coast is approaching a shortfall period, when local gas cannot meet demand
- Europe's gas supply network uses a combination of indigenous gas, long distance pipelines and LNG import terminals to meet demand - a future model for the east coast of Australia.
- Sydney and Melbourne are the two largest demand centres on the east coast.
- NSW has no material gas supply, until Narrabri comes on line, and will still need to import gas.
- Supply/Demand analysis shows that at least two LNG import terminals are required in the south-east, and placing these near the two largest demand centres should optimise flexibility and cost.
- Queensland already has a virtual import terminal by diverting LNG feedstock from the Gladstone projects.

European gas network, and supply connections

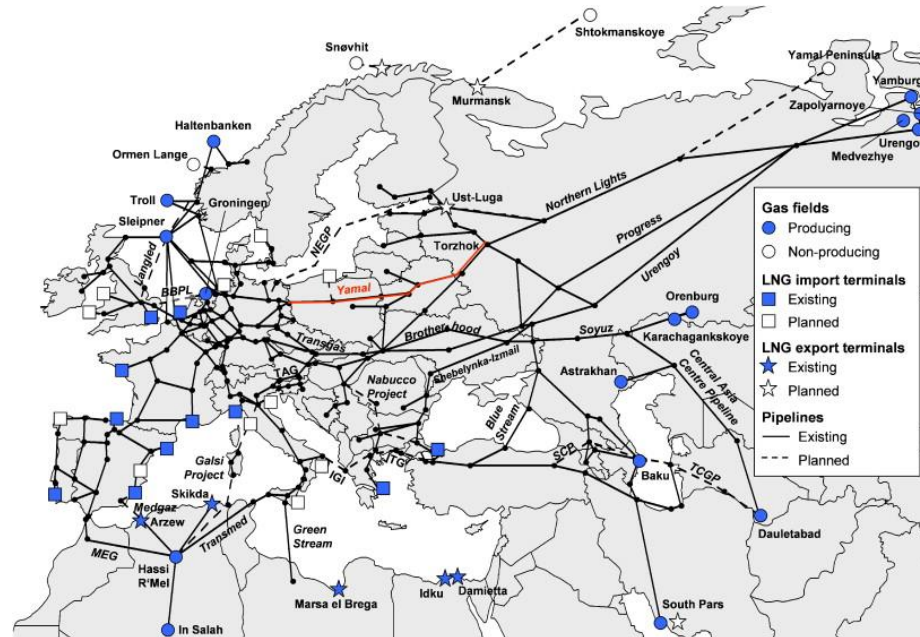


Image source: Sciencedirect.com

<https://www.sciencedirect.com/science/article/abs/pii/S0301421508000165>

5. Risks and game changers #1

There is still a high degree of uncertainty as to how the gas market will play out on the east coast of Australia.

Several scenarios can be identified which may materially change the long term outlook:

| Scenario | Description | Sign post |
|--|---|--|
| Australian Domestic Gas Security Mechanism | Government aggressively uses the ADGSM to lower domestic prices. | Use of export controls to limit LNG export |
| LNG imports | LNG import project over reaches and forces over contracted gas into the market | LNG FID, and contracting status |
| New plays and supply | New play is successfully developed e.g. Beetaloo shales | Exploration and appraisal success |
| Demand destruction | High prices cause large gas users to close, reducing gas demand, and possibly releasing over contracted gas onto the market | Exit of large gas users |
| Carbon tax or equivalent | A carbon tax favours gas use compared to coal. | Government policy |
| High oil prices | Higher oil prices increase Asian LNG prices, and make selling domestic gas less attractive. | Forward oil prices |

continued...

5. Risks and game changers #2

...continued.

Several scenarios can be identified which may materially change the long term outlook:

| Scenario | Description | Sign post |
|--|--|--|
| High price volatility | Oil and gas prices swing from high to low scenarios due to political drivers, trade wars, COVID 19 and the next pandemic, corporate investment | Forward curves |
| Un-investible projects | Capital investment moves to renewables, raising the cost of capital for gas projects. | Cost of capital and investment decisions |
| Gas-fired power generation replaced by renewables and storage technologies | Loss of power generation market share to renewables and storage is accelerated due to change in government policy and lower cost | Cost of dispatchable power |
| Opponents of gas development curtailing demand and access to gas assets | Activities targeting pipelines, acreage releases, company meetings and strategies, gas-users and residential developments. | impacts on government policy |

...and there may be others