



RystadEnergy

# Western Australia Domestic Gas Policy Study

Final Report

18.08.2023



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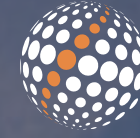
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# Content

1. Executive Summary
2. Supply Outlook
3. Demand Outlook
4. Supply-Demand Balance
5. Domestic Gas Policy and Pricing
6. Appendices





## Key Takeaways



### Western Australia's domestic gas market to experience near-term tightness

- New gas supply is needed to offset declining production from legacy fields and meet growing demand.
- Market tightness is expected to persist until new supply led by Perth Basin and Scarborough volumes ramps up from 2026, but significant shortfall re-emerge from 2030.
- Gas demand will remain robust through to 2033, with new gas plants needed to support planned coal retirements and the expansion of renewables in the power sector alongside an almost doubling of demand for gas.





### Access to export markets could unlock new gas supply for the domestic market

- The LNG Domestic Market Obligation (DMO) has supported gas supply and price stability in WA – a gas price benefit of approx. 1.2 BAUD/year or 6.1 AUD/GJ to WA gas users between 2019-2023YTD.
- Close to 11BAUD of new gas investment is needed to sustain the long term supply outlook but policy stability and certainty, including the LNG DMO, remains vital.
- Allowing onshore gas projects to access export markets would expand the number of commercially viable projects, boosting investments and new supply. The access to larger export markets reduces the domestic price required for fields to become commercial while improving access to capital and financing.
- The government could unlock more domestic supply through incentives for exploration, investment, faster approvals processes, and establishing legal frameworks for unconventional gas development.

# Domestic gas supply remains tight until 2027, before rebalancing as new supply comes online

## Key Takeaways for Supply Outlook

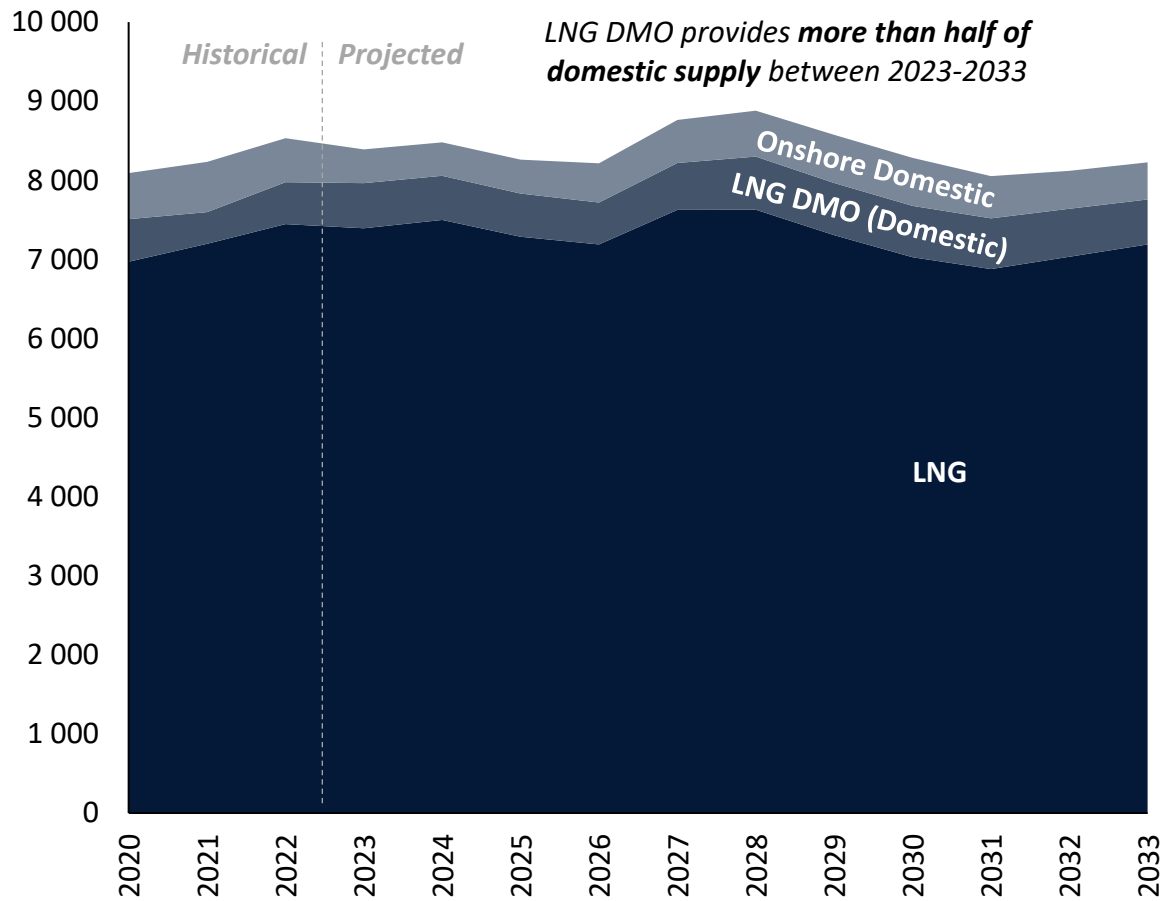
### Key Takeaways

-  The domestic market is expected to see some supply tightness in the near term due to legacy fields' decline. Longer term, domestic supply is expected to grow underpinned by:
  - *Growth of DMO volumes from new LNG exporting fields (e.g. Scarborough)*
  - *Various new domestic onshore supply projects especially from the Perth basin such as West Erregulla, Lockyer Deep, Waitsia Stage 2*There could be higher potential for new supply additions in the longer term given WA's large resources availability from Carnarvon, Browse basins as well as unconventional
-  Overall, the domestic market will see increased supply from new players, especially in the Perth basin. The domestic market is likely to see close to 11 billion AUD of new investments by 2033 to sustain the long-term supply outlook.
-  Long term supply may see higher downside risks if Perth basin volumes are not sanctioned and developments for Scarborough and Waitsia 2 are delayed

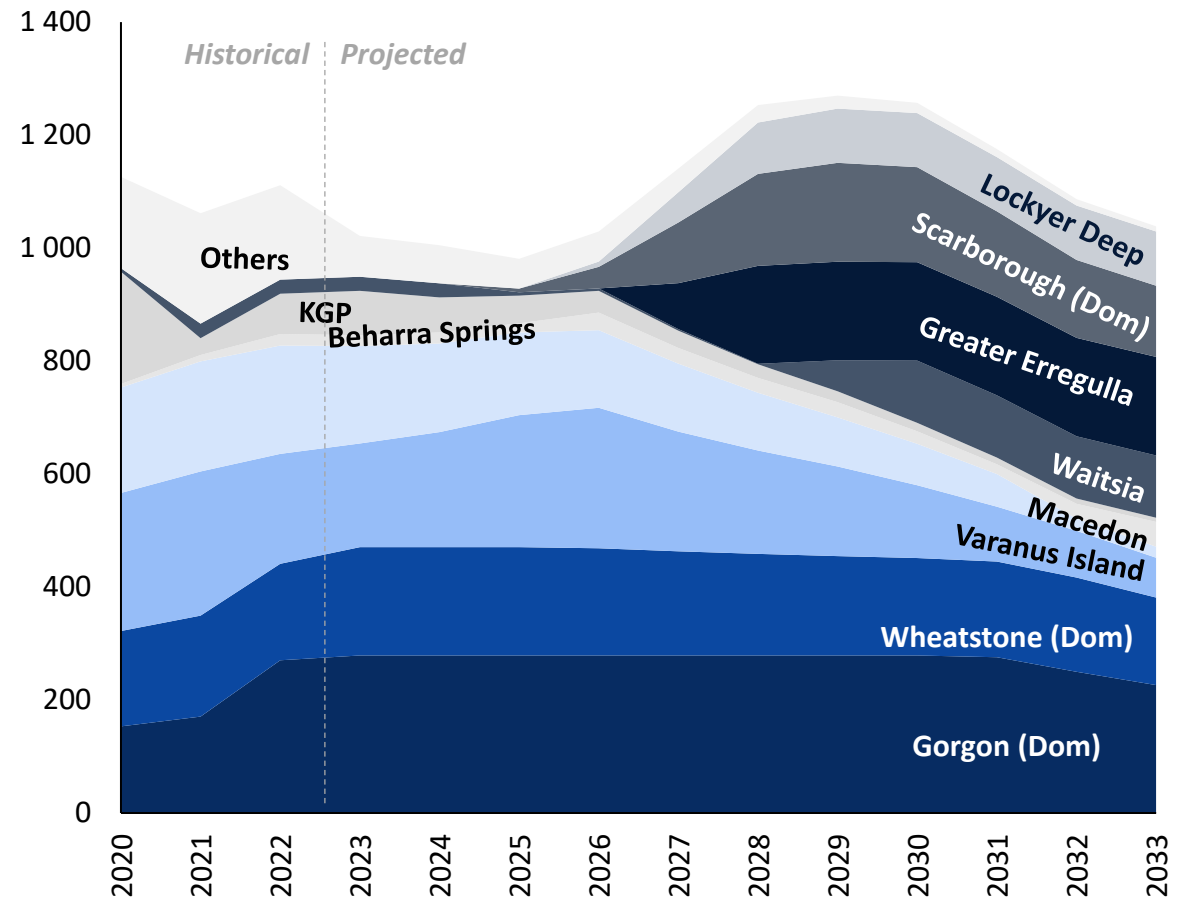
Source: Rystad Energy research and analysis

# Near term supply to plateau till 2026 before the entrants of new developments from the Perth Basin & Scarborough field; DMO remains crucial in enabling sufficient supply for domestic market

**Estimated Overall Gas Supply Outlook by Market**  
TJ/d



**Estimated Domestic Gas Supply Outlook by Project**  
TJ/d



Source: Rystad Energy research and analysis

# Overall gas demand to remain robust through to 2033 underpinned by growth in power, industrial and the residential and commercial sector

## Key Takeaways for Demand Outlook

### Key Takeaways



1 Western Australia's total gas demand is expected to remain robust driven by various sector developments:

- **Mining and minerals** sector to see continued decarbonisation via gas displacement from renewables and energy efficiency initiatives. However, this sector will still be a key contributor to overall gas demand.
- **Industrial sector** expected to grow at a fast pace due to recent developments in expected Perdaman Urea, CSBP expansion projects necessitating higher gas demand offtake
- **Power sector** will increasingly need to rely on gas to stabilise the grid and support coal retirements. Renewables penetration will likely weigh in on gas in the longer term
- **Residential and commercial sector** demand will likely remain stable underpinned by continued population growth in the region

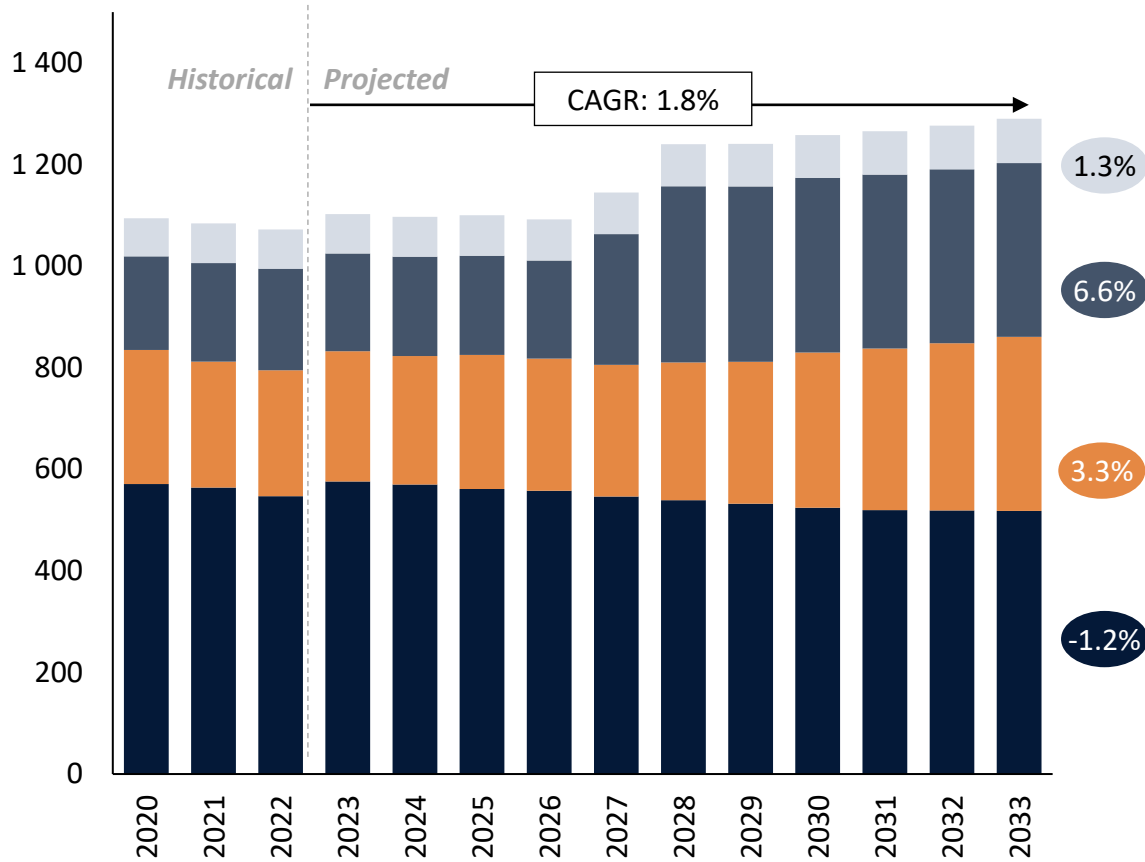


2 Demand scenario analysis suggest there may be higher upside to gas demand driven by faster coal retirements and potentially clean ammonia/hydrogen uptake. Downside risks remain low, though accelerated decarbonisation and faster renewables adoption could threaten longer term gas demand

Source: Rystad Energy research and analysis

# Robust forecast for domestic demand raises the need for additional supply

Estimated WA Total Domestic Gas Demand  
TJ/day



Source: Rystad Energy research and analysis

Key Drivers for WA Total Gas Demand

Sector	Key Drivers
R&C	<ul style="list-style-type: none"> <li>Moderate growth with small volumes of hydrogen uptake between 2023 and 2033</li> </ul>
Industrial	<ul style="list-style-type: none"> <li>Demand <b>almost doubles</b> with Perdaman Urea and CSBP Expansion despite some renewables uptake</li> </ul>
Power	<ul style="list-style-type: none"> <li><b>New gas plants required</b> to support planned coal retirements and renewables entrants</li> </ul>
Mining & Minerals Processing	<ul style="list-style-type: none"> <li><b>Large-scale renewable adoption amongst mining companies seeking to decarbonise quickly.</b> Decline is mitigated by increased minerals processing and diesel-to-gas switching</li> </ul>



# Near term market tightness to prevail until 2027 before new supply rebalances the market

## Key Takeaways for Supply-Demand Balance

### Key Takeaways

1



The WA domestic gas market is expected to face tightness in the near term due to limited supply developments, primarily driven by legacy field decline outpacing supply additions.

Longer term market fundamentals likely to return to balance the overall market with Scarborough (post 2026) and Waitsia coupled with gradual demand growth

Extent and duration of market tightness may impact gas prices

2



Gas storage facilities such as Tubrigi and Mondarra will likely play a critical role in maintaining market balance and prices through periods of supply tightness

3

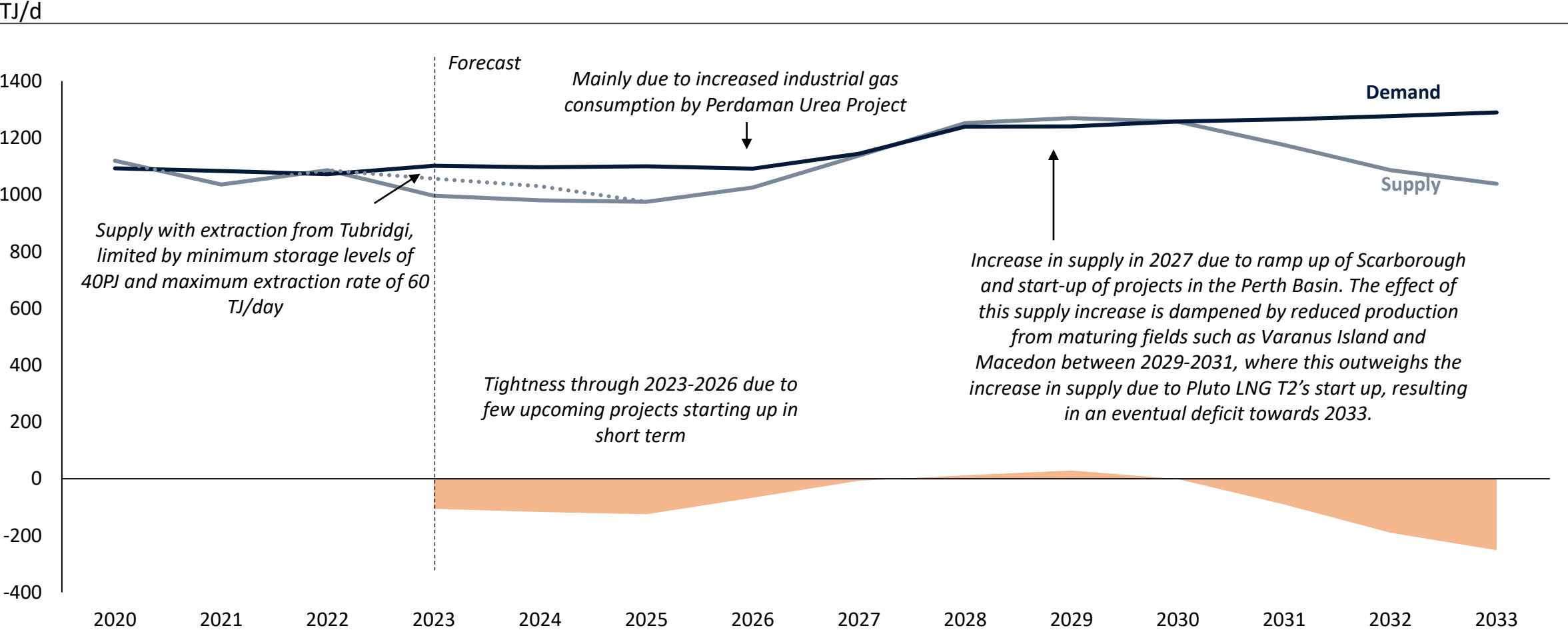


Greater downside risk of increased market tightness if supply projects are delayed/cancelled coupled with higher demand developments.

Source: Rystad Energy research and analysis

# Market tightness in the short term with a supply imbalance if no new gas supply is brought forward

## Estimated WA Domestic Gas Demand and Supply Balances



Source: Rystad Energy research and analysis

# The DMO has contributed to price and supply stability

## Key Takeaways for Domestic Gas Obligation Policy Assessment

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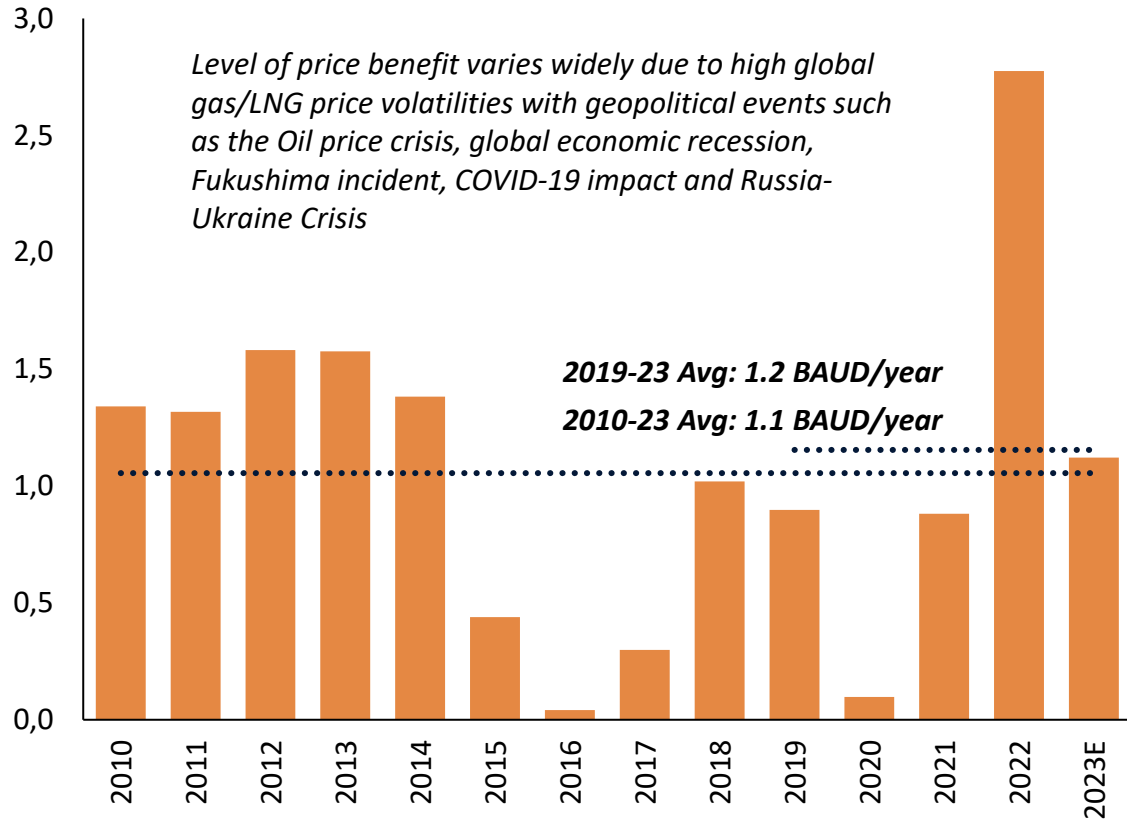
### Key Takeaways

-  1 The DMO policy has enabled supply and gas price stability in WA.
-  2 Provision of an export allowance for onshore gas projects will improve both investments into the market and government revenue, due to better project economics from higher realised export prices.
-  3 Exploration and exploitation of potential low-cost discoveries (including unconventional resources) can increase supply, but this is likely to occur beyond 2033.

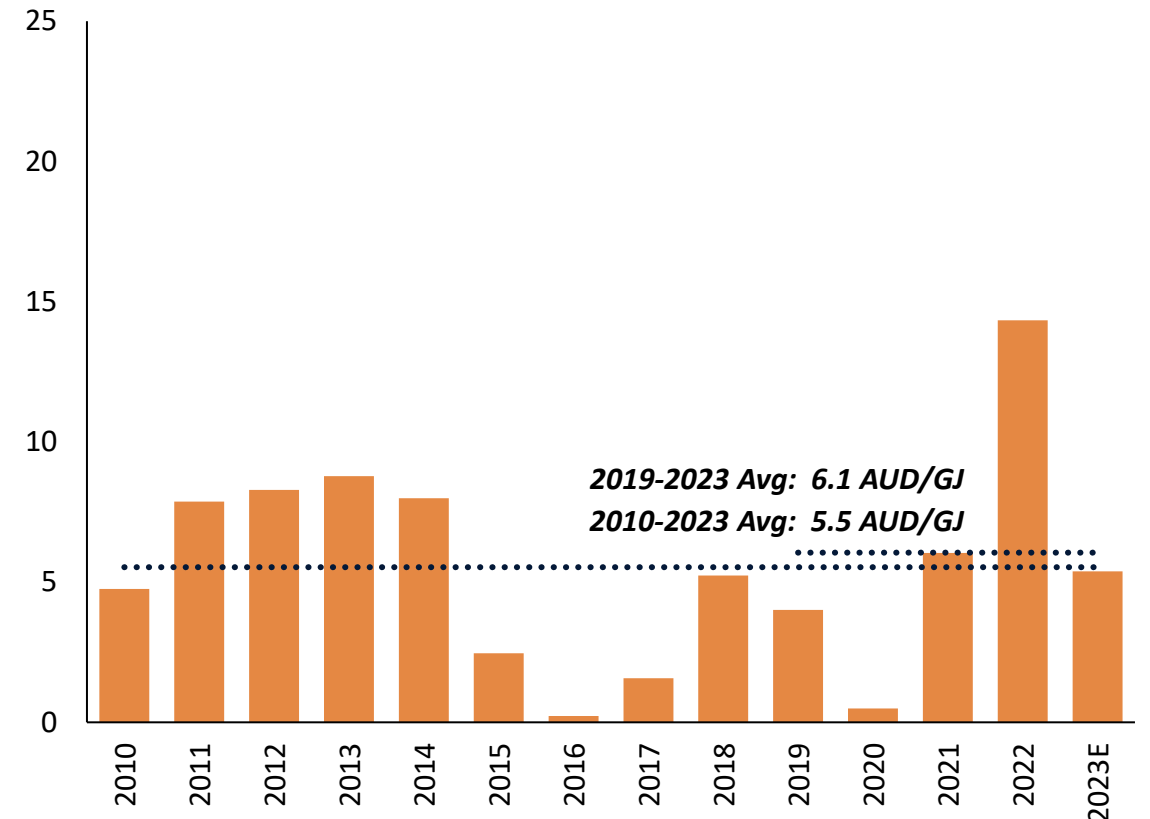
Source: Rystad Energy research and analysis

# Western Australia has seen an average of 1.2 BAUD/year and 6.1 AUD/GJ of gas price benefits over 2019-2023E

**Historical Absolute Gas Price Benefit<sup>1,2,3</sup>**  
Billion AUD, Nominal



**Historical Unit Gas Price Benefit<sup>2,3</sup>**  
AUD/GJ, Nominal



Notes: (1) 2023 based on volume estimates and extrapolating price benefit number from YTD value.

(2) Until June 2023

(3) 2023 values partially estimated.

Source: Rystad Energy research and analysis

# The government could focus on key initiatives to incentivise investments and bring new supply to the domestic gas market

## Approach to Unlocking Resource Potential in Western Australia

	<u>Key Initiatives</u>	<u>Stakeholder(s)</u>	<u>Details</u>	<u>Priority</u>
Upstream	Incentivise Exploration	Government/ Operators	<ul style="list-style-type: none"> <li>Increase acreage offerings for petroleum &amp; CCS exploration in underdeveloped basins and support exploration &amp; development of lower emission production</li> <li>Facilitate M&amp;A syndication and consolidate resources and investments to overcome high capital requirement of greenfield petrochemical developments</li> </ul>	●
	Drive Productivity Improvements	Operators	<ul style="list-style-type: none"> <li>Support EOR to prolong production lifetime and volumes for legacy fields (e.g. initiating collaboration among industry players to share “best practices”)</li> </ul>	●
	Accelerate Approval Process	Government	<ul style="list-style-type: none"> <li>Expedite, streamline and simplify processes that are often costly due to delays<sup>1</sup></li> <li>Increase communication between federal and state departments to reduce timeframes and red-tape associated with the approvals process</li> </ul>	●
	Enable Development of Unconventionals	Government	<ul style="list-style-type: none"> <li>Accelerate development of new regulations based on the Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia</li> <li>Incentivise partnerships for existing operators to acquire technical expertise</li> </ul>	●
	Enable Greater Capital Access & Financing	Investors	<ul style="list-style-type: none"> <li>Facilitate partnerships between government and financial institutions to provide some capital access</li> <li>Provide public forum to drive deeper understanding of key market risks, fundamentals for financial investors</li> </ul>	●
Mid-stream	Develop Infrastructure	Government/ Infrastructure Player	<ul style="list-style-type: none"> <li>Develop pipeline infrastructure to connect large resource basins to key demand centres, thus increasing commerciality of previously stranded assets</li> <li>Drive collaboration initiatives (e.g. develop shared, large capacity gas processing plants) amongst players to de-risk, capitalise on economies of scale</li> </ul>	●
Down-stream	Spur New Gas Demand Market Opportunities	Government/ Investors/ Infrastructure Player	<ul style="list-style-type: none"> <li>Incentives and financing to spur vertical integration between upstream and downstream (e.g. assisting downstream operators in acquiring and developing develop upstream projects)</li> <li>Encourage downstream demand from new industries (e.g. blue hydrogen, ammonia) through up- and downstream collaboration – spurring markets to invest in new large-scale projects</li> </ul>	●

Note: (1) EPA decisions take an average of close to 3 years. This is based on a sample of 15 projects that were the most recently approved before the end of 2021  
 Source: Rystad Energy research and analysis; EPA

● High ● Medium ● Low



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# Domestic gas supply remains tight until 2027, before rebalancing as new supply comes online

## Key Takeaways for Supply Outlook

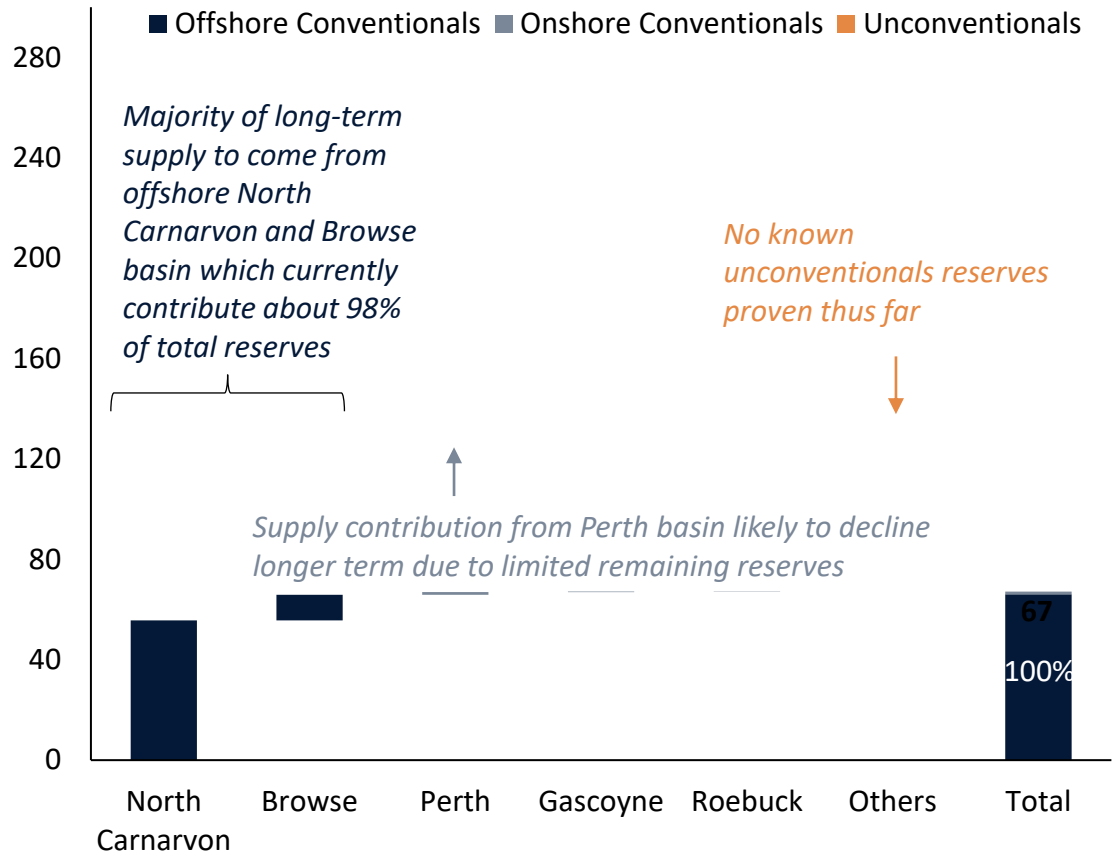
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-  2 Overall, the domestic market will see increased supply from new players, especially in the Perth basin. The domestic market is likely to see close to 11 billion AUD of new investments by 2033 to sustain the long-term supply outlook.
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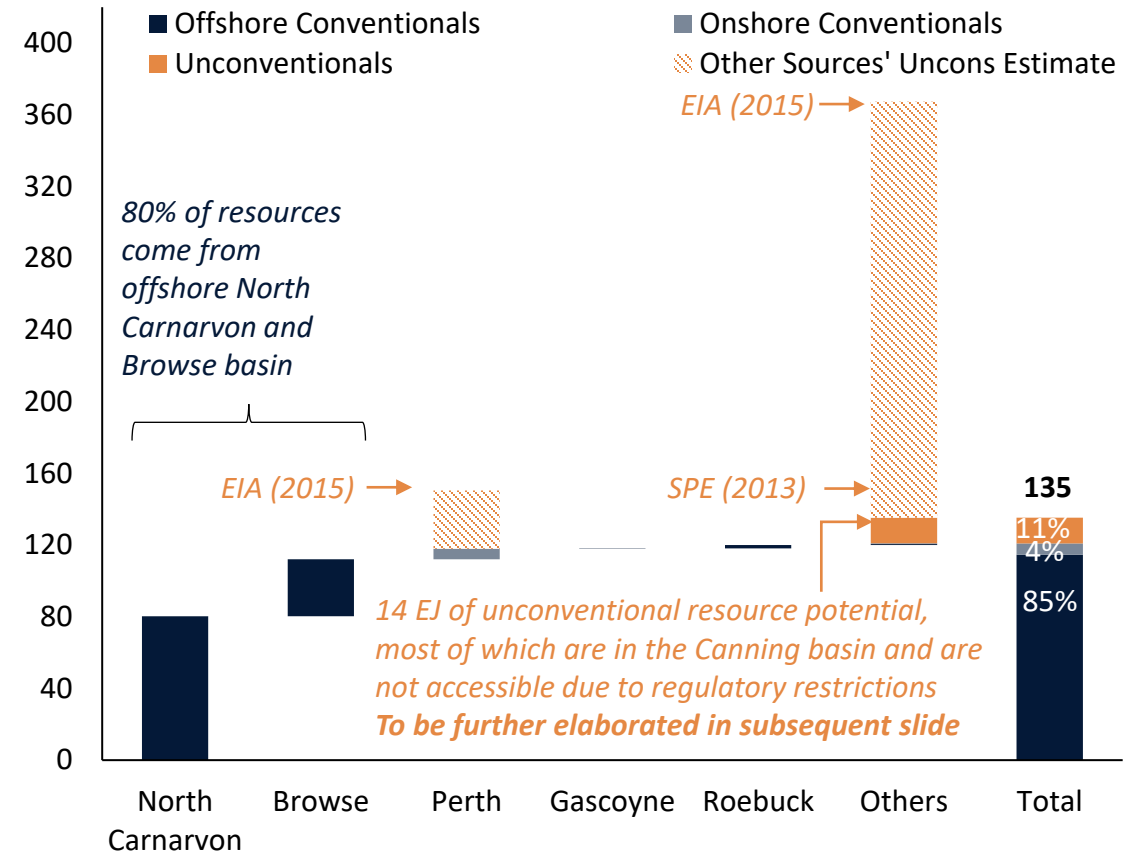
Source: Rystad Energy research and analysis

# Western Australia still retains significant gas resource potential, of which unconventional (if proven) could present immense supply upside

Remaining 2P Gas Reserves by Resource Theme and Basin, EJ



Remaining Contingent Gas Resources by Resource Theme and Basin, EJ

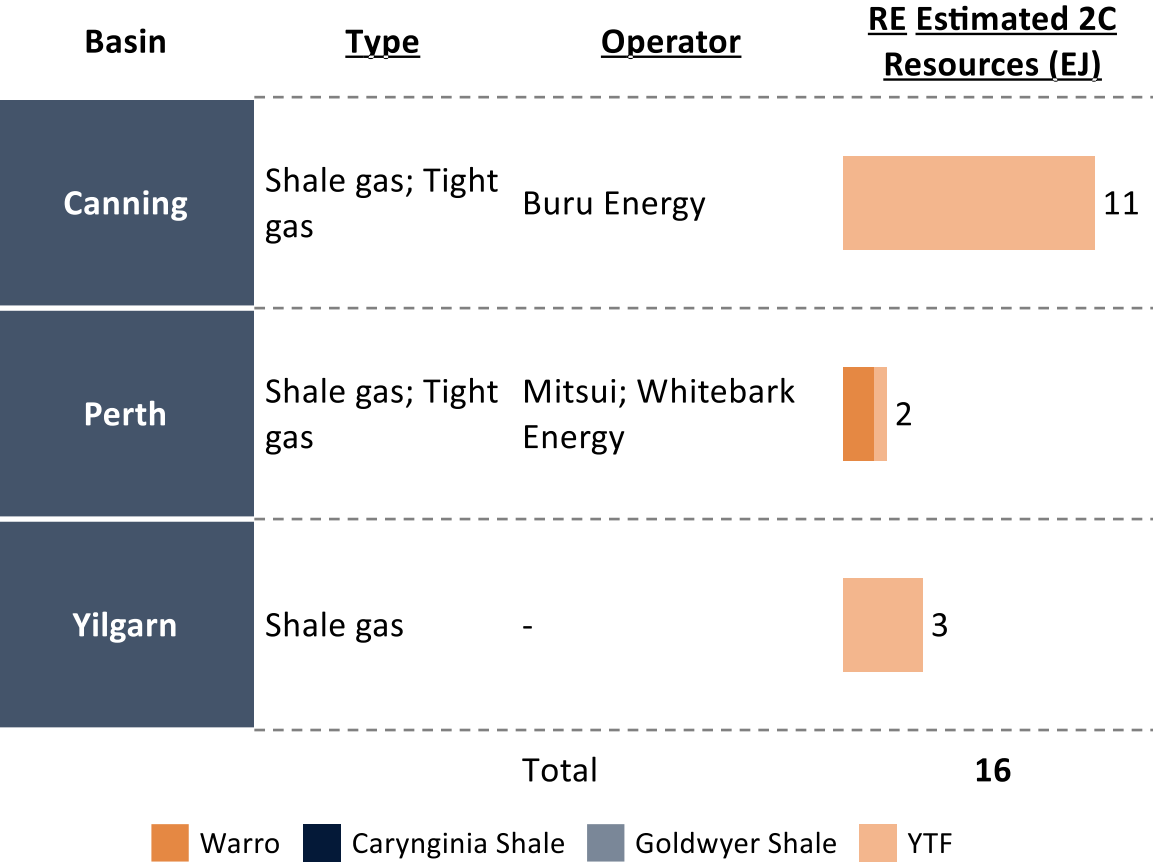


Notes: Resources are the remaining economically recoverable volumes; Reserves (2P basis) is based on proven plus probable reserves (resources with 50% likelihood and where assets are producing and/or under development); Others consist of Canning, Officer, Yilgarn, Bonaparte basins; 1 EJ = 1000 PJ

Source: EIA, SPE, Rystad Energy research & analysis

# Most of the unconventional resource sit in the Canning basin, of which further exploitation is limited by challenges

## Western Australia Unconventional Resource Potential (2023)



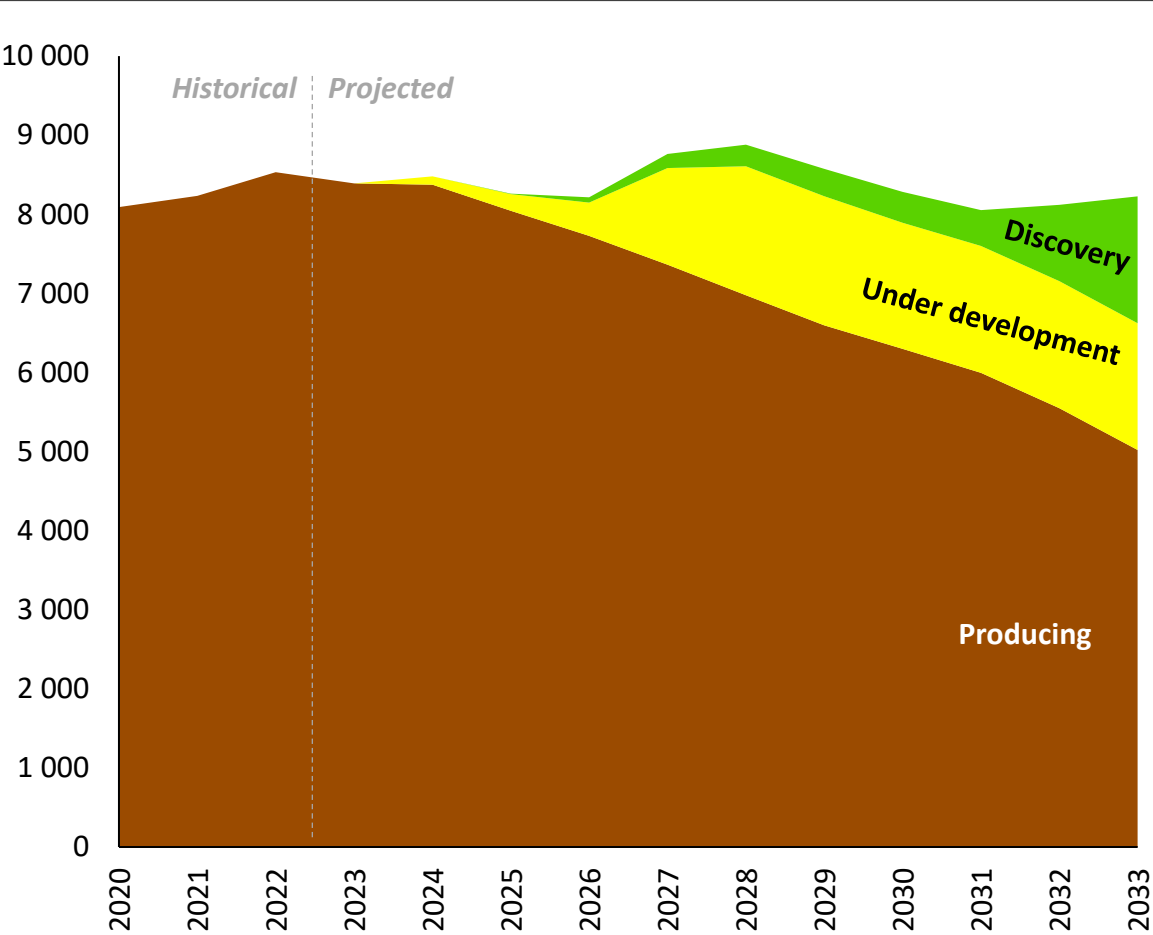
## Key challenges in unlocking resource potential

Key Challenges	Overview
Regulatory Issues	<ul style="list-style-type: none"> <li>Allowed only in areas with existing petroleum licenses not within Dampier Peninsula/Perth and 2km of Public Drinking Water Source Areas, towns.</li> <li>Subject to veto by Aboriginal groups and farmers and require EPA approval</li> <li>Regulatory regime under development and cannot guide operator’s planning process</li> </ul>
Lack of Infrastructure	<ul style="list-style-type: none"> <li>Lack of existing takeaway pipeline capacity to transport gas from field to end markets</li> </ul>
Public Concerns	<ul style="list-style-type: none"> <li>Intense opposition towards fracking, with public concern on its effects on increased emissions, water pollution and destruction of the natural environment</li> <li>Protests across WA states after fracking ban overturn</li> </ul>
Lack of Operators’ Interest	<ul style="list-style-type: none"> <li>Lack of experienced operators interest in potential development (e.g Whitebark Energy farm-out for Warro); likely due to high technical challenges</li> </ul>

Source: Rystad Energy research and analysis

# Gas supply outlook to remain flat through to 2030 with new developments and discoveries offsetting legacy field decline

Gas Supply Outlook by Lifecycle Category TJ/d



Source: Rystad Energy research & analysis

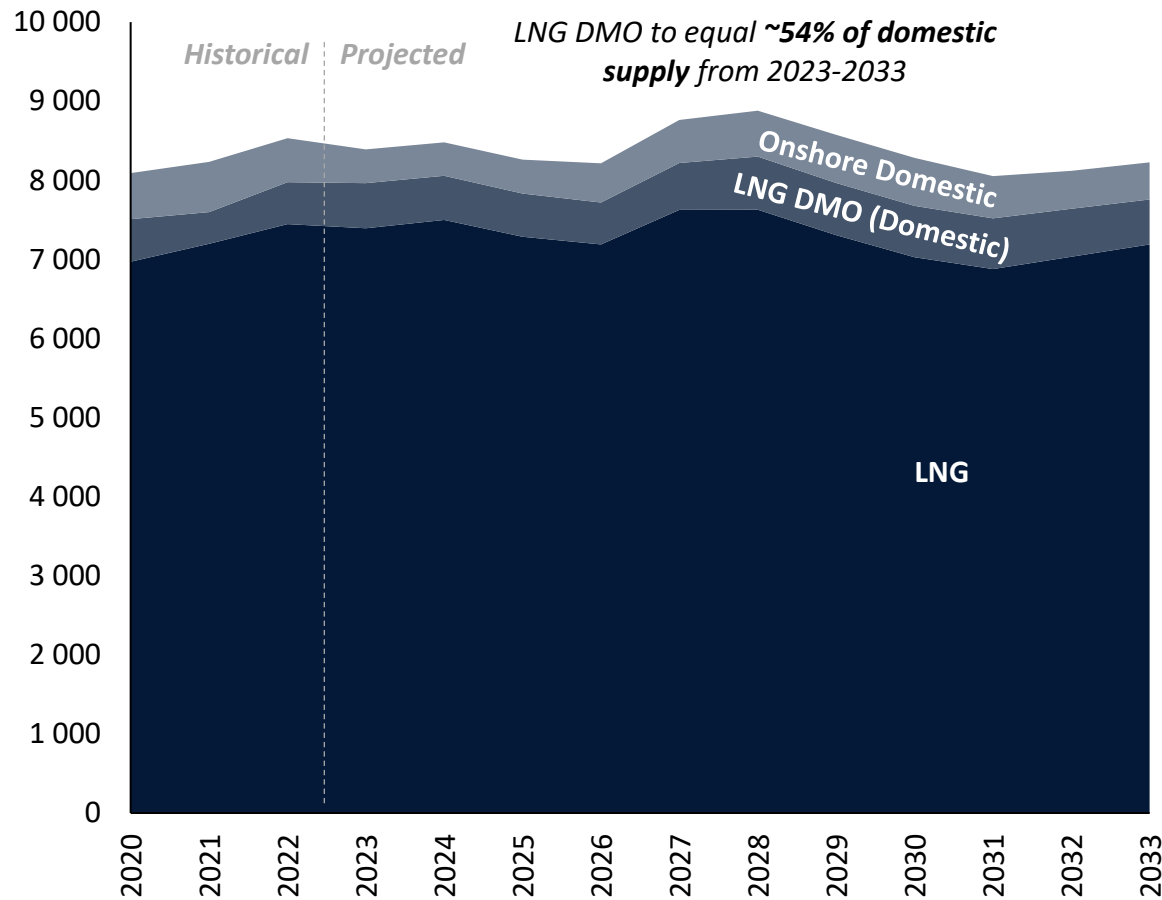
## Lifecycle Category - Overview

Project	Overview
Discovery	<ul style="list-style-type: none"> <li>Pre-2030, new discovery volumes likely to come from <b>Waitsia, Lockyer Deep</b> and <b>Greater Erregulla</b></li> <li>Post 2030, <b>NWS backfills from Clio-Acme project</b> is the main driver of the supply growth through to 2033</li> <li>These projects may be sanctioned in the near term</li> </ul>
Under development	<ul style="list-style-type: none"> <li>Main contribution to the growth is <b>Scarborough</b>, most of which are likely to come into the supply picture post 2026</li> </ul>
Producing	<ul style="list-style-type: none"> <li>Overall production to plateau driven by incremental supply upside from <b>Gorgon associated fields</b></li> <li>Post 2025, overall supply likely to decline driven by <b>Gorgon, Macedon and Pluto mature field supply decline</b></li> </ul>



# LNG export growth is the key driver of supply growth and has also benefited the domestic market through its domestic market obligation

## Estimated Gas Supply Outlook by Market TJ/d



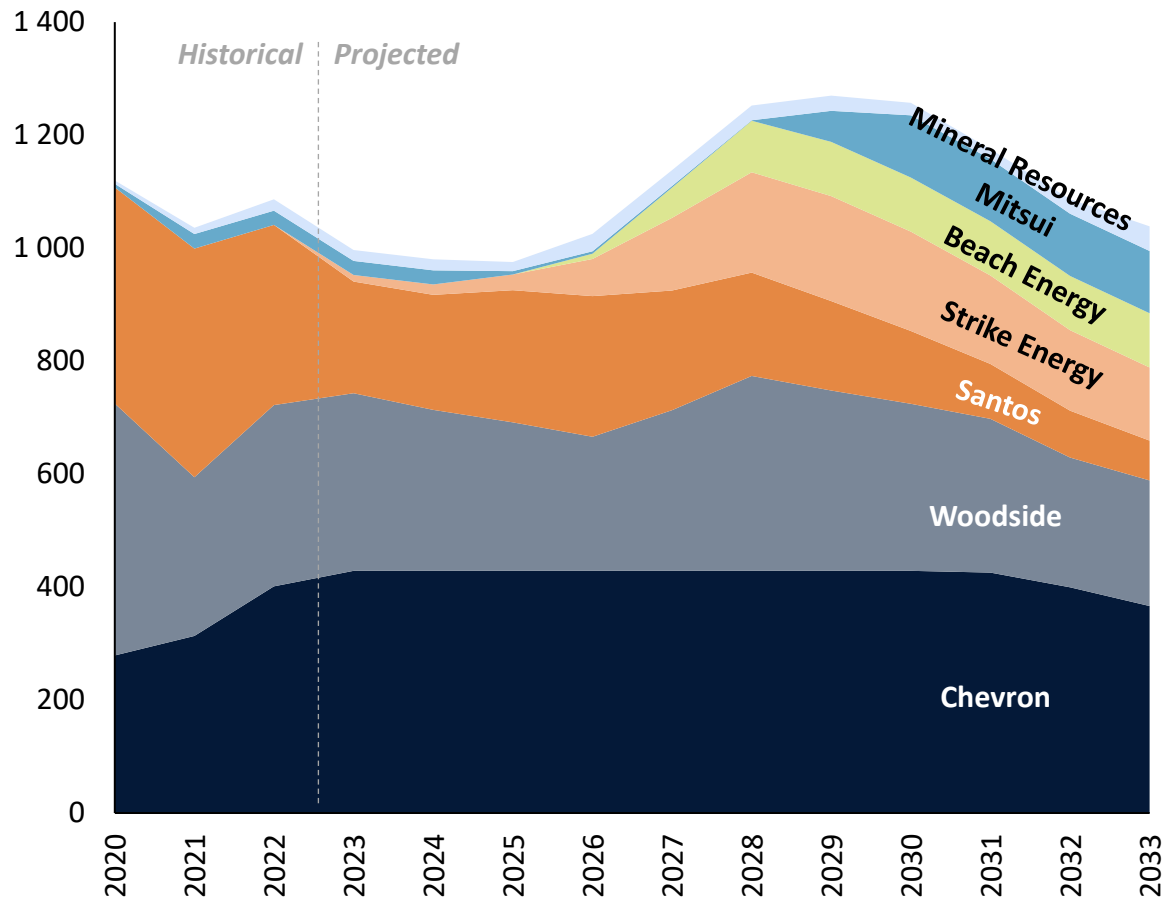
Source: Government of Western Australia; Rystad Energy research & analysis

## Market - Overview

Project	Overview
Onshore Domestic	<ul style="list-style-type: none"> <li>Gradual growth until 2028, thereafter some supply reduction towards 2033, mainly driven by <b>Varanus Island</b> and <b>Macedon</b> field decline</li> <li><b>Greater Erregulla</b> is to come online in 2025 (South) and 2026 (West)</li> </ul>
LNG DMO (Domestic)	<ul style="list-style-type: none"> <li>In 2023, LNG DMO accounts for almost half of domestic supply. LNG DMO contribution to domestic supply to remain consistent through to 2033</li> </ul>
LNG	<ul style="list-style-type: none"> <li>Main contributing projects to LNG production are <b>NWS</b>, <b>Gorgon</b>, <b>Pluto</b> and <b>Wheatstone</b></li> <li>Post 2030 growth largely driven by <b>NWS (Clio-Acme)</b></li> </ul>

# Several new operators expected to enter the market post 2026. Chevron, Woodside and Santos to remain the dominant suppliers to the domestic market

Estimated Domestic Gas Supply Outlook by Operator TJ/d



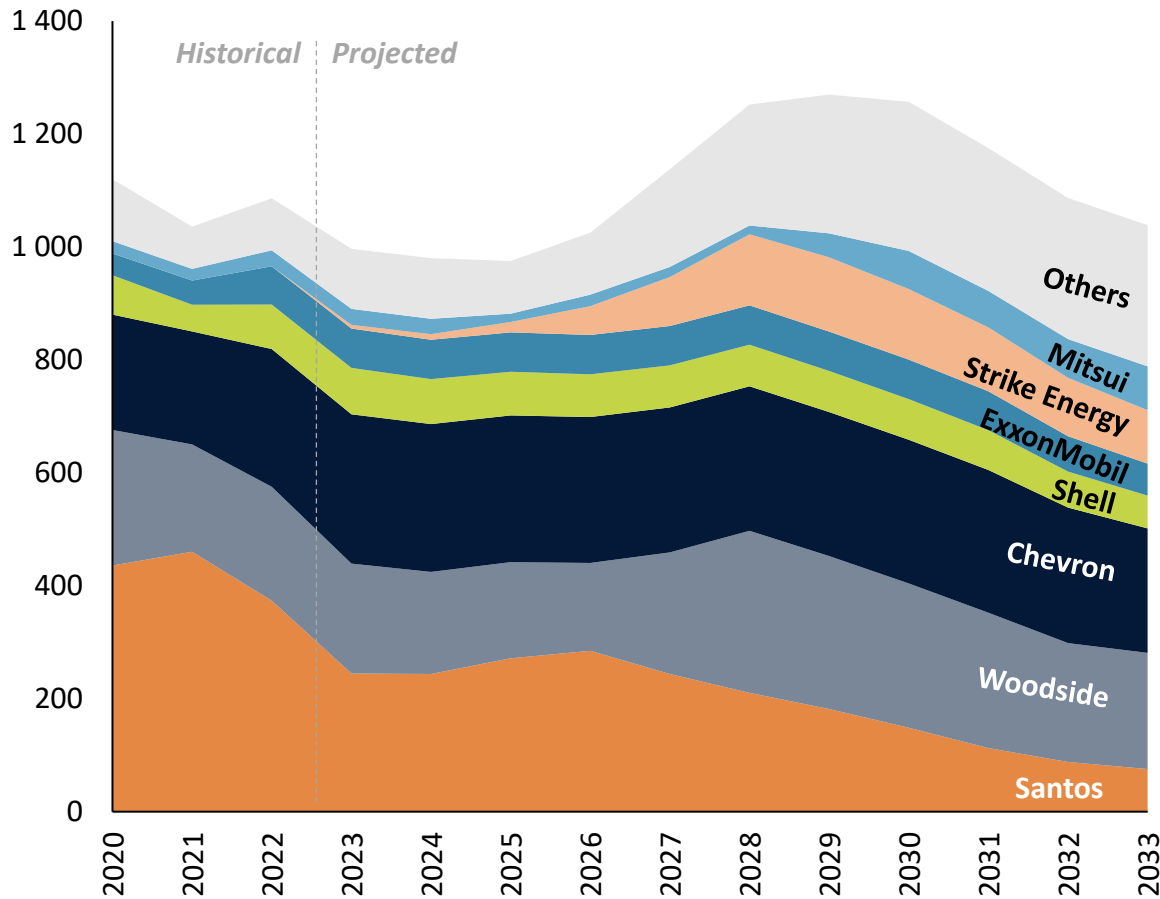
Source: Rystad Energy research & analysis

## Key Operators - Overview

Operator	Overview
Mineral Resources	<ul style="list-style-type: none"> <li>• <b>Lockyer Deep</b> would expand its operated footprint by 100 TJ/d, gas likely for downstream operational use</li> </ul>
Mitsui	<ul style="list-style-type: none"> <li>• Operator of <b>Waitsia (Stage 2 Dom)</b> post 2027 to when providing domestically from 2029.</li> </ul>
Beach Energy	<ul style="list-style-type: none"> <li>• Current operator of <b>Beharra Springs Deep</b>, with <b>Phase 1 and 2</b> going online in 2026 and 2032, respectively.</li> </ul>
Strike Energy	<ul style="list-style-type: none"> <li>• Operates <b>Walyering</b> project but will see increased share from <b>Greater Erregulla</b> when it comes online post 2025</li> </ul>
Santos	<ul style="list-style-type: none"> <li>• Operates <b>Varanus Island</b>, supplying gas to the major mining and industrial customers.</li> </ul>
Woodside	<ul style="list-style-type: none"> <li>• Operates <b>Pluto, KGP, Wheatstone</b> and <b>Macedon</b>. Share likely to increase from <b>Scarborough</b> in 2028</li> </ul>
Chevron	<ul style="list-style-type: none"> <li>• Largest operator with <b>Gorgon</b> and <b>Wheatstone</b> producing a total of 428 TJ/d for the domestic market</li> </ul>

# Market to become increasingly diversified with more equity players in the gas market

Estimated Domestic Gas Supply Outlook by Working Interest TJ/d



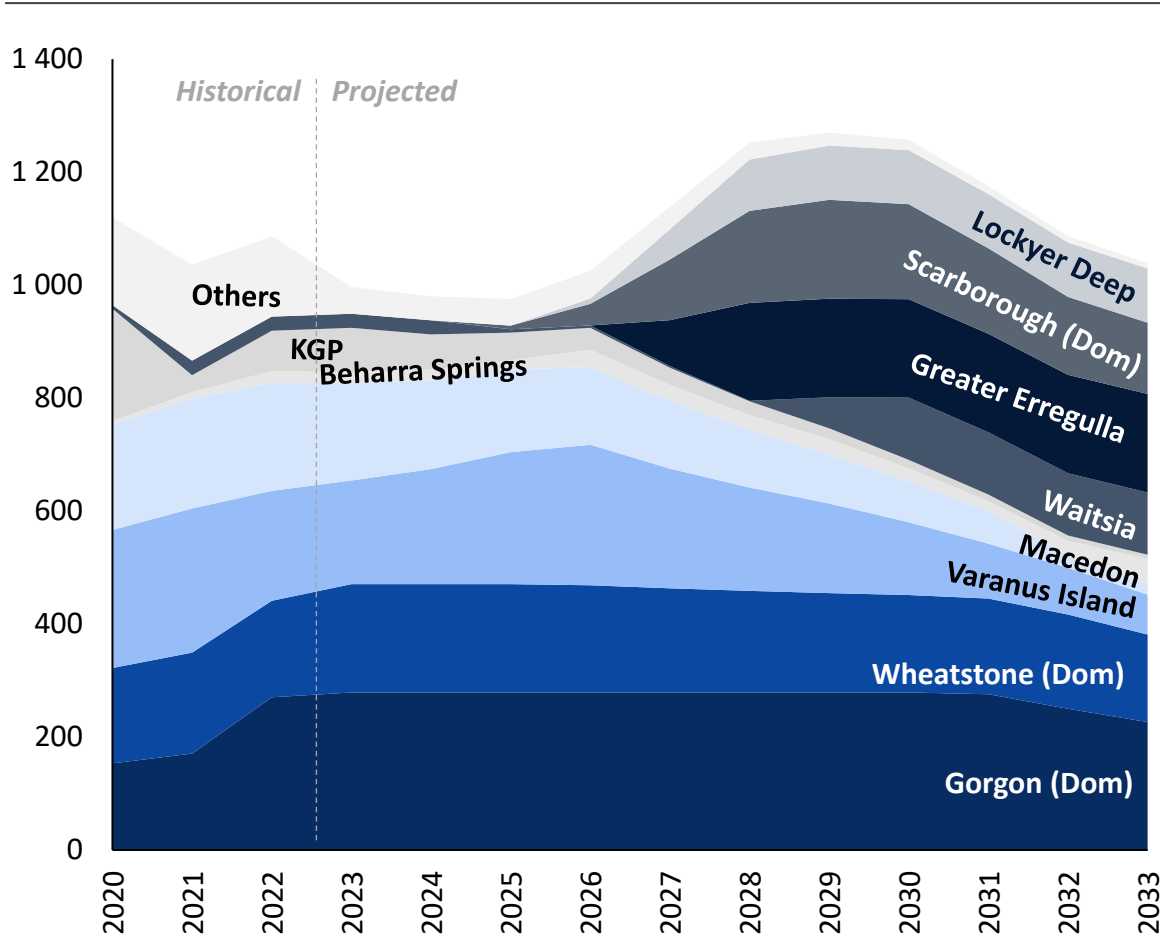
Source: Rystad Energy research & analysis

## Key Owners - Overview

Players	Overview
Others	<ul style="list-style-type: none"> <li>Make up ~24% of the supply in 2033. Major interests are <b>Beach Energy</b>, <b>Mineral Resources</b> and <b>Warrego Energy</b>.</li> </ul>
Mitsui	<ul style="list-style-type: none"> <li>Owner of 50% of <b>Baharra Springs Deep</b> and 50% of <b>Waitsia (Stage 2)</b>.</li> </ul>
Strike Energy	<ul style="list-style-type: none"> <li>Owns 100% of <b>South Erregulla (Phase 1 and 2)</b> and 50% of <b>West Erregulla (Phase 1 and 2)</b> and <b>55% of Walyering</b></li> </ul>
ExxonMobil	<ul style="list-style-type: none"> <li>Owns 25% of <b>Gorgon</b>, supplying ~70 TJ/d to the domestic market.</li> </ul>
Shell	<ul style="list-style-type: none"> <li>Owns 25% of <b>Gorgon</b>, representing 84.9% of their owned domestic supply.</li> </ul>
Chevron	<ul style="list-style-type: none"> <li>Largest working interest (47.3%) of <b>Gorgon</b>, which attributes to more than 60% of Chevron's owned domestic supply.</li> </ul>
Woodside	<ul style="list-style-type: none"> <li>Owns 71.4% of <b>Macedon</b>, accounting for 63.3% of their total domestic supply ownership.</li> </ul>
Santos	<ul style="list-style-type: none"> <li>Largest working interest, owns 98.8% of <b>Varanus Island</b> and 28.6% of <b>Macedon</b>.</li> </ul>

# Scarborough, Waitsia, and Erregulla are expected to drive incremental supply and offset the decline of legacy fields

Estimated Domestic Gas Supply Outlook by Project TJ/d



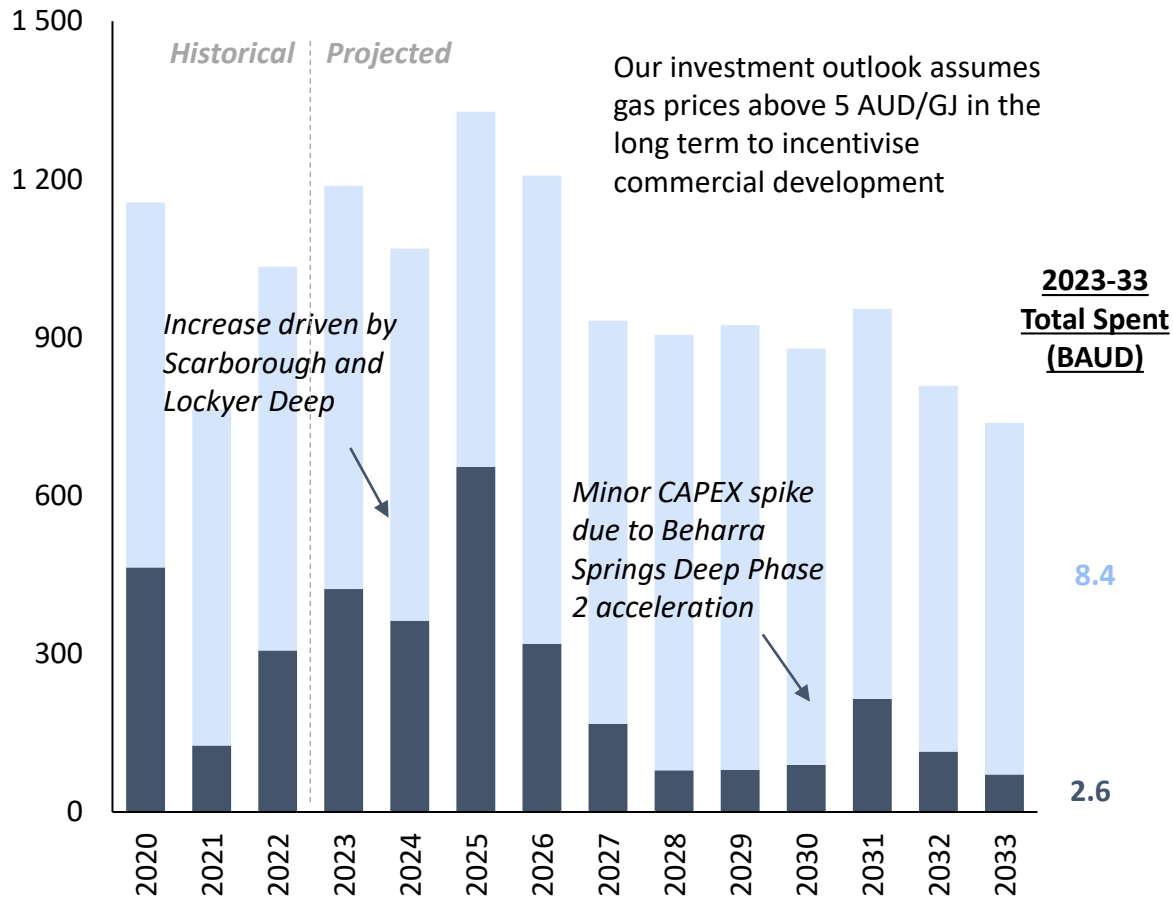
Source: Rystad Energy research & analysis

## Largest Projects - Overview

Project	Overview
Others	• Consists of <b>Pluto (Dom)</b> , <b>Walpyring</b> , <b>Devil's Creek</b>
Lockyer Deep	• To ramp up post 2026
Scarborough	• Volumes to underpin <b>Pluto T1-T2</b> in 2027
Greater Erregulla	• Consists of <b>South (2025)</b> & <b>West Erregulla (2026)</b>
Waitsia	• Domestic supply from <b>Stage 2</b> starting in 2029.
KGP	• Gradual decline with <b>Goodwyn</b> field decline
Beharra Springs	• <b>Phase 1 &amp; 2</b> to mitigate some production decline
Macedon	• To see decline with no new expansion
Varanus Island	• <b>John Brookes &amp; Spartan</b> to sustain LT decline
Wheatstone	• Gradual decline driven by <b>Brunello</b> field from 2026
Gorgon	• <b>Jansz Stage 2</b> to compensate for <b>Jansz/Io</b> decline

# Domestic market to see investments close to 11 BAUD through to 2033 which is key to sustaining new gas supply

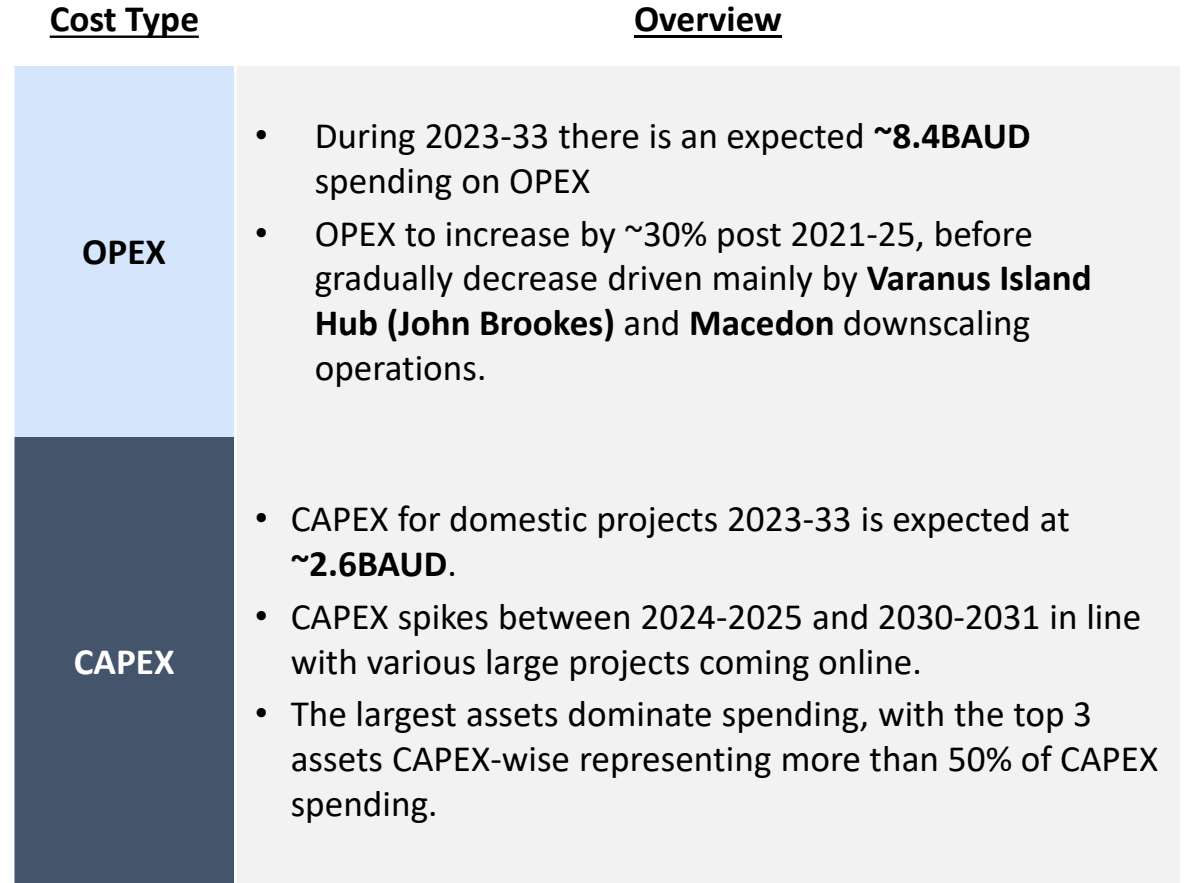
## Investment Outlook for Domestic Projects by CAPEX/OPEX MAUD<sup>1</sup>, Real 2023



(1) Converted from USD using historical average exchange rates from 2020 to 2023 and prevailing market rates from 2024 and onwards

Source: Rystad Energy research & analysis

## Investment Split - Overview





# We have considered ten key projects that could be sanctioned over 2023-2035

## Project Outlook for Sanctioned/Pre-Sanctioned Domestic Gas Projects<sup>1</sup>

<u>Project</u>	<u>Development Type</u>	<u>Potential Resources (PJ)</u>	<u>Development Status</u>	<u>Expected Start-Up Year</u>	<u>Peak Production Year</u>	<u>Infrastructure Access to WA</u>	<u>Forecast CAPEX<sup>2</sup> (MAUD)</u>	<u>RE Assessment<sup>4</sup></u>
Waitsia Stage 2	Expansion	300	FID	2029	2030	Yes	96	●
Lockyer Deep	Backfill	551	Feasibility	2026	2029	Yes	607	●
Greater Erregulla	Greenfield	749	FID in 2023	2025	2029	Yes	838	●
Beharra Springs Expansion	Expansion	338	Feasibility	2026	2034	Yes	492	●
Rafael	Greenfield	232	Early	2028	2030	No	316	●
Corvus	Backfill	112	Feasibility	2027	2028	Yes	292	●
Browse	Backfill	1816	Feasibility	2033	2036	Yes	2,195	●
Red Gully	Greenfield	7	Possible Restart	2027	2028	Yes	13	●
Equus	Backfill	1931	Early	2028	2032	Yes	4,508	●
Dorado	Backfill	640	Feasibility	2036	2038	No	1,228	●
Ocean Hill	Greenfield	244	Early	2026	2029	Yes	294	●

Notes: (1) Values shown are in real 2023 terms; expected start-up dates based on Rystad Energy's qualitative assessment.

(2) USD converted to AUD at 1.476 conversion rate; CAPEX spent is based on a forward looking basis from 2023;

(3) Weighted average based on potential resources and breakeven cost of all assets;

(4) RE assessment is based on various factors such as the development status, start-up year and above parameters

Source: Rystad Energy research & analysis

● Likely development

● Probable development

● Possible development

● Unlikely development

# Some of the more commercially challenging projects are unlikely to be online prior to 2033 with the onshore export ban in place

## Projects supplying to the domestic market over 2020-33: Overview of commercial projects

<u>Development Status</u>	<u>Projects</u>	15% DMO (LNG Exports) + Export Ban (Dom Onshore)
Producing	Devil Creek	✓
	Greater Gorgon Area (DMO)	✓
	Macedon	✓
	KGP	✓
	Pluto (DMO)	✓
	Varanus Island Hub	✓
	Waitsia Stage 1	✓
	Walyering	✓
	Wheatstone (DMO)	✓
Under development	Beharra Springs	✓
	Scarborough (DMO)	✓
Discovery <sup>1</sup>	Waitsia Stage 2	✓
	Greater Erregulla	✓
	Beharra Springs Expansions	✓
	Lockyer Deep	✓
	Varanus Island Hub (Spar Deep)	✗
	Varanus Island Hub (Kultarr)	✗
	Varanus Island Hub (Corvus)	✗
	Cash-Maple (Padthaway)	✗
	Roc (Phoenix South)	✗
	Okapi	✗
	Yulleroo	✗
	Browse (DMO)	✗
	Equus Phase 1 (Nimblefoot)	✗
	Equus Phase 1 (Mentorc)	✗
	Equus Phase 2 (Glenloth)	✗
Equus Phase 2 (Glencoe)	✗	

Notes: (1) Despite commerciality, the Browse, Ocean Hill and Equus fields face challenges, and are not included in the economic analyses.  
 Source: Rystad Energy research and analysis

✗ Excluded  
 ✓ Included

# Allowing for export of gas from onshore fields could support the development of these discoveries through access to premium export prices and capital

## 1 Reduced 'domestic breakeven prices' as some gas is sold at premium export LNG prices

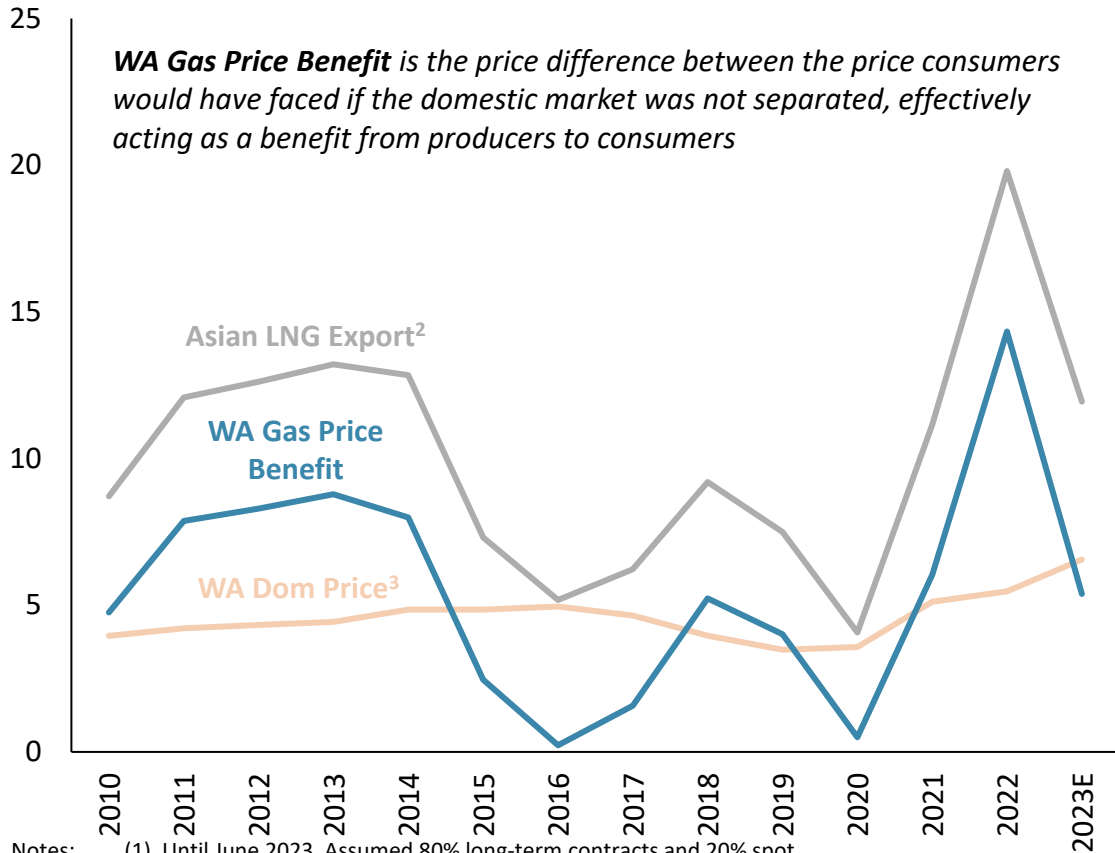
- If gas produced from onshore fields is allowed to be sold on the export market at premium prices, it can reduce the domestic gas price required for the fields to become commercial.
- Consequently, certain fields that are currently deemed uncommercial (such as the ones listed on the previous page) could become commercial by allowing export.
- Access to significantly larger export markets allows producers to offer gas into the domestic market at a considerably lower price than the international market, we have seen this with the offshore LNG DMO policy, please see page 27.
- Allowing for exports will also give operators more certainty around access to markets, which will incentivise operators to explore for future gas supplies, see page 28.

## 2 Increased access to capital and improved financing terms

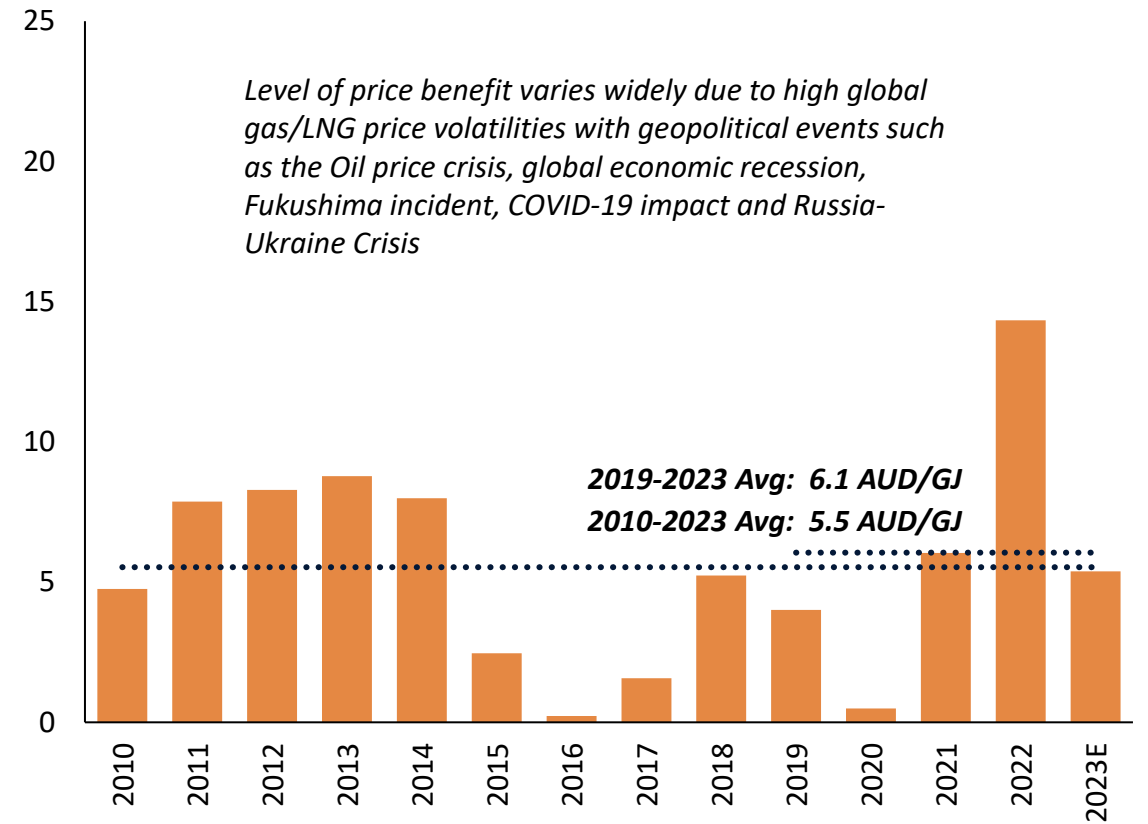
- By allowing for export of onshore gas as LNG, it will be easier to secure long-term contracts, as the LNG market is significantly larger than the Western Australia domestic market.
- This will make it easier for projects to obtain financing, as banks and other financial institutions are more supportive of projects with credit-worthy counterparts with a large potential customer base.
- This gives lenders more favourable financing terms, which could further lower a projects' breakeven gas price due to lower cost of capital expenditure.

# WA has received an average price benefit of 6.1 AUD/GJ from the current LNG DMO policy between 2019-2023E

**Historical<sup>1</sup> Gas Price Benefit**  
AUD/GJ, Nominal



**Historical<sup>1,3</sup> Unit Gas Price Benefit**  
AUD/GJ, Nominal



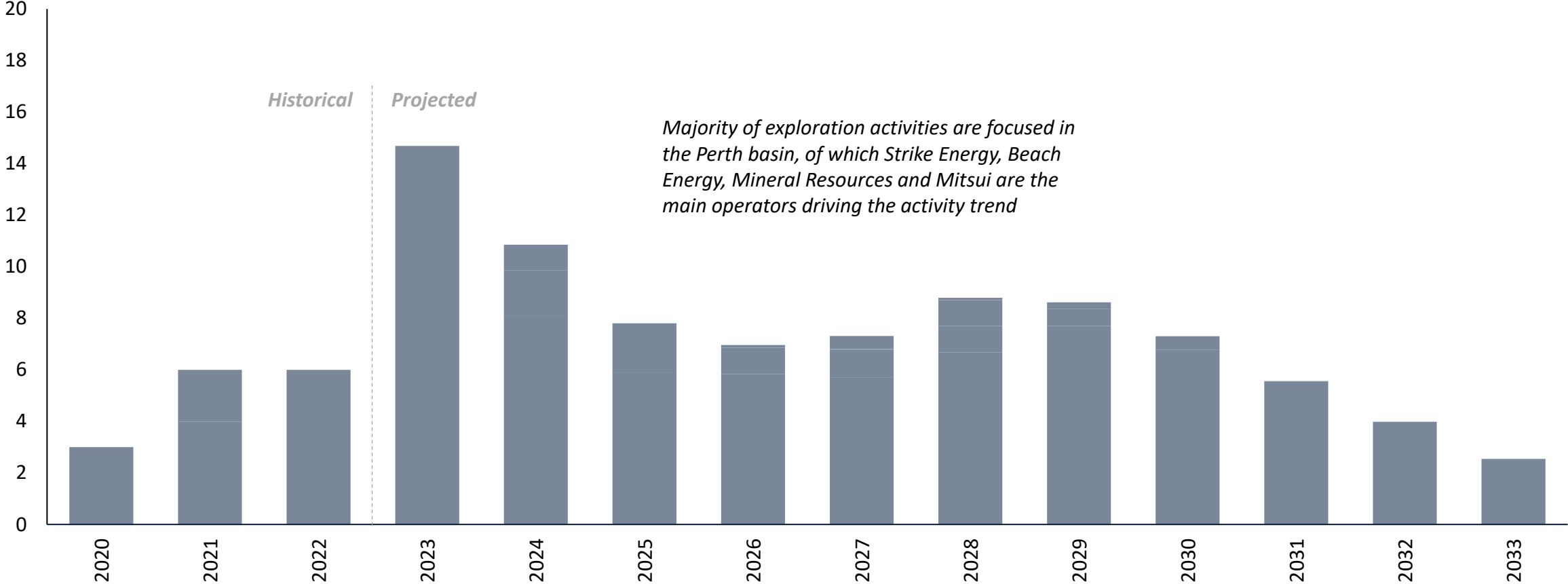
Notes: (1) Until June 2023. Assumed 80% long-term contracts and 20% spot  
 (2) Asia LNG less 1 USD/mmbtu and 2.5 USD/mmbtu for transportation and liquefaction, respectively. Convert from USD to AUD terms using monthly FX-rates.  
 (3) 2023 values partially estimated. Based on contract prices

Source: Rystad Energy research and analysis, WA Gov DMIRS, gasTrading, FRED, Seeking Alpha, Macrotrends

# An LNG export allowance for onshore operators could provide better market signals to incentivise future exploration

## Estimated Exploration Activity in the Perth Basin<sup>1</sup>

Wellbore Count



Majority of exploration activities are focused in the Perth basin, of which Strike Energy, Beach Energy, Mineral Resources and Mitsui are the main operators driving the activity trend

Notes: (1) Risked based on Rystad Energy research assessment; comprises of wildcat/exploration and appraisal drilling  
Source: Rystad Energy research and analysis

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# Overall gas demand to remain robust through to 2033 underpinned by growth in power, industrial and the residential and commercial sector

## Key Takeaways for Demand Outlook

### Key Takeaways



1 Western Australia's total gas demand is expected to remain robust driven by various sector developments:

- **Mining and minerals** sector to see continued decarbonisation via gas displacement from renewables and energy efficiency initiatives. However, this sector will still be a key contributor to overall gas demand.
- **Industrial sector** expected to grow at a fast pace due to recent developments in expected Perdaman Urea, CSBP expansion projects necessitating higher gas demand offtake
- **Power sector** will increasingly need to rely on gas to stabilise the grid and support coal retirements. Renewables penetration will likely weigh in on gas in the longer term
- **Residential and commercial sector** demand will likely remain stable underpinned by continued population growth in the region



2 Demand scenario analysis suggest there may be higher upside to gas demand driven by faster coal retirements and potentially clean ammonia/hydrogen uptake. Downside risks remain low, though accelerated decarbonisation and faster renewables adoption could threaten longer term gas demand

Source: Rystad Energy research and analysis



# We have adopted a sectorial demand forecast for Western Australia's demand outlook

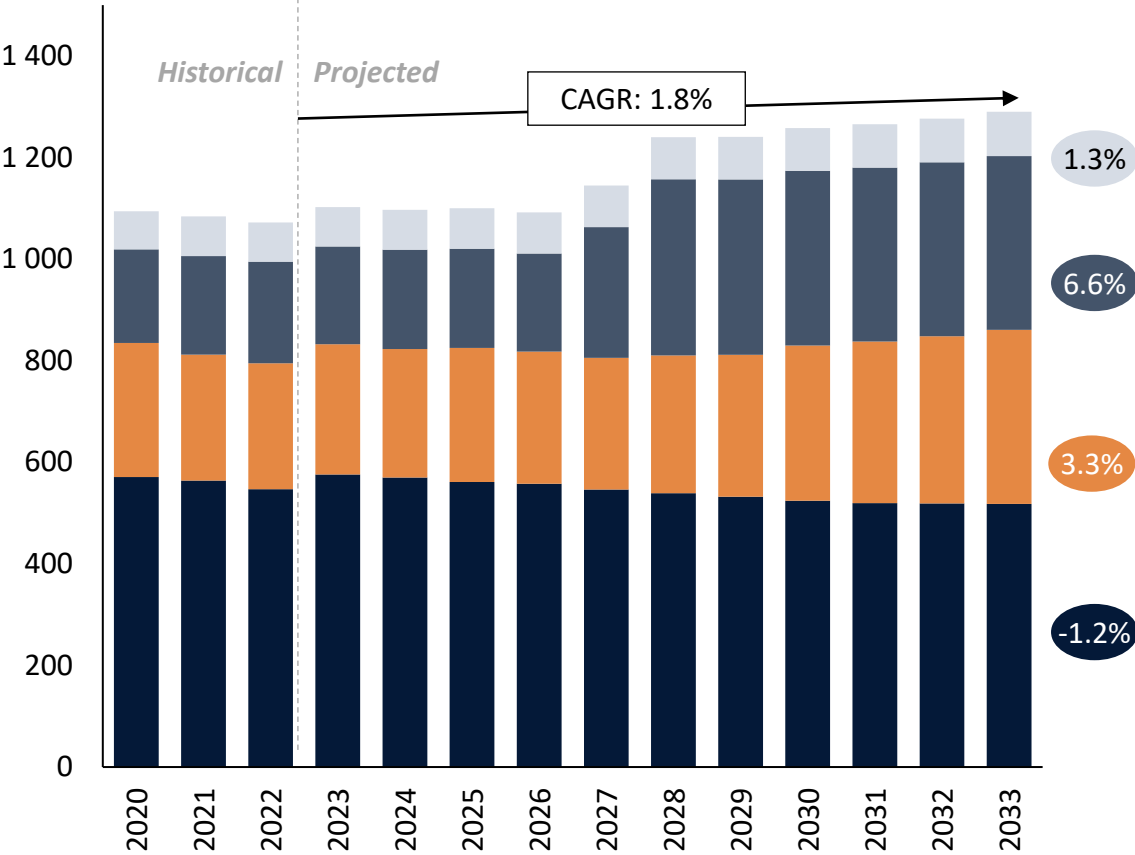
## Western Australia Demand Outlook Methodology

<u>Focus Sectors</u>	<u>Identified Demand Drivers</u>	<u>Objectives</u>
<b>1</b> <b>Power</b>	<ul style="list-style-type: none"> <li>Scale of renewables penetration</li> <li>Coal-to-gas switching due to retirement of coal-fired power plants</li> <li>Planned additions to gas capacity</li> </ul>	<ul style="list-style-type: none"> <li>Understand key demand trends and its underlying drivers</li> <li>Assess demand between 2023-2033</li> </ul>
<b>2</b> <b>Mining and Minerals</b>	<ul style="list-style-type: none"> <li>Additions to mining and mineral plants that consume gas</li> <li>Gas displacement from increased renewables uptake and decarbonisation efforts</li> </ul>	
<b>3</b> <b>Industrial</b>	<ul style="list-style-type: none"> <li>Upcoming greenfield projects increasing gas consumption</li> <li>Penetration of feedstock substitution displacing gas</li> <li>Buildout of renewables capacity</li> </ul>	
<b>4</b> <b>Residential and Commercial (R&amp;C)</b>	<ul style="list-style-type: none"> <li>Rate of population growth</li> <li>Electrification levels displacing gas</li> <li>Levels of hydrogen blending</li> </ul>	

Notes: (1) Non-Exhaustive  
 Source: Rystad Energy research and analysis

# Western Australia’s domestic gas demand is expected to grow underpinned by developments in the power and industrial sector

Estimated WA Total Domestic Gas Demand  
TJ/day



Source: Rystad Energy research and analysis

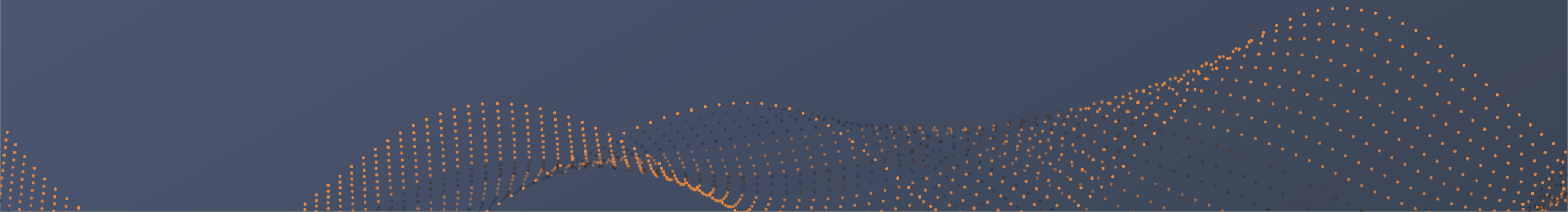
## Key Drivers for WA Total Gas Demand

Sector	Key Drivers
R&C	<ul style="list-style-type: none"> <li>Moderate growth with minimal volumes of hydrogen uptake between 2023 and 2033</li> </ul>
Industrial	<ul style="list-style-type: none"> <li>Demand almost doubles with Perdaman Urea and CSBP Expansion despite some renewables uptake</li> </ul>
Power	<ul style="list-style-type: none"> <li>New gas plants required to support planned coal retirements and renewables entrants</li> </ul>
Mining & Minerals Processing	<ul style="list-style-type: none"> <li>Large-scale renewable adoption amongst mining companies seeking to decarbonise quickly, though overall decline mitigated by increased minerals processing requirements and diesel-to-gas switching</li> </ul>



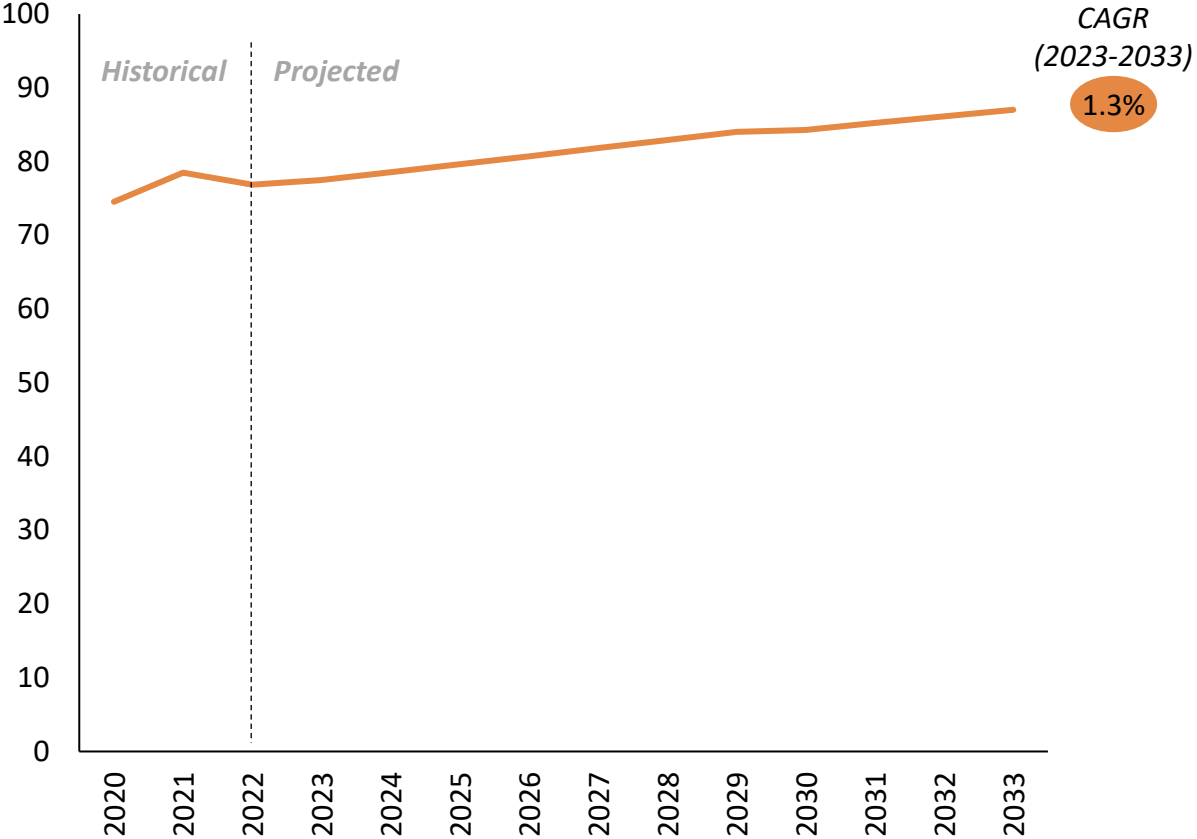
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# 1 Residential and Commercial



# The Residential and Commercial sector is expected to see sustained growth underpinned by population growth and electrification

**Estimated Gas Consumption for Residential and Commercial Sector TJ/day**



Note: (1) -0.1% is the CAGR between 2014 to 2020  
 Source: Rystad Energy research and analysis; ATCO; Australia Bureau of Statistics

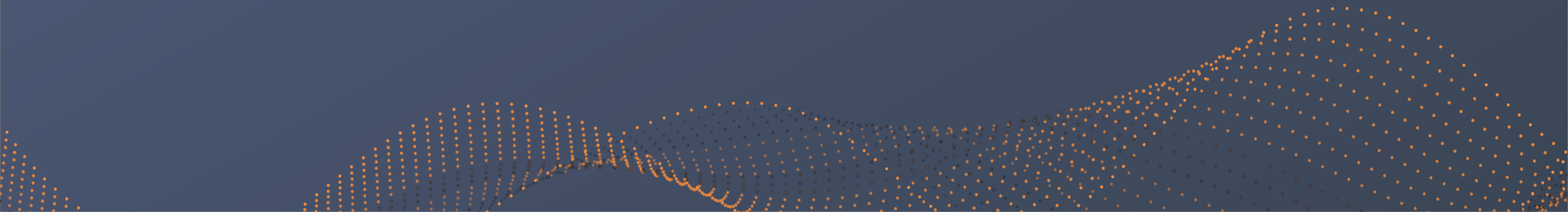
## Overview of Assumptions

Key Drivers	Overview
<b>Population Growth</b>	<ul style="list-style-type: none"> <li>Applies the WA Government population forecast of Band C<sup>1</sup> – Median. Forecast is derived through the median estimates for fertility. Assumes a growth rate of 1.23% from 2021-2025, 1.53% from 2026-2030, and 1.61% from 2031 onwards.</li> </ul>
<b>Customer connection</b>	<ul style="list-style-type: none"> <li>Number of people per customer connection continues to decrease at a rate of -0.1%<sup>1</sup></li> </ul>
<b>R&amp;C Electrification</b>	<ul style="list-style-type: none"> <li>To remain modest, especially since gas delivered to homes/small businesses costs half of grid-based electricity.</li> </ul>
<b>Hydrogen Blending</b>	<ul style="list-style-type: none"> <li>Still in feasibility stages and not expected to undergo wide adoption.</li> </ul>



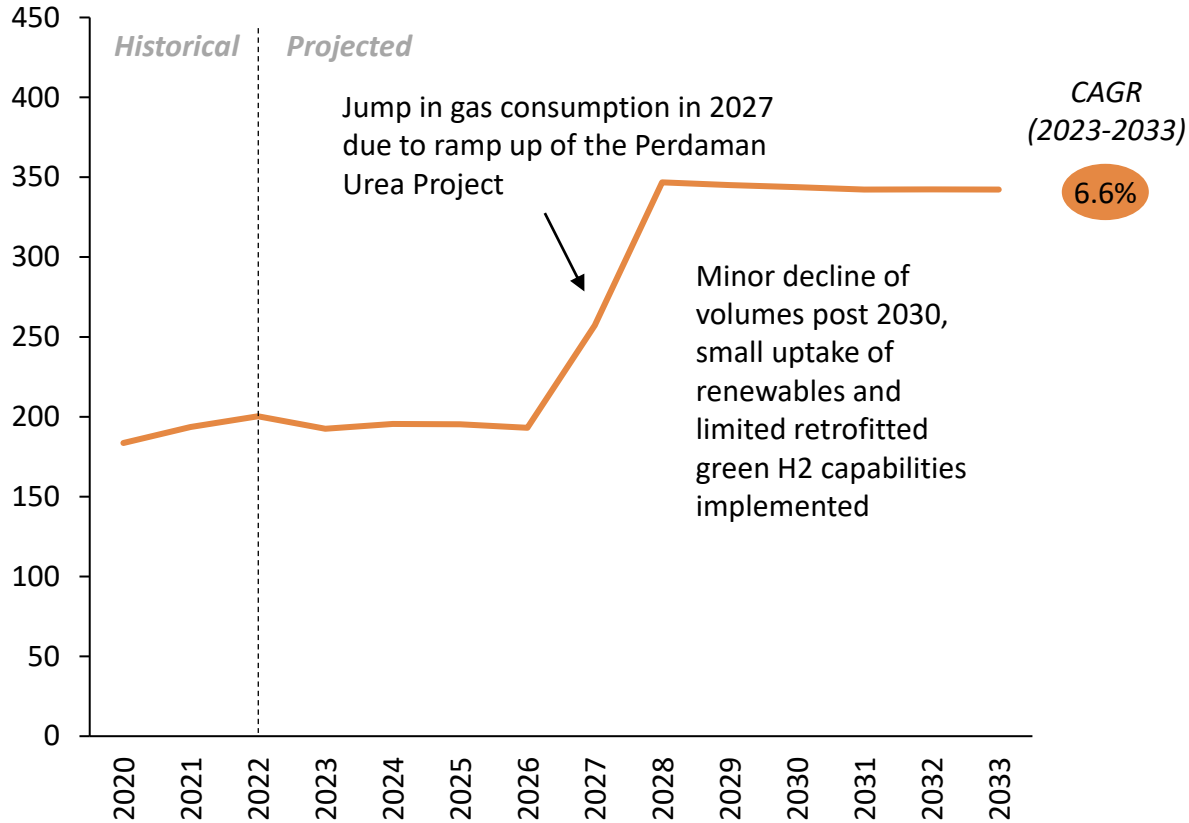
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## 2 Industrial



# Industrial demand to increase towards 2033, with Perdaman driving majority of the increase

## Estimated WA Industrial Gas Demand TJ/day











## Overview of Assumptions

Key Drivers	Comment
<b>Greenfield Projects</b>	<ul style="list-style-type: none"> <li><b>CSBP Expansion (+300 KTPA) and Perdaman Urea Project (+1300 KTPA)</b> assumed as part of base case. Project Haber and YURI Project was not considered given its earlier development stages.</li> <li><b>Other industries:</b> Other Industries' gas demand is expected to remain flat, with no new developments assumed.</li> </ul>
<b>Feedstock Substitution</b>	<ul style="list-style-type: none"> <li>Likely to occur post 2030 with large-scale green hydrogen projects coming online.</li> <li>No current plans to retrofit green H2 capabilities at the existing large-scale fertiliser plants.</li> <li><b>Other industries:</b> No feedstock substitution expected in other sectors due to economic/technical challenges.</li> </ul>
<b>Renewables Addition</b>	<ul style="list-style-type: none"> <li>Potential addition of 100 MW solar facility to Perdaman, displacing up to 10 TJ/day of gas.</li> </ul>




Note: Project Haber has an ammonia production capacity of 800 KTPA, urea production capacity of 1.4 MTPA. (1): Santos to supply > 120 PJ of natural gas over five years to Yara, from 2023.  
Source: Rystad Energy research and analysis

# Two greenfield fertiliser projects to add >150 TJ/d of gas demand

## Key Greenfield Projects within the Fertiliser Industry

Project Details	Main projects considered by RE		YURI Project	Project Haber
	Perdaman Urea Project	CSBP Expansion Project		
Operator	 Perdaman	 CSBP	 YARA	 strike energy
Gas Consumption (TJ/d)	130	27	0	81.6
NH3 Capacity (KTPA)	1,300	300	800 <i>(Green ammonia)</i>	800
Start-up Year	H2 2027	2028	2027	2027
On-site Renewables	<ul style="list-style-type: none"> <li>✓ A 100 MW solar facility is being proposed at the Perdaman project.</li> </ul>	<ul style="list-style-type: none"> <li>✗ No on-site renewables due to limited access to renewables or cost effective green H2 in the vicinity.</li> </ul>	<ul style="list-style-type: none"> <li>✓ 2 GW of renewables capacity to be installed to produce green ammonia</li> </ul>	<ul style="list-style-type: none"> <li>✓ Possible integration of up to 170 MW of on-site renewable energy.</li> </ul>
Project Status				
Remarks	Financing secured in Apr 2023 and has begun construction	Awaiting EPA approval	Construction for initial phase under way	In process of submitting environmental approvals























Source: Rystad Energy research and analysis; CSBP; Yara; Strike Energy; Perdaman

 In progress/FID  
  Completed FEED  
  Pre-FEED/Proposed







# Industrial consumption of gas is still largely underpinned by technical and cost challenges of alternatives

## Feedstock/fuel Substitution Methods Across Various Industries

Industrial Sector	Feedstock/fuel Substitution Methods		
	 Electrification of heat	 Blue/green H2	 Biomass as fuel/feedstock
 Ammonia			
 Cement			
 Iron and steel			
 Petrochemical			
Other industries <sup>1</sup>			

- Displacement of gas by renewables is more **complex and costly**, especially for processes requiring **gas as a feedstock** or chemical processes<sup>2</sup>. Substituting gas in their existing operations would require **major operational redesign**.
- Industrial processes that use **gas for heat and steam** processes may be able to **electrify processes**. However, this requires new heat process equipment to be incorporated.
- For **blue/green H<sub>2</sub> as feedstock**, cost is still a key obstacle, however, this is expected to decrease with wider adoption.

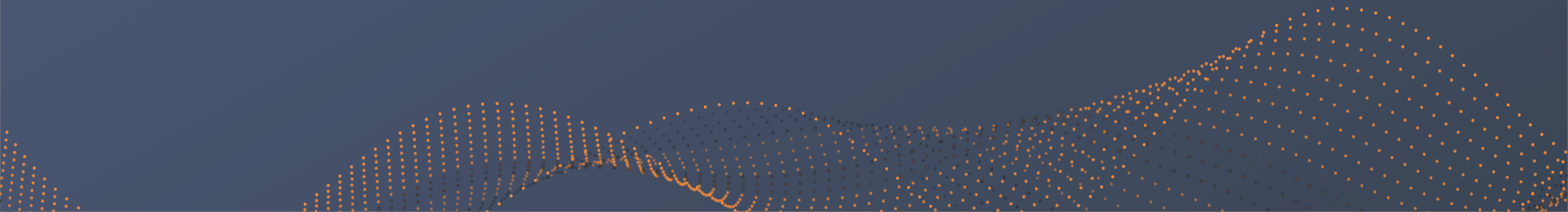
Note: (1): Includes heat demand in other sectors such as manufacturing, construction, food & tobacco; (2) E.g. ammonia, alumina, lithium hydroxide).  
 Source: Rystad Energy research and analysis

 Already applied at industrial scale
  Pilot phase
  Unlikely to be adopted
  R&D phase



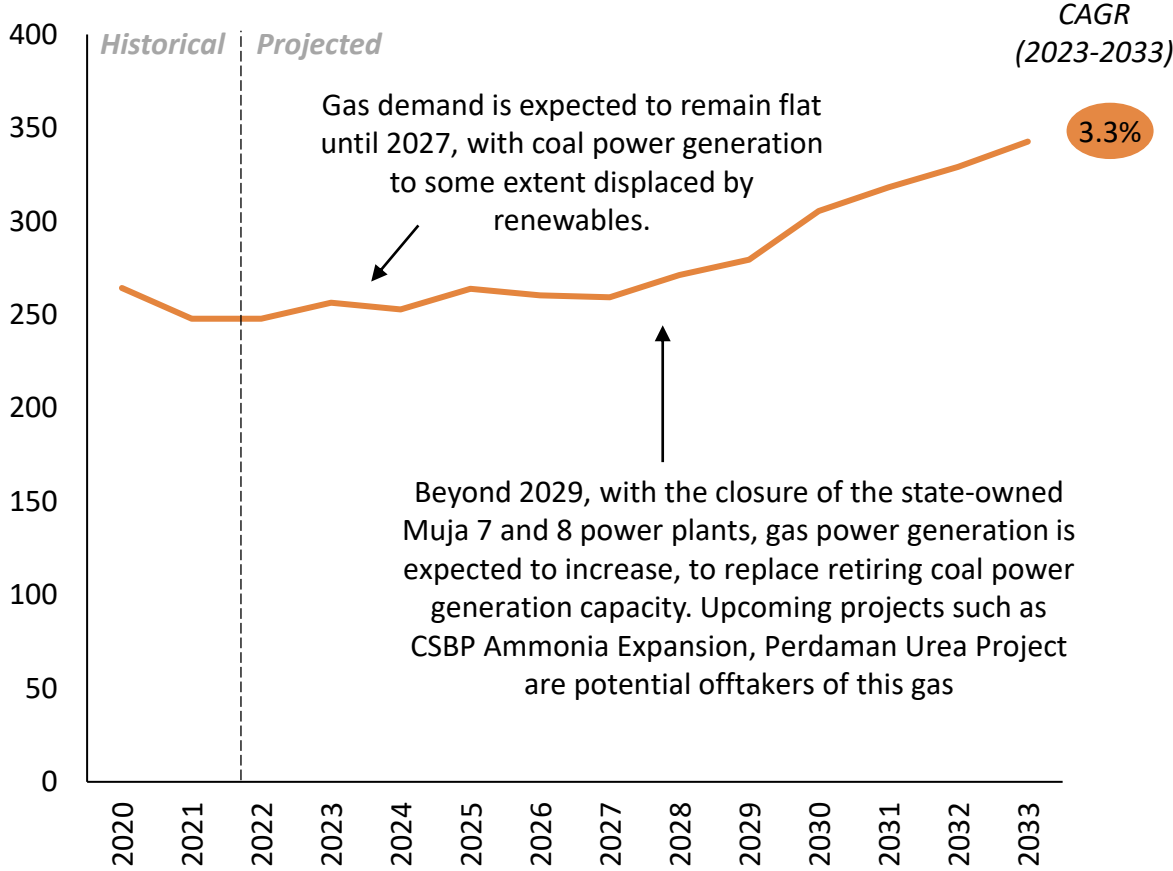
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### 3 Power



# Up to 350 TJ/d of gas demand required to support the power sector by 2033 where gas will play a pivotal role in offsetting planned coal retirements and supporting intermittent renewables

**Estimated Gas Demand in the Power Sector TJ/d**



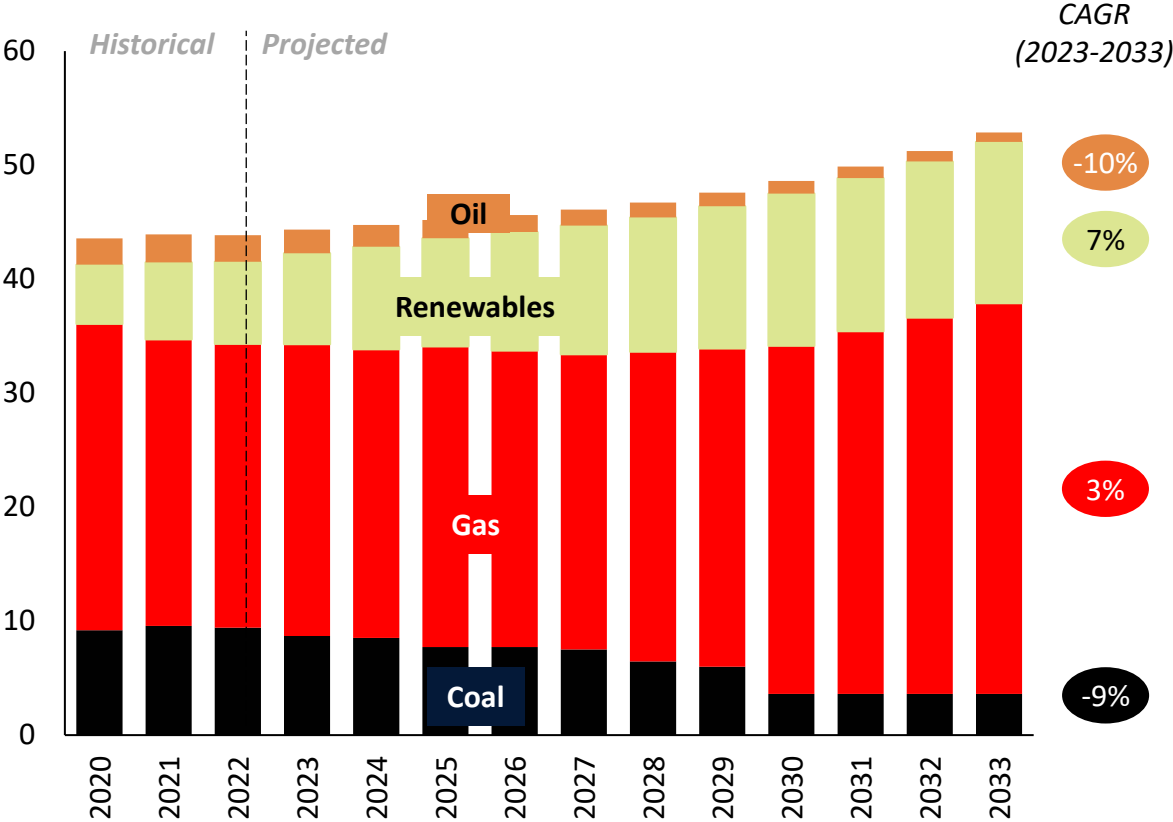
**Key drivers**

<u>Drivers</u>	<u>Overview</u>
<b>Renewables Penetration</b>	<ul style="list-style-type: none"> <li>• <b>Rooftop solar PV</b> capacity expected to increase from 1.6 GW in 2022 to 3.9 GW in 2030. <b>Large-scale solar</b> and <b>wind</b> capacity expected to become operational as well, damping impact on gas-fired power generation</li> </ul>
<b>Coal retirement</b>	<ul style="list-style-type: none"> <li>• Planned <b>retirement</b> of WA’s state-owned coal power plants by 2029 expected to have overall uplifting effect on gas-fired power generation in the state to fill gap that cannot be met by renewables</li> </ul>
<b>New gas plant additions</b>	<ul style="list-style-type: none"> <li>• Despite no commitment to new gas-fired power stations in the SWIS after 2030, it is assumed new gas-fired power capacity will be required in the market beyond 2030 due to the retirement of coal-fired plants.</li> <li>• Synergy is believed to be working on plans to build its own gas-fired generator, while Alinta Energy is keen to increase its gas-fired generation capacity.</li> </ul>

Source: Rystad Energy research and analysis; Rystad Energy RenewableCube, Australian Energy Statistics, Alinta Energy

# Gas to stay relevant in the power sector by displacing coal and at the same time mitigating grid intermittency arising from higher renewables penetration

Estimated Power Generation Outlook<sup>2</sup> by Sector  
TWh



## Key drivers by energy source

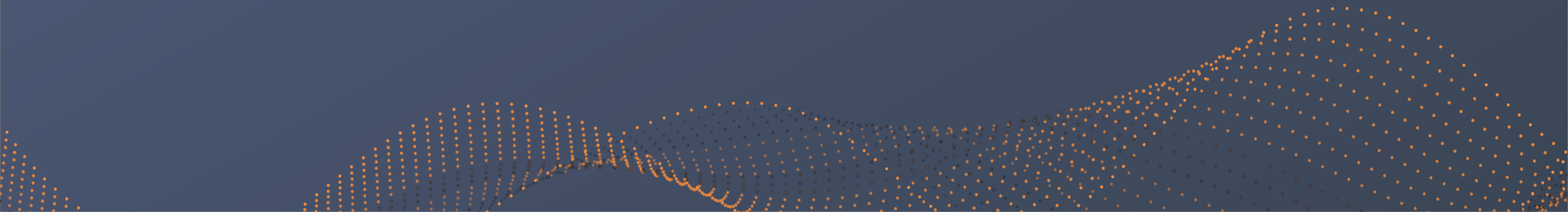
Energy source	Key Drivers
Oil	<ul style="list-style-type: none"> <li>Declining consumption of diesel for power generation, in line with the state’s decarbonisation efforts.</li> </ul>
Renewables	<ul style="list-style-type: none"> <li><b>3.9 GW</b> of rooftop solar PV capacity installed by 2030, in line with state forecasts<sup>1</sup>, with sufficient storage.</li> <li><b>2.2 GW</b> of onshore wind and <b>4.7 GW</b> of large-scale solar PV capacity comes online (projects that are currently under construction, approved or pending approval).</li> <li>Hydropower and biomass projects currently planned becoming operational.</li> </ul>
Gas	<ul style="list-style-type: none"> <li>Growth expected with coal phase out to avoid a supply crunch in the WA power market.</li> </ul>
Coal	<ul style="list-style-type: none"> <li>Retirement of state-owned coal-fired power plants in line with government announced targets.</li> </ul>

Notes: (1) Forecasts refers to solar PV uptake projections published by the Western Australia government in the Whole of System Plan and AEMO in the Wholesale Electricity Market, Electricity Statement of Opportunities 2022  
 (2) Power Generation Outlook excludes electricity generated for consumption in the Mining, Minerals Processing and Industrial sectors. Power for large-scale production of hydrogen is excluded as well.  
 (3) Western Australia’s top line power demand forecast has been estimated using historical power demand statistics at the state and country levels, as well as Australia’s forecasted power demand up to 2035 (PowerCube).  
 Source: Rystad Energy research and analysis; Rystad Energy RenewableCube, Rystad Energy PowerCube, Australian Energy Statistics



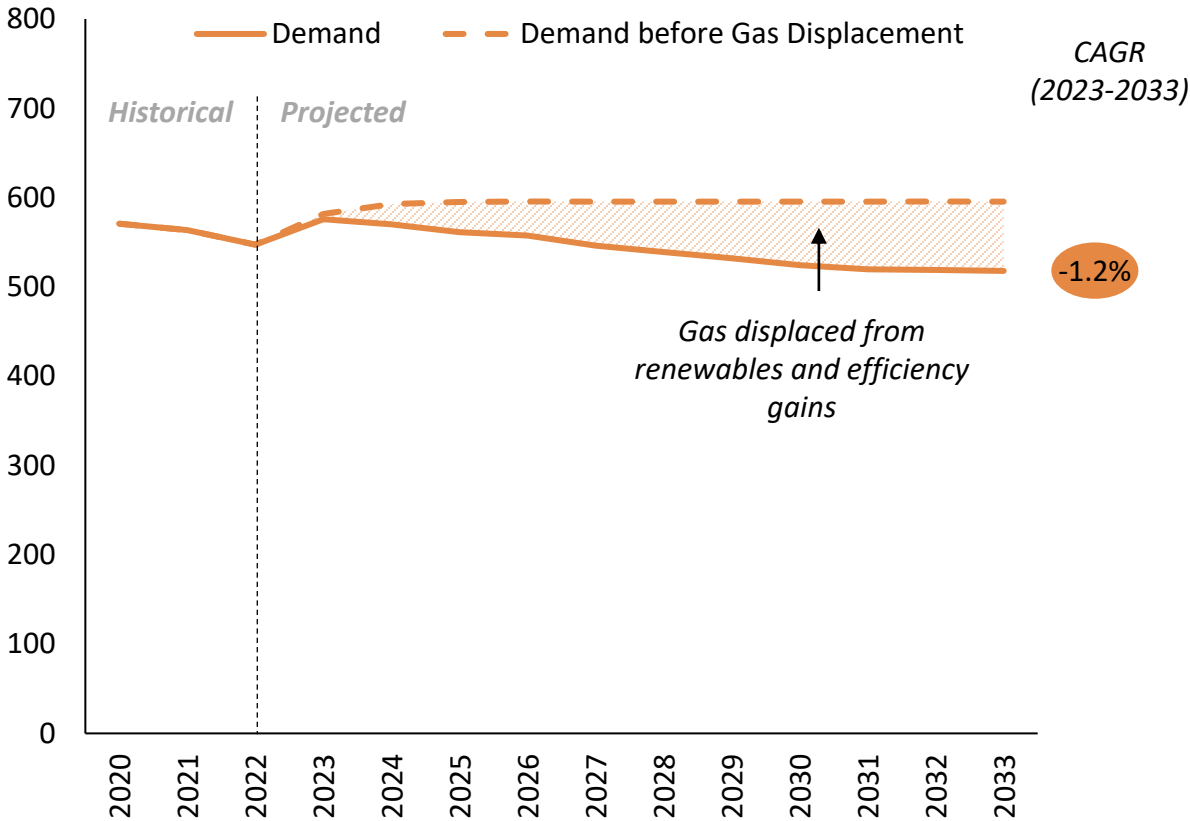
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## 4 Mining and Minerals



# Gas demand in the mining and minerals processing sector to decrease, driven by moderate renewable plans

## Estimated WA Mining and Minerals Processing Gas Demand, TJ/day



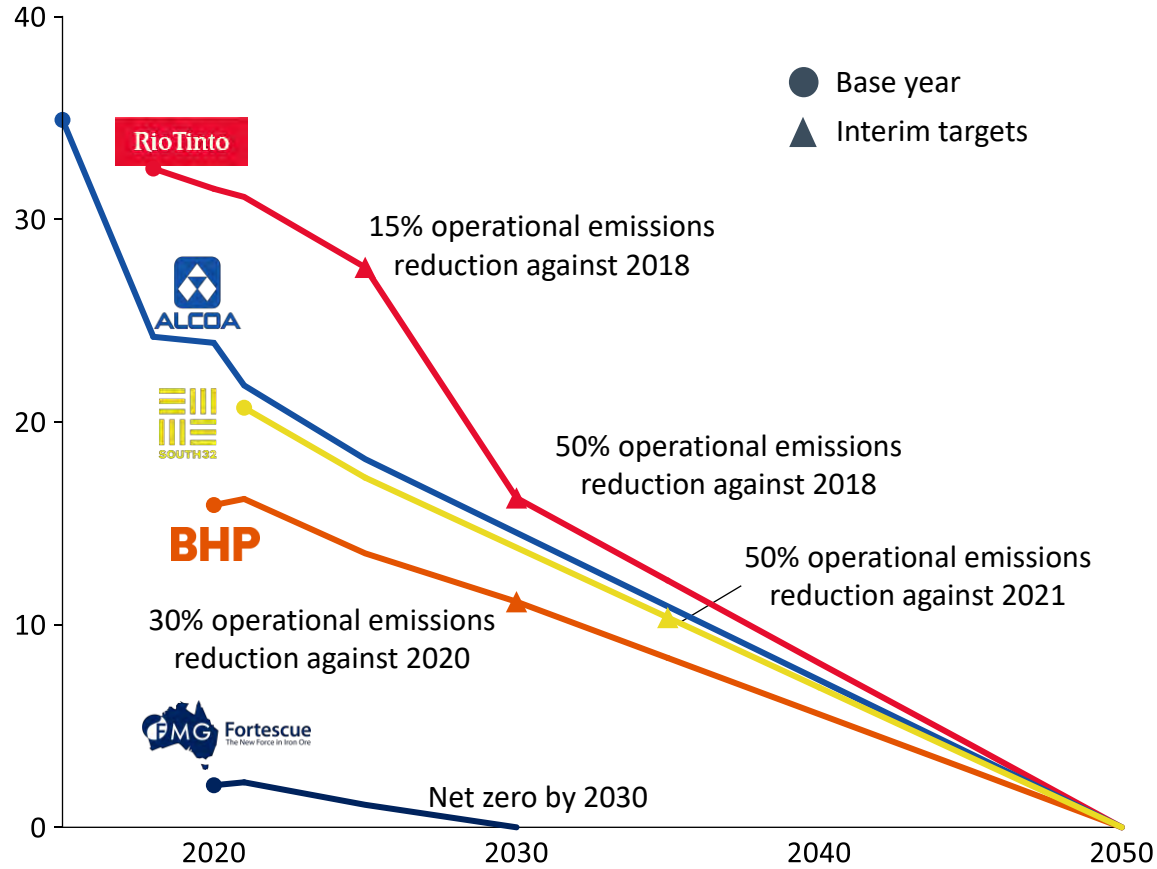
## Overview of Assumptions

Case	Key Drivers
Mining Developments	<ul style="list-style-type: none"> <li>Includes 6 new projects: Iron Bridge, Nifty Copper Mine, Bellevue Gold, Mount Holland Lithium Mine, Thunderbox Mill Expansion, Ashburton Hub.</li> </ul>
Minerals Processing Developments	<ul style="list-style-type: none"> <li>Includes Kemerton Lithium Plant, Kathleen Valley and South32’s Worsley Alumina Coal Plant replacement. Alcoa’s MVR<sup>2</sup> trials show positive results, with ~ 10% gas to be displaced by 2030.</li> </ul>
Renewables uptake	<ul style="list-style-type: none"> <li>Large-scale renewable capacity additions from mining major such as Rio Tinto to come online by 2030. We have assumed only 30%<sup>1</sup> of the gas displacement target will be realised given gas continued role to maintain baseload power demand while managing renewables intermittency.</li> <li>Minimal gas displacement for minerals processing via renewables as it remains economically and technologically challenging.</li> </ul>

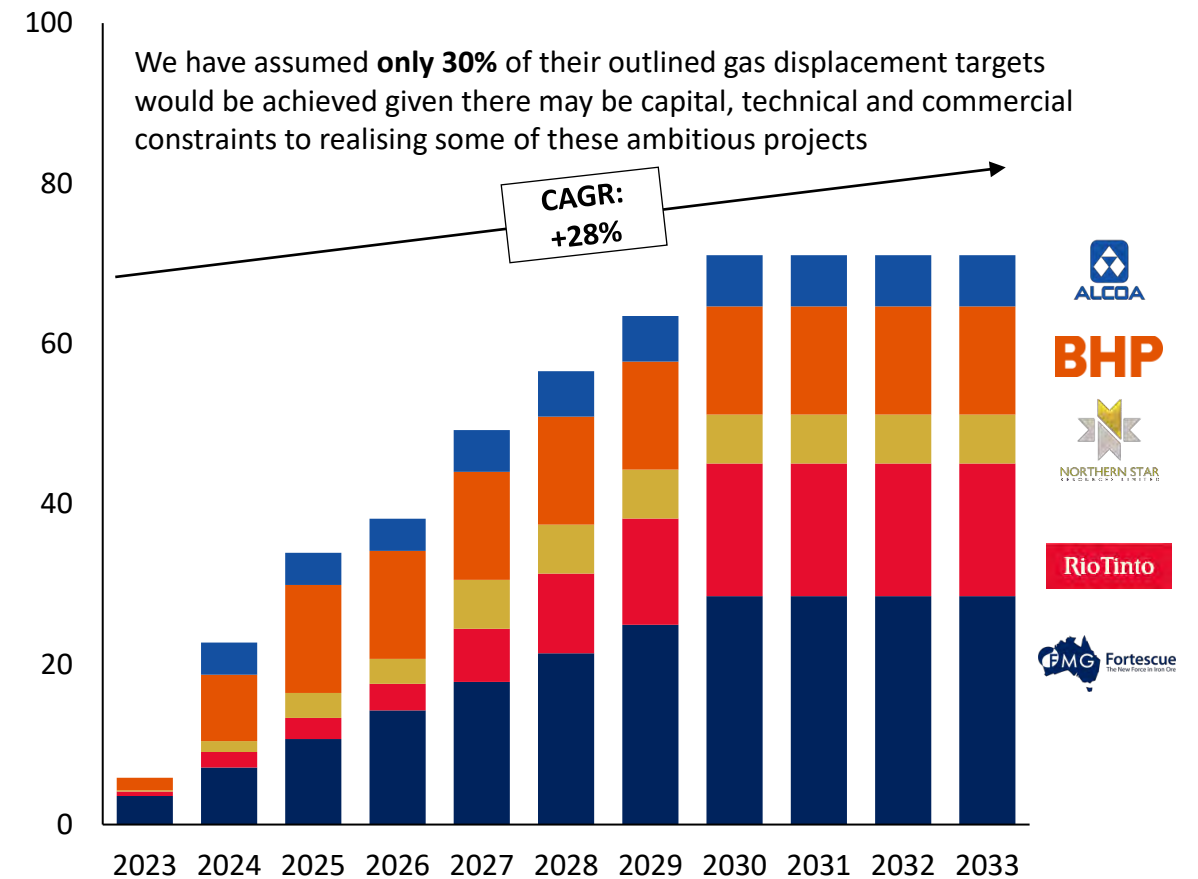
Note: (1) 80% gas displacement from planned renewable capacity additions is based on discussion with industry experts and internal analysis. (2): MVR stands for Mechanical Vapour Recompression  
 Source: Rystad Energy research and analysis; WA Gas Bulletin Board

# The largest mining and minerals processing companies could displace a maximum of 170 TJ/day of gas by 2033 – of which it is assumed only 30% of such will be achieved

**Announced Emission Reduction Targets for Selected Miners in WA<sup>1</sup>**  
Million tonnes CO<sub>2</sub>e



**Risked Gas Displacement in WA's Mining and Minerals Sector**  
TJ/day

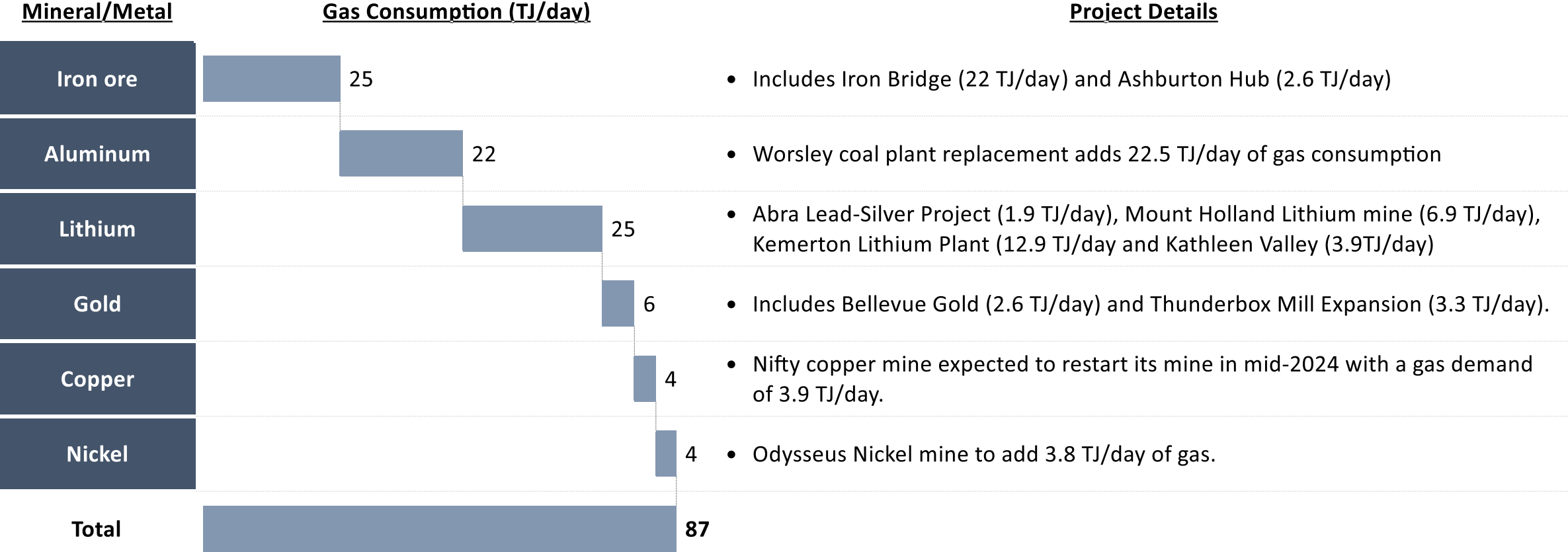


Note: (1): Scope 1 and 2 emissions. The chart refers to net emissions which should not be interpreted as absolute zero emissions  
Source: Rystad Energy research and analysis; Fortescue Metals Group; Rio Tinto; BHP; Northern Star; Alcoa



# 11 projects expected to add ~ 87 TJ/day of gas consumption between 2023 and 2033

## WA Mining and Minerals Processing Project Pipeline



Source: Rystad Energy research and analysis; Australia Government Department of Industry, Science and Resources

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# Near term market tightness to prevail until 2027 before new supply rebalances the market

## Key Takeaways for Supply-Demand Balance

### Key Takeaways

1



The WA domestic gas market is expected to face tightness in the near term due to limited supply developments, primarily driven by legacy field decline outpacing supply additions.

Longer term market fundamentals likely to return to balance the overall market with Scarborough (post 2026) and Waitsia coupled with gradual demand growth

Extent and duration of market tightness may impact gas prices

2



Gas storage facilities such as Tubrigi and Mondarra will likely play a critical role in maintaining market balance and prices through periods of supply tightness

3

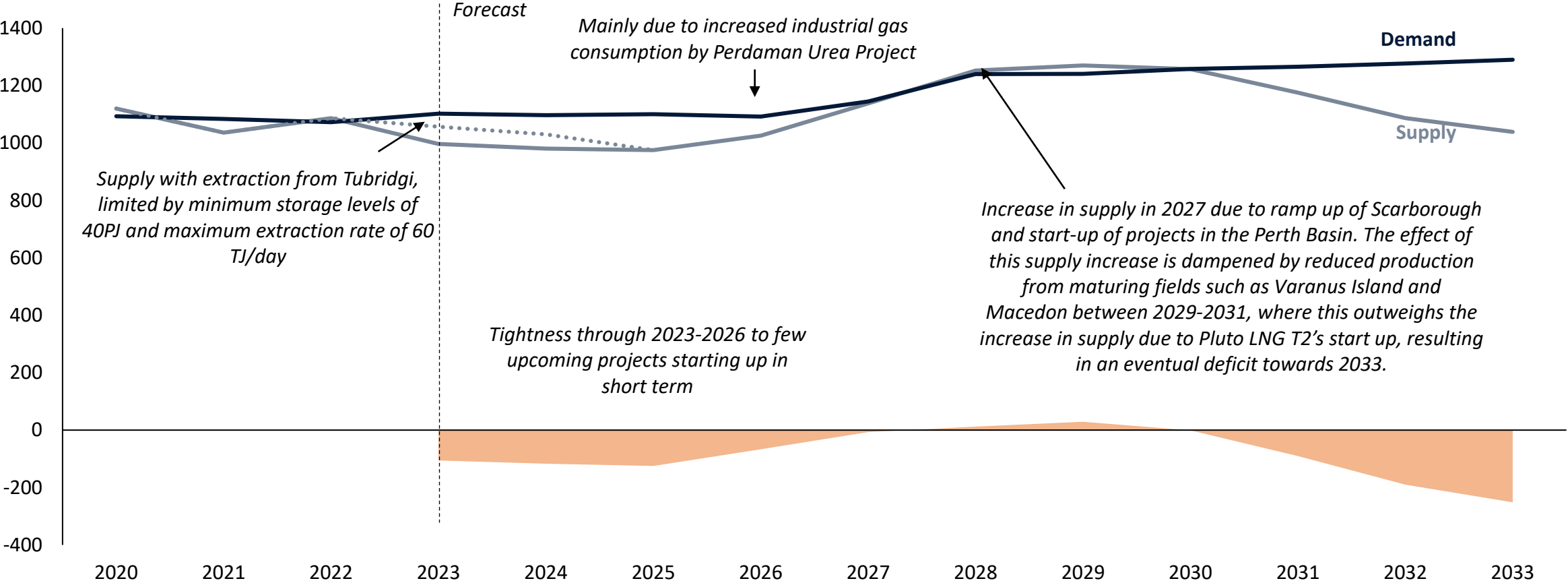


Greater downside risk of increased market tightness if supply projects are delayed/cancelled coupled with higher demand developments.

# Market tightness in the short term with a supply imbalance if no new gas supply is brought forward

## Estimated WA Domestic Gas Demand and Supply Balances

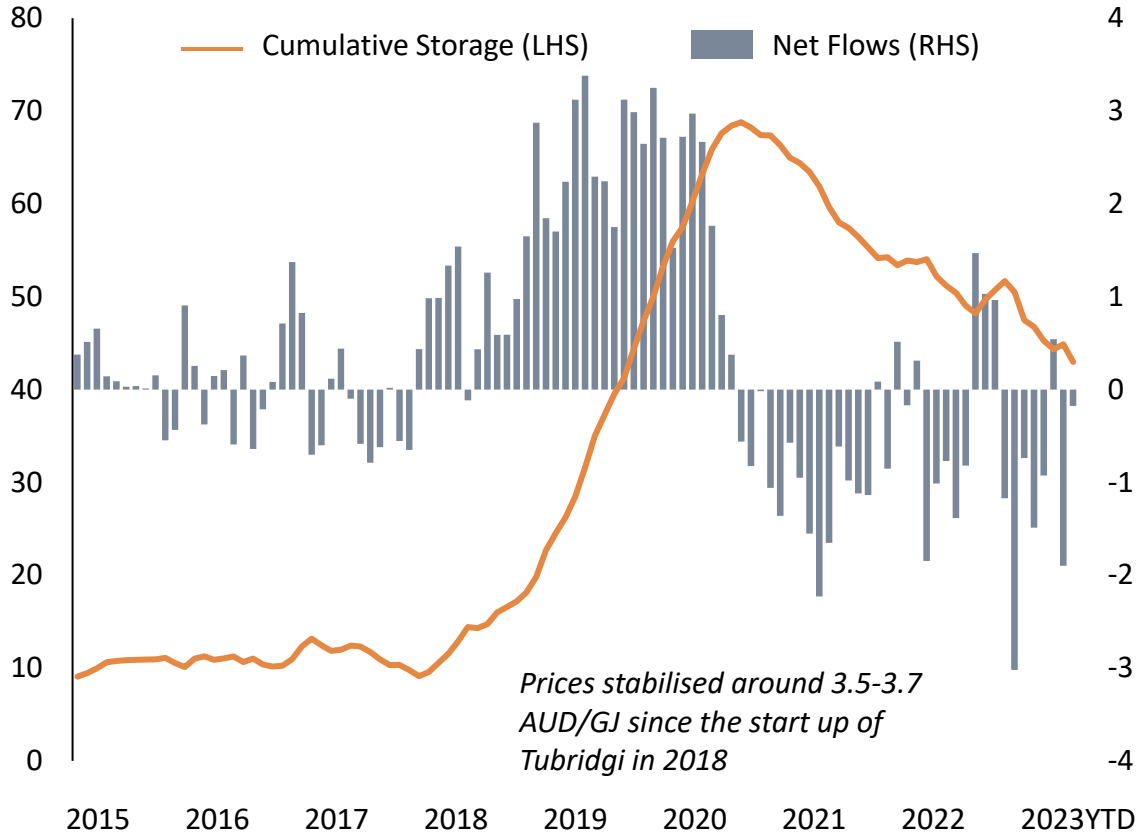
TJ/d



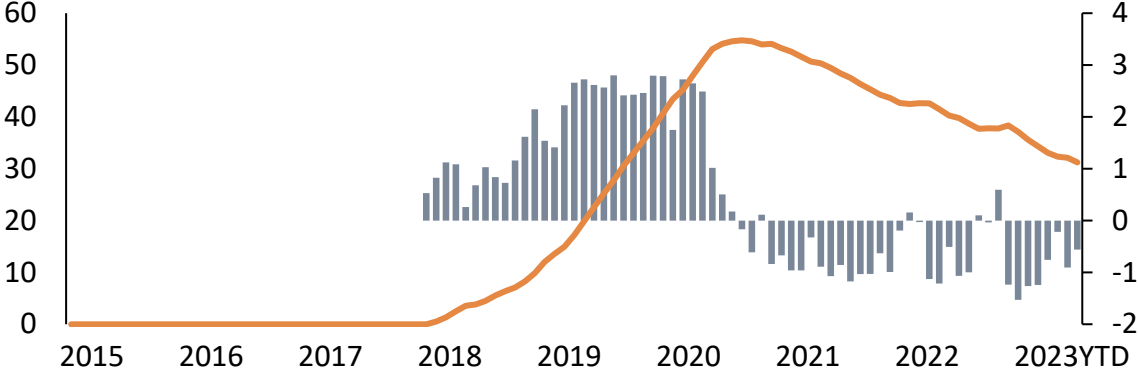
Source: Rystad Energy research and analysis

# Storage a key enabler of balancing market flows and prices especially post 2020 due to slower production growth

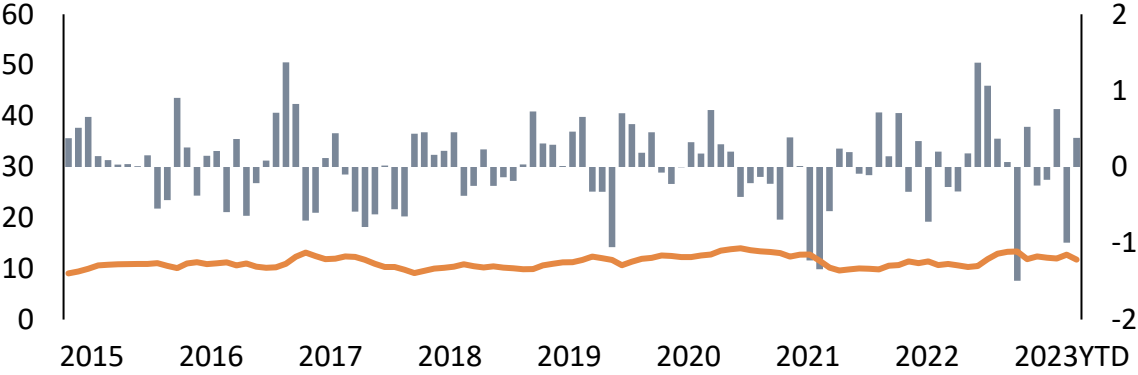
**Total Reserves from Storage**  
PJ



**Tubridgi Cumulative Storage Level and Net Flows**  
PJ



**Mondarra Cumulative Storage Level and Net Flows**  
PJ



Source: Rystad Energy research and analysis; AEMO; WA Gas Bulletin Board

# Any market imbalances likely to disproportionately impact industry more than households

## Impact of Demand-Supply Imbalances on End Sectors

Market Situation	Impacted Sector	Sub-Sector	Volume Offtake/ Prices	Assessment
Surplus	Industries	Existing		<ul style="list-style-type: none"> <li>Existing industries would see limited volume and pricing risk given that their gas is likely to be contracted on a fixed basis. Any volume/price impact on industry likely to be delayed (when contract expires)</li> <li>New industries could see higher economic incentives from lower feedgas cost/prices and supply availability, which could spur FID/development thus driving up long term gas demand.</li> <li>Impact of increased volume/prices unlikely to materially change household demand given low demand inelasticity. However, prolonged, lower prices could incentivise LT switching to gas</li> </ul>
		New		
	Households	Existing/New		
Deficit	Industries	Existing		<ul style="list-style-type: none"> <li>Existing industries would see limited volume and pricing risk given that their gas is likely to be contracted on a fixed basis. Any volume/price impact on industry likely to be delayed (when contract expires)</li> <li>Prolonged deficit may result in elevated prices which can deter long term investments into new demand industries</li> <li>Impact of increased volume/prices unlikely to materially change household demand given low demand inelasticity. However, prolonged, high prices could incentivise faster switching to electrification</li> </ul>
		New		
	Households	Existing/New		

Positive Impact  
 Negative Impact  
 Limited/Mixed Impact

Source: Rystad Energy research and analysis

# Content

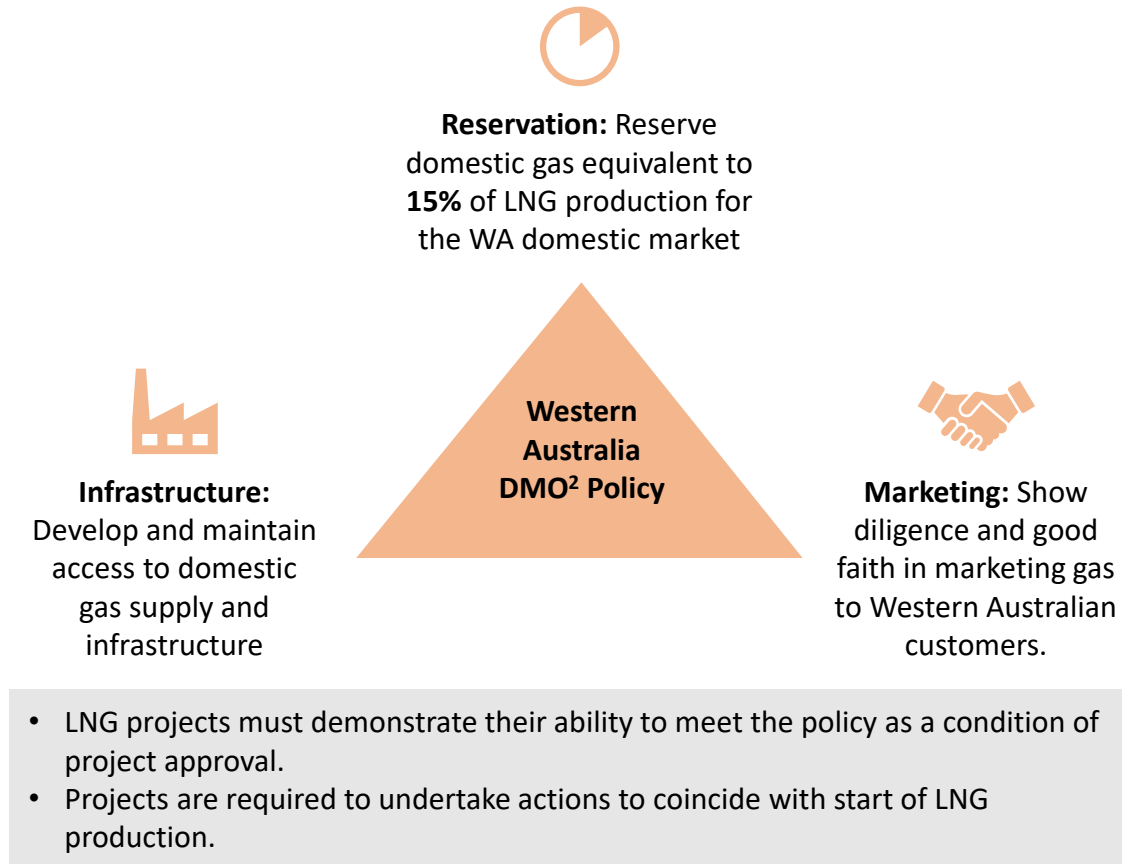
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# The WA Domestic Market Obligation policy is designed to ensure sufficient supply for the domestic market and simultaneously foster continued investments in the sector

## Key Highlights of Western Australia's DMO<sup>2</sup> Policy



## Other aspects of the Domestic Gas Policy

<u>Detail</u>	<u>Overview</u>
 <p>Scope</p>	<ul style="list-style-type: none"> <li>WA Government will not agree to the export of gas via the domestic WA pipeline network other than in <b>exceptional circumstances</b>.</li> <li>Supply of gas to markets on the <b>Australian east coast</b>, whether via an LNG import terminal or pipeline connection to east coast gas markets, is considered export.</li> <li>LNG used in <b>international shipping</b> is also considered export.</li> </ul>
 <p>Offsets<sup>1</sup></p>	<ul style="list-style-type: none"> <li>LNG exporters may propose to <b>offset</b> their commitments by supplying gas or other energy from alternative sources, rather than supplying gas from their own LNG projects.</li> <li>The WA Government will assess offset proposals, considering whether an offset agreement provides an <b>equivalent level of energy security</b> and is consistent with the net <b>additionality</b> requirement of the policy.</li> </ul>
 <p>Reporting</p>	<ul style="list-style-type: none"> <li>LNG exporters <b>report</b> annually on the <b>implementation</b> of their domestic gas commitments, including:               <ul style="list-style-type: none"> <li>LNG export approval and contracting</li> <li>Domestic gas commitment, sale &amp; supply</li> <li>Reserve adequacy</li> <li>Domestic gas infrastructure and marketing in good faith</li> </ul> </li> </ul>




Notes: (1) Despite legislation, there are no disclosed records of companies utilising offsets in the event of non-compliance to DMO targets.  
 (2) DMO refers to the Domestic Market Obligation

Source: Rystad Energy research and analysis, Rystad Energy Ucube, Government of Western Australia, Department of Jobs, Tourism, Science and Innovation

# The DMO has contributed to price and supply stability

## Key Takeaways for Domestic Gas Obligation Policy Assessment

### Key Takeaways

-  1 The DMO policy has enabled supply and gas price stability in WA.
-  2 Provision of an export allowance for onshore gas projects will improve both investments into the market and government revenue, due to better project economics from higher realised export prices.
-  3 Exploration and exploitation of potential low-cost discoveries (including unconventional resources) can increase supply, but this is likely to occur beyond 2033.

Source: Rystad Energy research and analysis

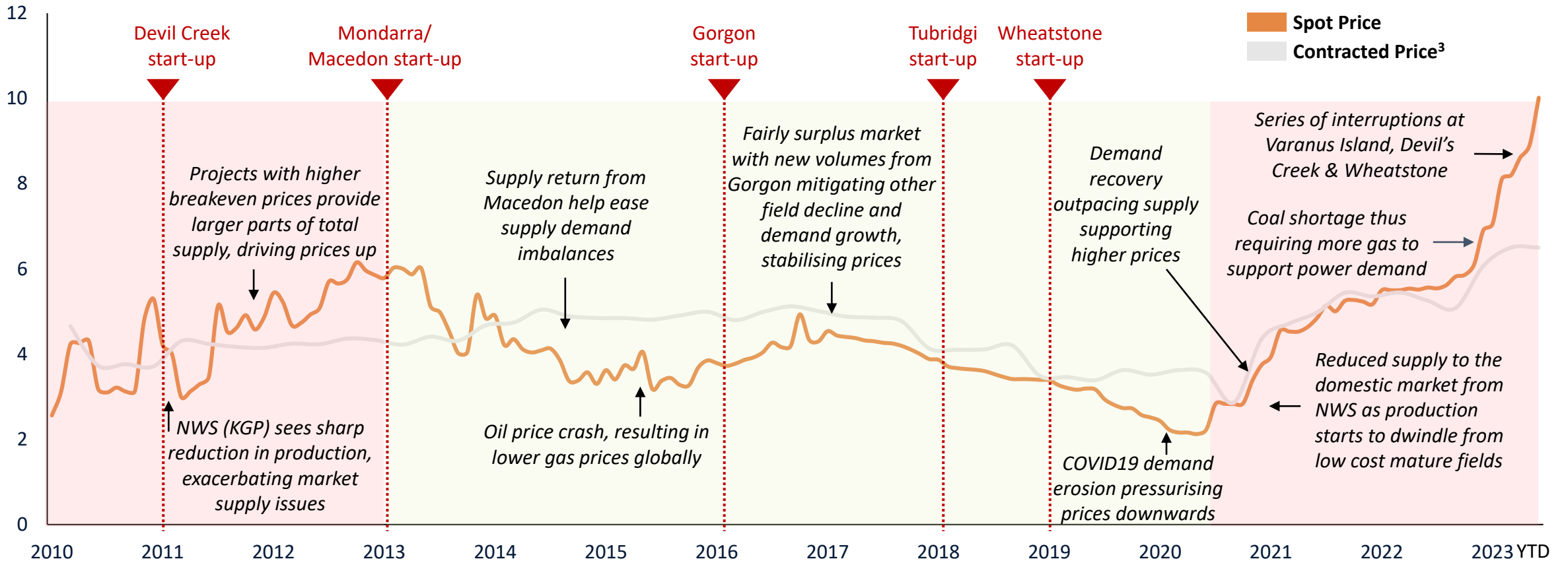
# Content

1. Executive Summary
2. Supply Outlook
3. Demand Outlook
4. Supply-Demand Balance
5. Domestic Gas Policy and Pricing
  - a. Global LNG/Domestic Gas Pricing
6. Appendices



# WA Domestic Gas Prices: Continued upward trajectory of domestic gas prices largely driven by demand-supply imbalances and rising production costs

Historical<sup>1</sup> Monthly/Quarterly<sup>2</sup> Domestic Gas Prices  
AUD/GJ, Nominal



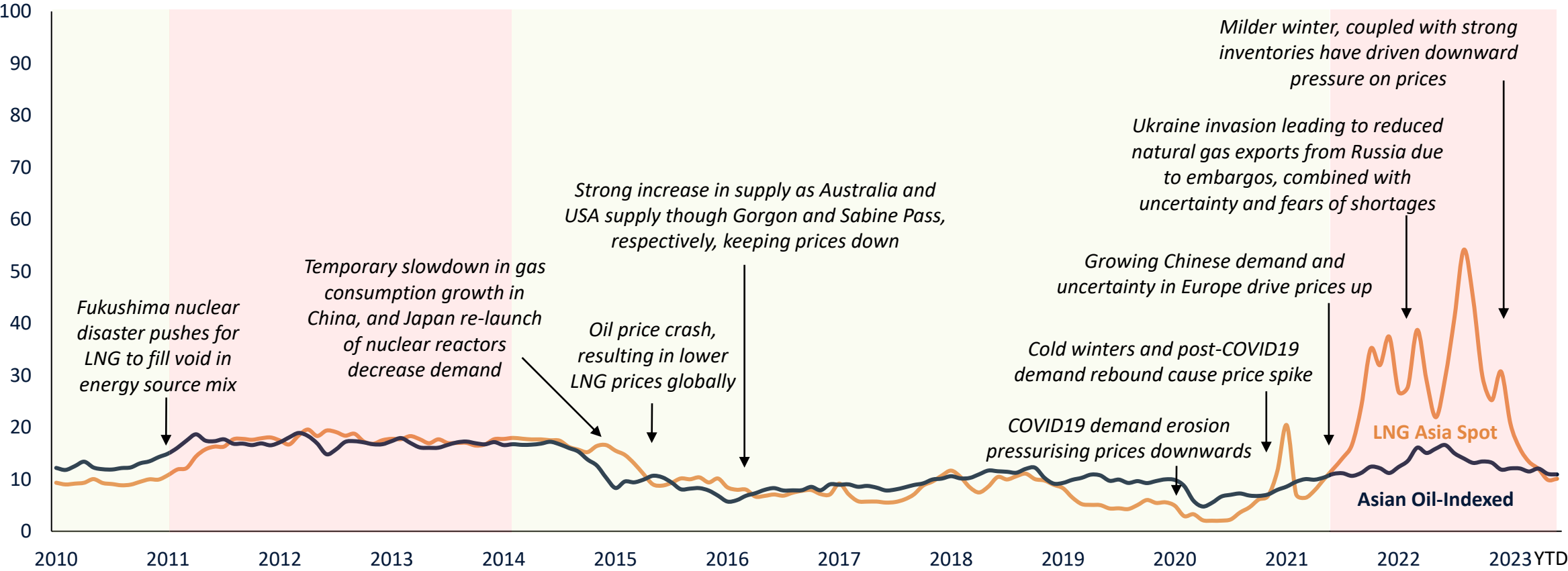
Notes: (1) Until June 2023; (2) Q1 starting in March.  
(3) Data pre-2016 is derived from all domestic gas sales into WA. Data post-2016 based on available published pricing data combined with prices from domestic gas sales reported to the government. The 2023 data is estimated based on Rystad Energy's research and quantitative assessment.

Source: Rystad Energy research and analysis, WA Gov DMIRS, gasTrading

▼ Major Field/Storage Start-up    Surplus Market    Tight Market

# Global LNG Prices: Continued market developments, geopolitical events have introduced substantial volatility in LNG prices especially in recent years

**Historical<sup>1</sup> Monthly LNG Asia Spot and Asian Oil-Indexed<sup>2</sup>**  
USD/mmbtu, Nominal



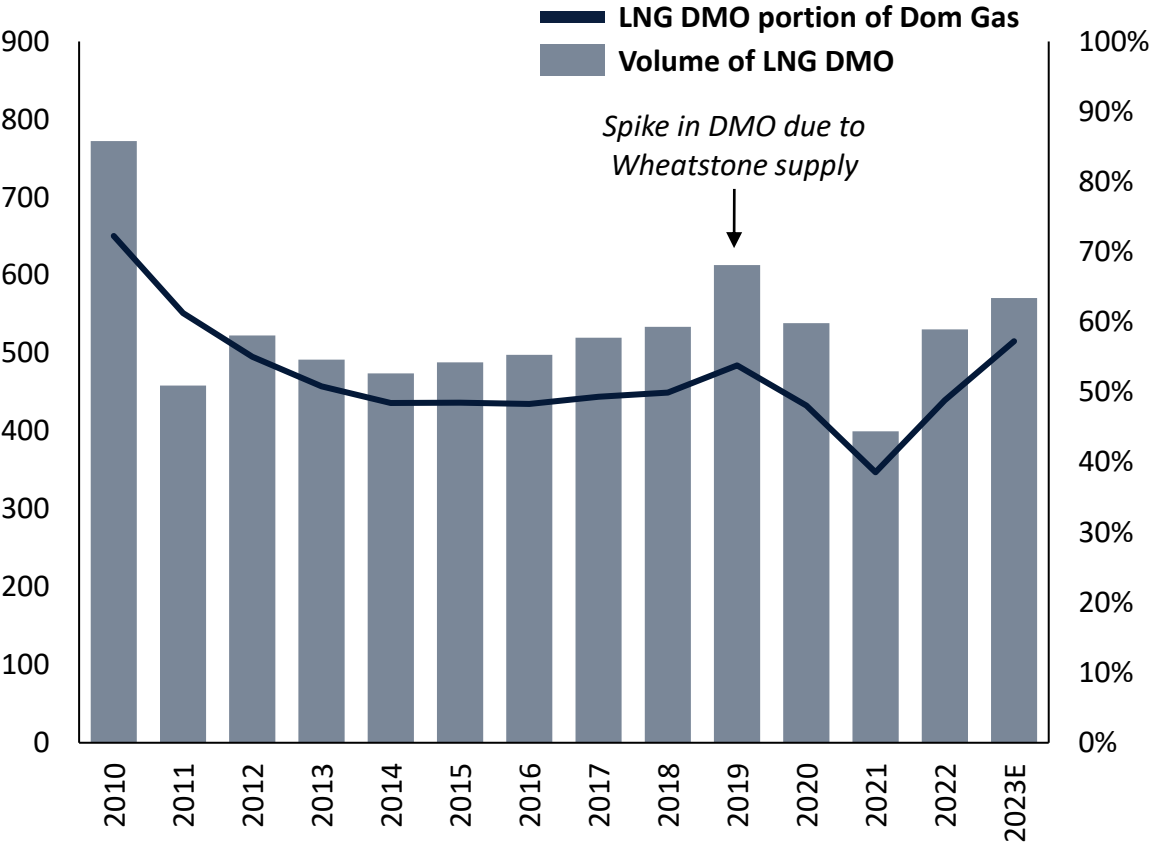
Notes: (1) Until June 2023.  
(2) Asian Oil-Index is based on historical oil slopes assessed from Rystad Energy LNG Contract Database multiplied with the historical Brent price plus an assumed shipping constant of 1.2 USD/mmbtu

Source: Rystad Energy research and analysis, FRED, Seeking Alpha

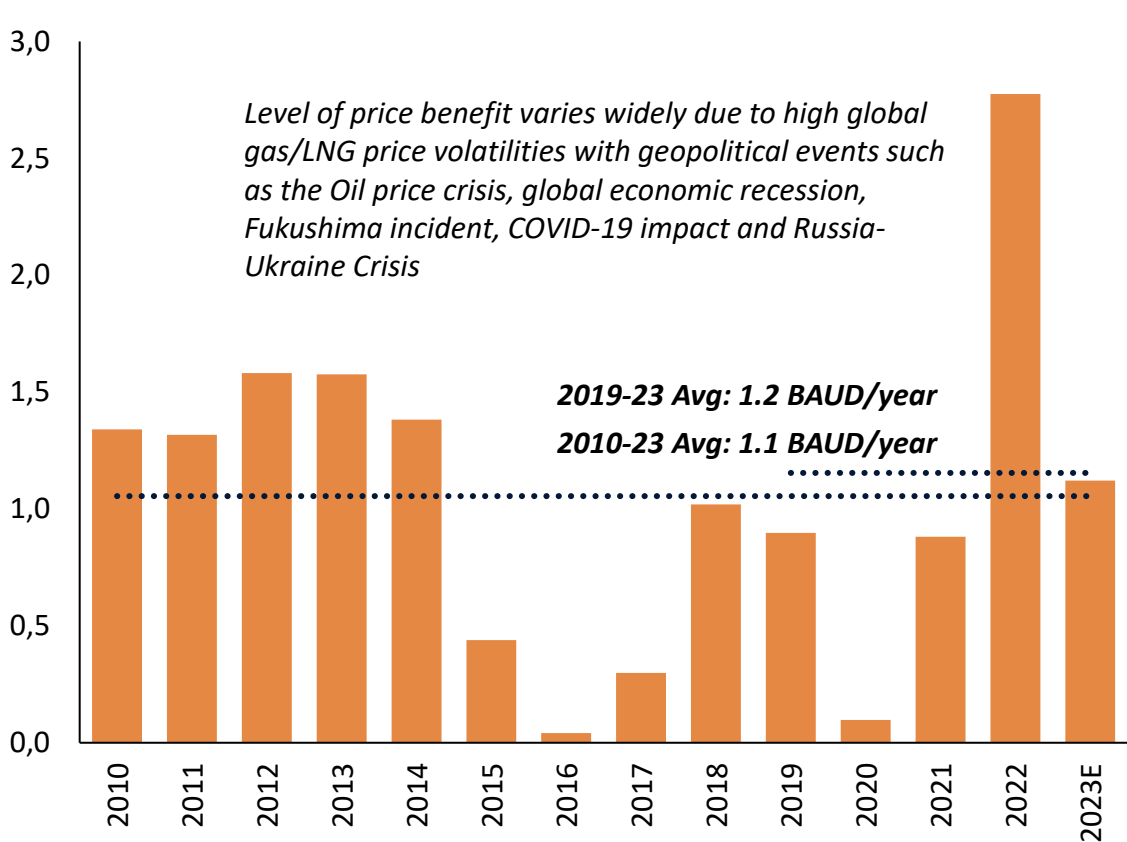
Buyer's market Seller's market

# The LNG DMO has also enabled WA to receive about 1.2 BAUD of benefits annually over 2019-2023E

**Volume of LNG DMO and Portion of Total Dom Gas from 2010-2023E<sup>1</sup>**  
TJ/d (LHS), % of DMO Volumes versus Total Supply (RHS)



**Total level of benefits from 2010-2023E<sup>2</sup>**  
Billion AUD, Nominal



Notes: (1) 2023 values partially estimated.  
(2) 2023 based on volume estimates and extrapolating price benefit number from YTD value.  
Source: Rystad Energy research and analysis, WA Gov DMIRS, gasTrading, FRED, Seeking Alpha, Macrotrends

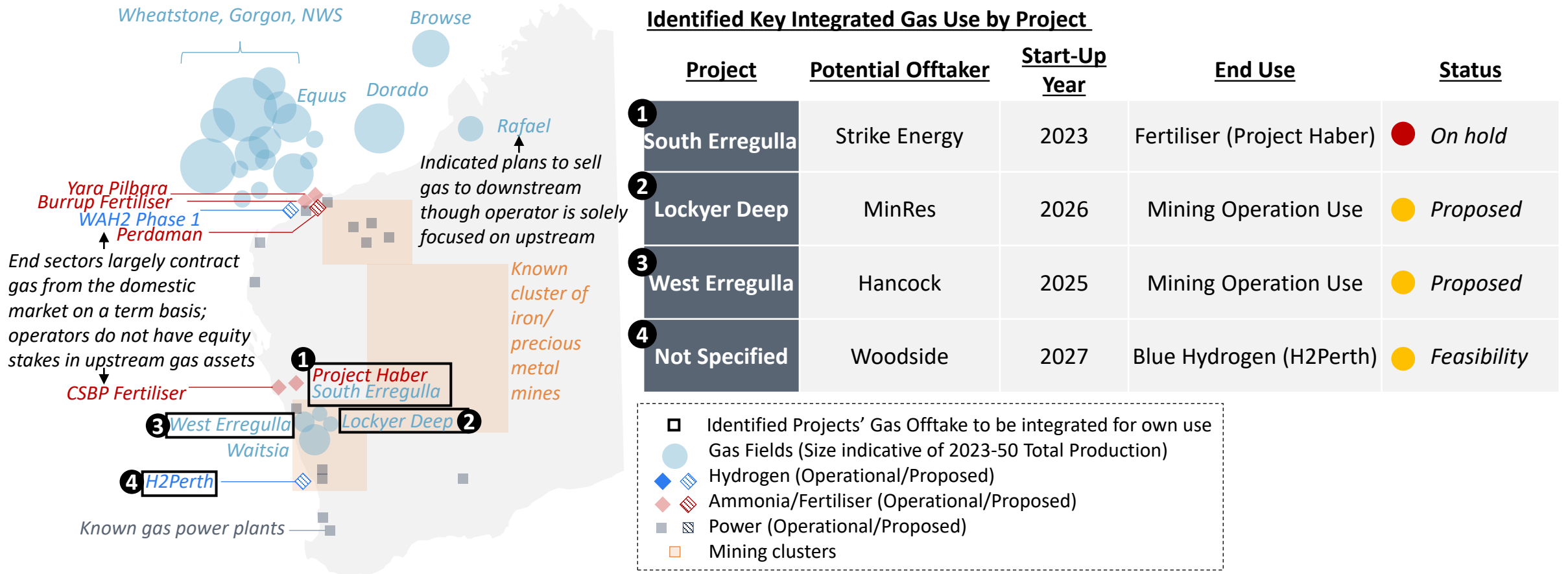
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# Limited integrated gas projects thus far due to low operators' downstream involvement

Location of Key Gas Reserves/Resources and Demand Centers/Sites<sup>1</sup> and Key Integrated Gas Project Status






Note: (1) Non-exhaustive  
Source: Rystad Energy research and analysis



Captive demand remains limited across most sectors, though may see some uptake in the mining sector if field development plans proceed

Analysis of Captive Gas Use by Sector

<u>Sector</u>	<u>2023 Sector Demand (TJ/day)</u>	<u>Players which have announced plans for captive gas use</u>	<u>Current Captive Gas Use</u>	<u>RE Assessment for Future Captive Gas Use</u>
Mining and Minerals	571	Minerals Resources; Hancock	<i>Nil</i> ; The mining and minerals sector remains non-integrated with no companies consuming gas from their upstream portfolio for own use	 Few companies have expressed initial interest in utilising gas its mining and minerals operation and have included them in future development plans. Fields of interest are located near mines. However, these projects development have been gradual.
Power	256	<i>Nil</i>	<i>Nil</i> ; The power sector remains non-integrated with no power companies holding any stakes in gas projects as of today	 No known plans have been expressed by power companies to acquire upstream project stakes
Industrial	193	Strike Energy; Buru Energy; Woodside	<i>Nil</i> ; The industrial sector remains non-integrated with no companies consuming gas from their upstream portfolio for own use	 Some companies with stakes in upstream gas fields have indicated interest in using gas for downstream use, particularly to gain a foothold in new energies (e.g. hydrogen, ammonia, methanol). However, developments remain speculative.

Source: Rystad Energy research and analysis

 Low 
  Medium 
  High

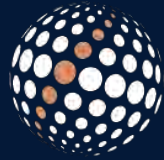
# Glossary

## Key Abbreviations

<u>Term</u>	<u>Definition</u>
<b>AUD</b>	Australian Dollars
<b>CAGR</b>	Compound Annual Growth Rate
<b>CO<sub>2</sub></b>	Carbon Dioxide
<b>DMO</b>	Domestic Market Obligation
<b>EPCI</b>	Engineering, Procurement, Construction, Installation
<b>FEED</b>	Front End Engineering and Design
<b>FID</b>	Final Investment Decision
<b>FMG</b>	Fortescue Metals Group
<b>GW</b>	Gigawatt
<b>GJ</b>	Gigajoule
<b>H<sub>2</sub></b>	Hydrogen
<b>KGP</b>	Karratha Gas Plant
<b>KTPA</b>	Kilo Tonnes per Annum
<b>LHS</b>	Left Hand Side
<b>LNG</b>	Liquefied Natural Gas
<b>LRMC</b>	Long Run Marginal Cost

<u>Term</u>	<u>Definition</u>
<b>MW</b>	Megawatt
<b>MWh</b>	Megawatt Hour
<b>MVR</b>	Mechanical Vapour Recompression
<b>MTPA</b>	Million Tonnes per Annum
<b>NGI</b>	Northern Goldfields Interconnect
<b>NH<sub>3</sub></b>	Ammonia
<b>PJ</b>	Petajoule
<b>PV</b>	Photovoltaic
<b>RE</b>	Rystad Energy
<b>RHS</b>	Right Hand Side
<b>SWIS</b>	South West Interconnected System
<b>TJ</b>	Terajoule
<b>TW</b>	Terawatt
<b>TWh</b>	Terawatt Hour
<b>U/D</b>	Under Development
<b>WA</b>	Western Australia

Source: Rystad Energy research and analysis



# RystadEnergy

Navigating the future of **energy**

Rystad Energy is an independent energy consulting services and business intelligence data firm offering global databases, strategic advisory and research products for energy companies and suppliers, investors, investment banks, organizations, and governments.

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