National Australia Bank

GAS AND LNG MARKET OUTLOOK

JANUARY 2017

HIGHLIGHTS

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Australia is significantly ramping up LNG production capacity, with new terminals in Western Australia, Queensland and the Northern territory having opened or under the advanced stages of construction. This will give Australia the world's largest LNG production capacity – around 85 million tonnes per annum, over 20% of global capacity. However, the ramp-up in production is progressing slower than expected, and some terminals are running well below capacity amid an oversupplied global market.

Global LNG prices have fallen significantly since mid-2014 on the back of lower oil prices, to which many LNG contracts are tied. While global dynamics have been somewhat more favourable of late, prices remain well below previous peaks and new supply from competitors will place further pressure on the market. We expect our Australian LNG export price indicator to finish 2017 at around AUD8/GJ.

While prices are likely to stay subdued for some time, increased volume will see the value of exports increase significantly. We forecast the annual value of Australian LNG exports to exceed AUD 27 billion in 2017 and approach AUD 35 billion in 2018, overtaking coal as Australia's largest export after iron ore. LNG exports alone will contribute 0.6, 1.0 and 0.3 ppts to annual real GDP growth in 2016, 2017 and 2018 respectively, before flattening off at a high level.

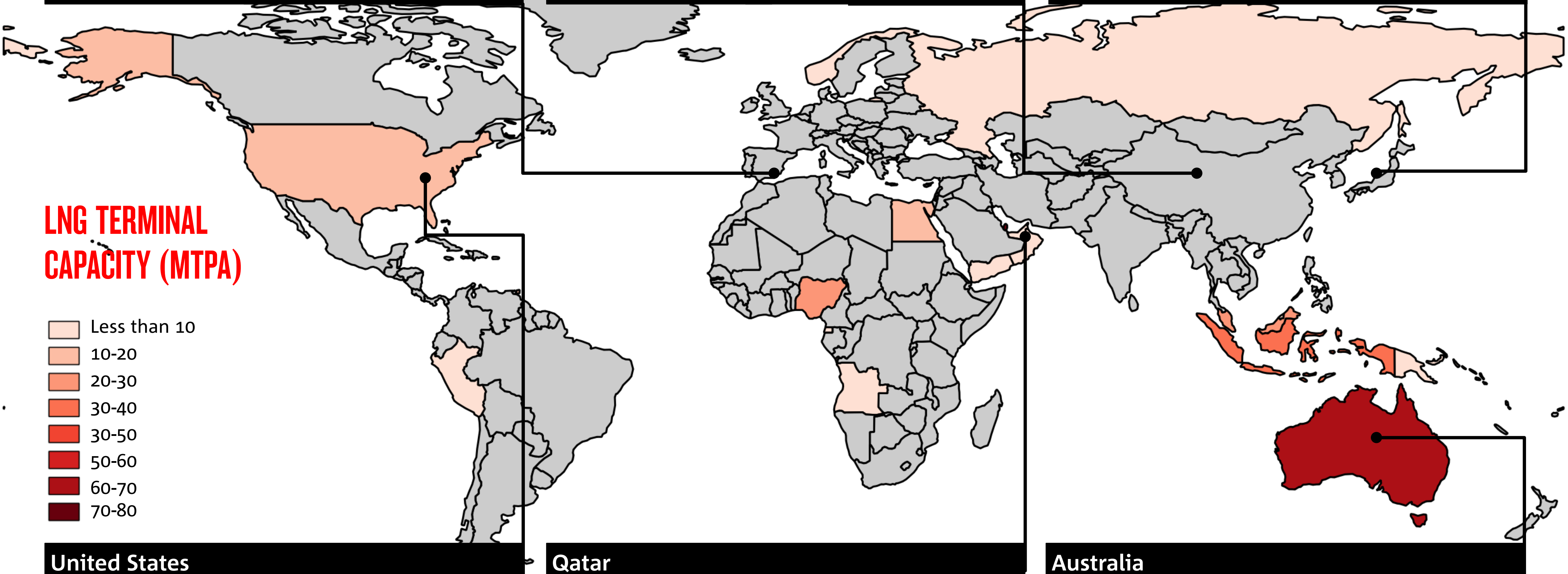
The exposure of eastern Australia to LNG export markets will have far reaching implications for domestic gas use. Wholesale prices are likely to increase significantly and some questions remain over availability of commercially recoverable gas from Queensland coal seam gas fields. Higher wholesale gas prices are likely to spill over into electricity markets by increasing fuel costs for peak load open cycle gas turbines. Higher gas prices are already flowing through to large domestic customers, with reports that contracts are being offered well in excess of current netback export parity prices. While wholesale gas prices generally constitute a smaller portion of residential customers' bills, higher prices are likely to see some fuel substitution to electricity, especially for space heating.

GLOBAL LNG OVERVIEW: KEY DEVELOPMENTS

Europe
- LNG will be more important energy source
- Qatar supplies over half of Europe's LNG needs, US likely to increase competition

China
- Future Chinese LNG demand likely to hinge on effectiveness of moves to limit growth of coal fired generation

Japan
- Major LNG importer and Australia's biggest LNG market
- Transition from nuclear will support LNG



United States
- LNG export from Sabine Pass began in February 2016
- Low oil prices affecting shale industry

Qatar
- World's largest LNG producer (for now)
- Low cost producer, keeping production high to protect market share

Australia
- Production ramping up from QLD and WA
- More plants to open in coming year
- Low export prices denting profitability

Source: Oxford Institute for Energy Studies and NAB Group Economics

GAS AND LNG: WESTERN AUSTRALIA AND NORTHERN TERRITORY

Wheatstone LNG
- Capacity: 8.9 mtpa
- Status: Completion in 2017
  Ownership: Chevron 64.14%, KUFPEC 13.4%, Woodside 13%, Wheatstone 8%, Kyushu 1.46%
- Cost: AUD32.2 billion
- Employment: 5,000 construction, 400 ongoing

Ichthys LNG
- Capacity: 8.9 mtpa
- Status: Completion in 2017
- Ownership: INPEX 62.245%, Total 30%, others 7.755%
- Cost: AUD37.7 billion
- Employment: 4,000 construction, 700 ongoing

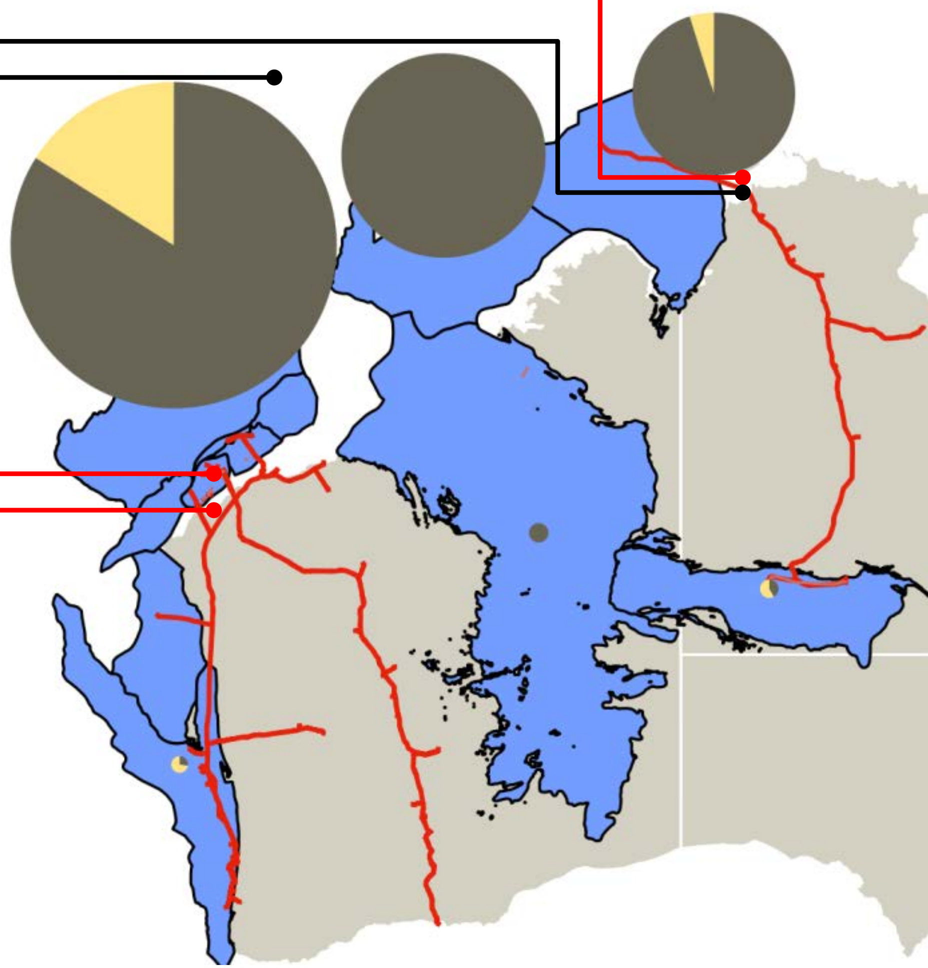
Darwin LNG
- Capacity: 3.7 mtpa
- Status: Operational
- Ownership: ConocoPhillips, Santos, INPEX, Eni, Tokyo Electric, Tokyo Gas
- Cost: NA
- Employment: Not known

Gorgon LNG
- Capacity: 16.6 mtpa
- Status: Operational since 2016
- Ownership: Chevron 47.3%, ExxonMobil 25%, Shell 25%, Osaka Gas 1.25%, Tokyo Gas 1%, Chubu 0.417%
- Cost: AUD60 billion
- Employment: 10,000, 300 ongoing

Prelude FLNG
- Capacity: 3.5 mtpa
- Status: Completion in 2017
- Ownership: Shell 67.5%, INPEX 17.5%, Kogas 10%, OPIC 5%
- Cost: AUD12.6 billion
- Employment: Not known

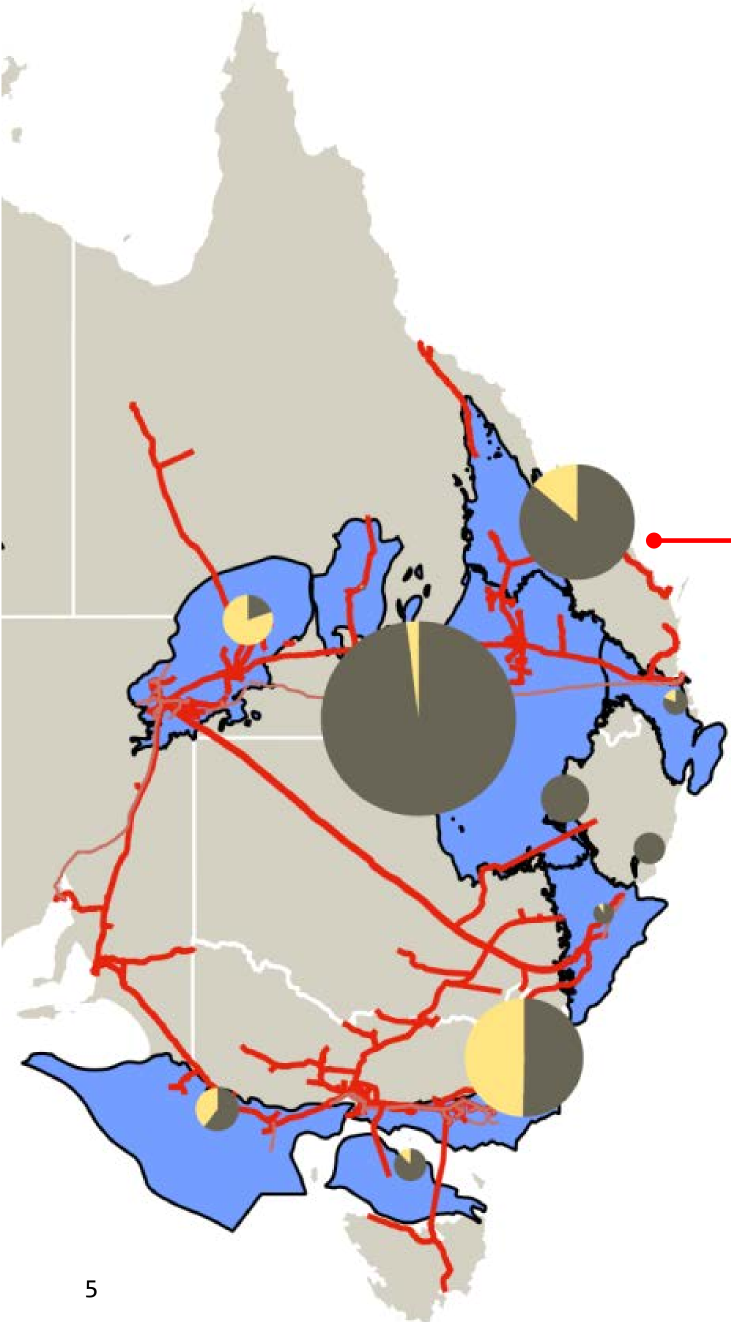
North West Shelf
- Capacity: 16.3 mtpa
- Status: Operational since 1989
- Ownership: BHB Billiton, BP, Chevron, MIMI, Shell, Woodside
- Cost: NA
- Employment: 1,000+ ongoing

Pluto LNG
- Capacity: 4.3 mtpa
- Status: Operational since 2012
- Ownership: Woodside
- Cost: NA
- Employment: Not known



Source: Company reports, APPEA, Oxford Institute for Energy Studies, Department of Industry, Geoscience Australia, Australian Bureau of Statistics and NAB Group Economics

GAS AND LNG: EASTERN AUSTRALIA



Gas basins
Past gas production
Gas remaining
Gas pipelines

Note: relative size of pie charts denote relative gas resources in each basin.

Australia- Pacific LNG (APLNG)
- Capacity: 9.0 mtpa
- Status: Operational since 2015 (1 of 2 trains)
- Ownership: Origin 37.5%, ConocoPhillips 37.5% Sinopec 25%
- Cost: AUD24,700 billion
- Employment: 6,000 construction 1,000 ongoing

Gladstone LNG (GLNG)
- Capacity: 7.8 mtpa
- Status: Operational since 2015
- Ownership: Santos, Petronas, Total, Kogas
- Cost: AUD21.2 billion
- Employment: 5,000 construction 1,000 ongoing

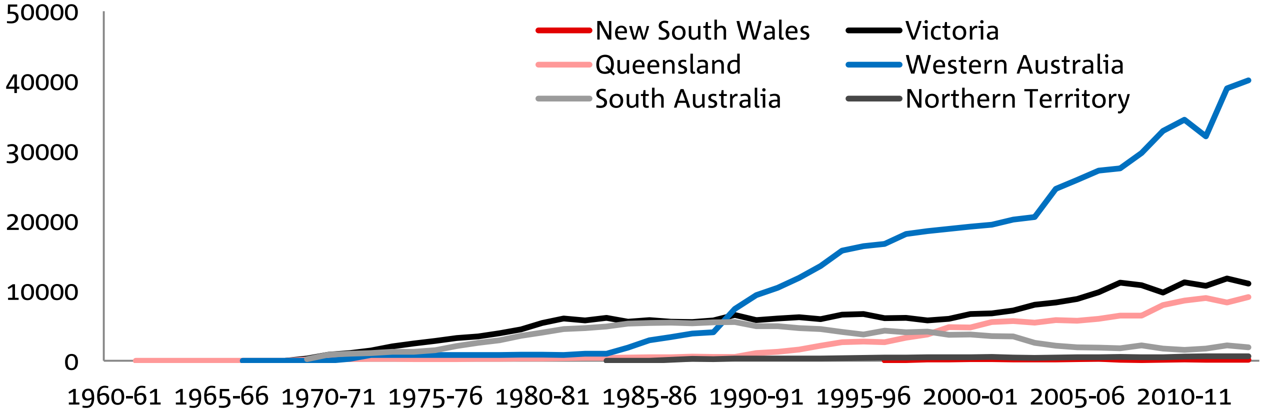
Queensland Curtis LNG (QCLNG)
- Capacity: 8.5 mtpa
- Status: Operational since 2015 (1 of 2 trains)
- Ownership: British Gas (being acquired by Shell) 73.75%, CNOOC 25%, Tokyo Gas 1.25%
- Cost: NA
- Employment:5,000, 1,000 ongoing

Source: AEMO, Queensland Government, APPEA and NAB Group Economics

AUSTRALIAN GAS PRODUCTION TRENDS

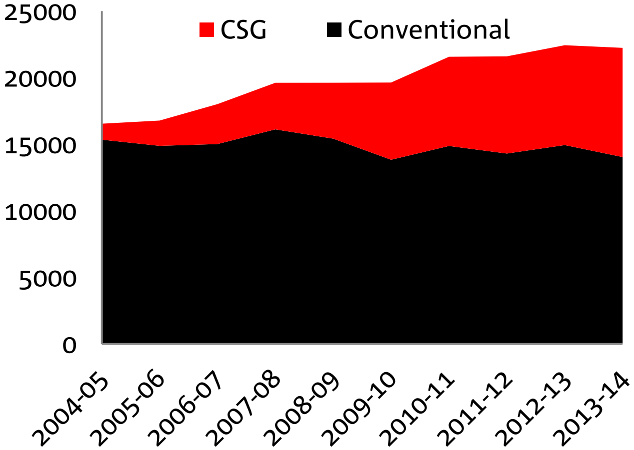
AUSTRALIAN GAS PRODUCTION BY STATE

Millions of cubic metres per year



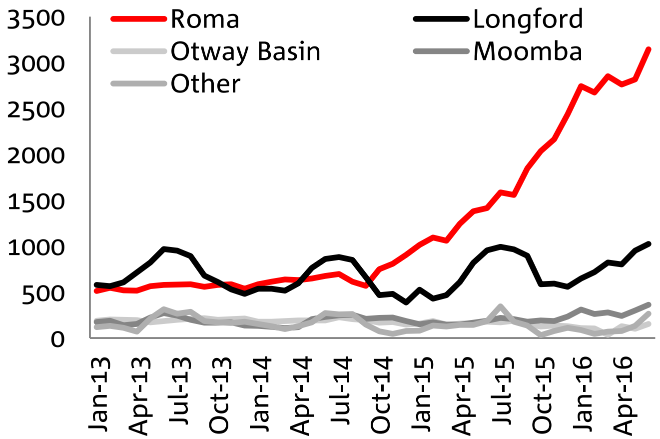
EASTERN AUSTRALIA GAS PRODUCTION

Millions of cubic metres by type



GAS PRODUCTION BY REGION

TJ/day, averaged monthly



Source: Department of Industry, AEMO, AER and NAB Group Economics

Western Australia is Australia's biggest gas producer, with most of the state's production (which is isolated from the east) destined for LNG export. Queensland production has increased rapidly with the development coal seam gas (CSG) projects to feed three LNG terminals on Curtis Island, and to a lesser extent the domestic market.

The balance of Australia's gas is produced from mature fields off the coast of Victoria, onshore at Moomba, South Australia, as well as offshore from the Northern Territory and some limited production in New South Wales.

Western Australia is likely to remain 'islanded' from the rest of the country for the foreseeable future due to the lack of pipeline connectivity, and remain focussed primarily on export. However, the interconnected gas networks of eastern Australia allow gas produced in Victoria or South Australia to be exported through Queensland LNG terminals, with wide-reaching implications for domestic gas prices. The Northern Territory is currently islanded, but will be connected with eastern Australia through the Northern Gas Pipeline, to be constructed by SGPAA.

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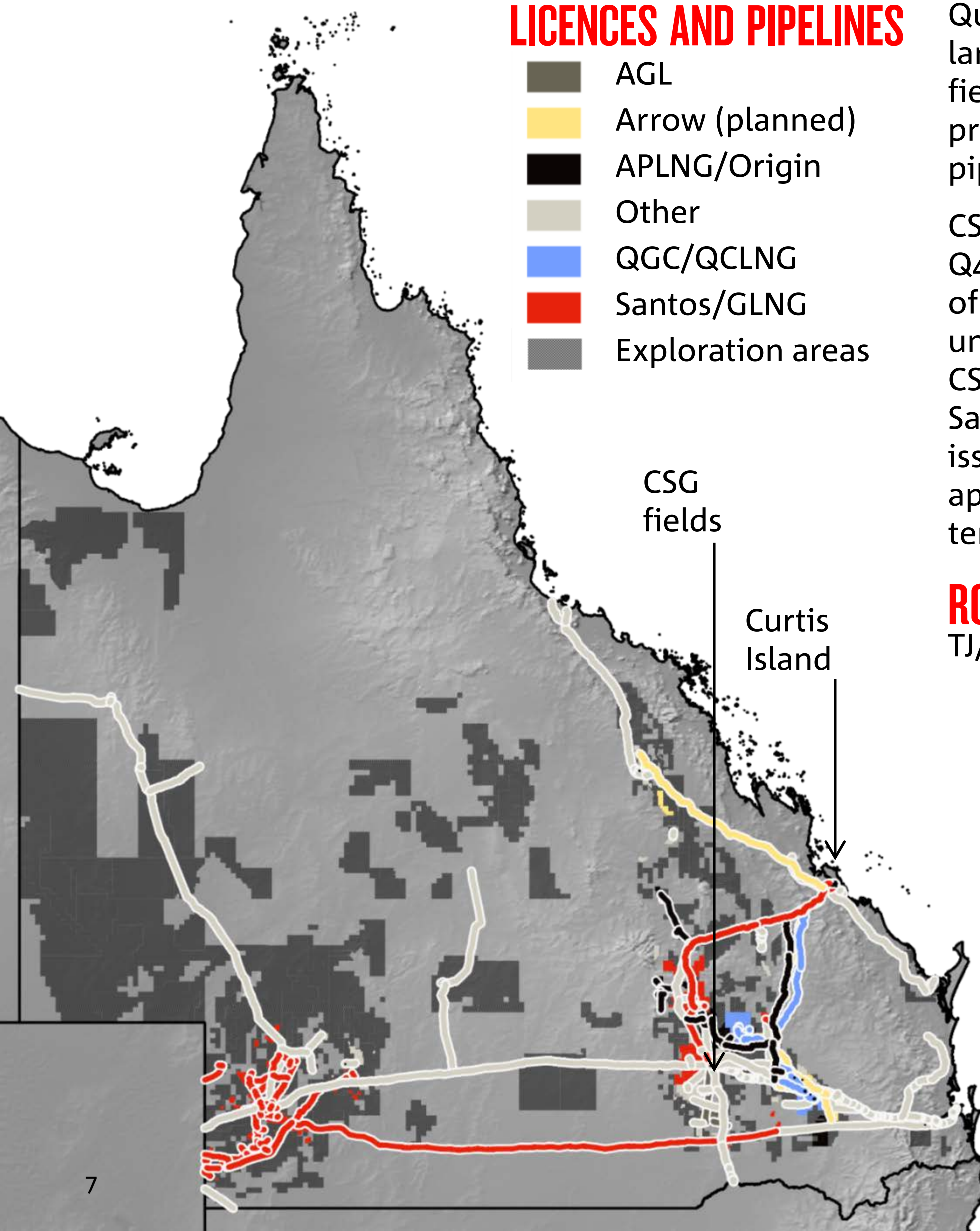
IN FOCUS: QUEENSLAND CSG DEVELOPMENT

LICENCES AND PIPELINES

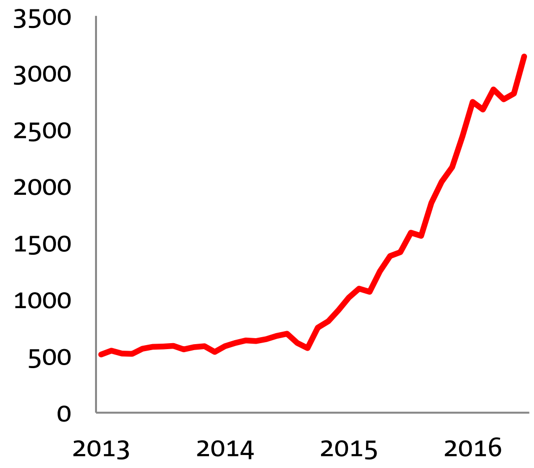


Queensland's three LNG terminals, all located on Curtis Island, are intended to be largely fed from new coal seam gas fields in the Surat and Bowen basins. These fields are predominantly owned or operated as joint ventures by LNG terminal proponents, with each of the three terminals operating their own dedicated pipelines from their upstream extraction and processing operations.

CSG production, much of which is concentrated around Roma, has surged since Q4 2014. Roma region daily production averaged 5-700 TJ/day in 2013 and much of 2014, before surging above 3,000 TJ/day in mid-2016. Nevertheless, it remains unclear whether sufficient gas can be economically extracted from Queensland's CSG fields for LNG export, particularly if LNG export prices remain low. Indeed, Santos' August 2016 $1.5bn write-down of its GLNG terminal partly relates to issues sourcing a sustainable source of feed gas. Meanwhile, Arrow continues the approvals process for its CSG and pipeline proposals despite no dedicated terminal (although Shell's acquisition of BG Group eases this need).

ROMA REGION CSG PRODUCTION

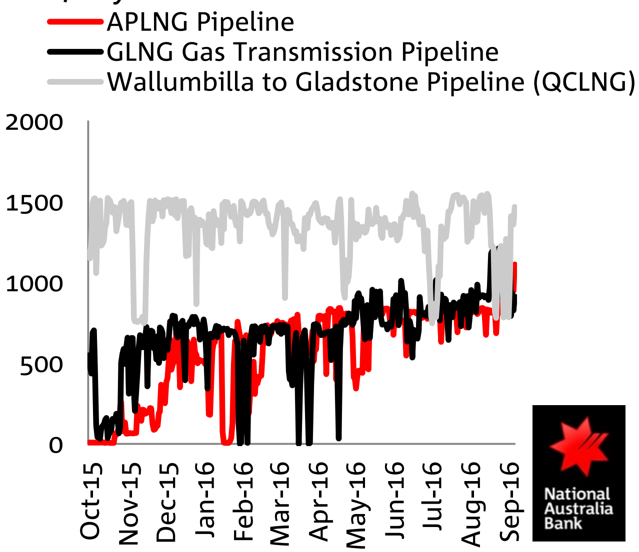
TJ/day, averaged monthly



Source: AEMO, AER, Queensland Government, APPEA and NAB Group Economics

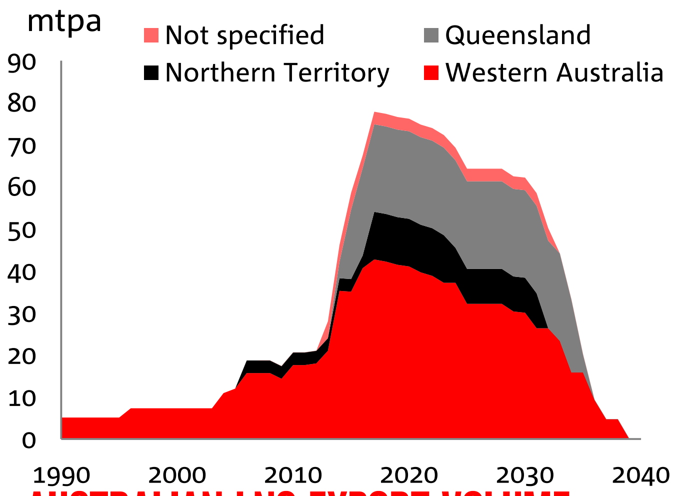
DAILY LNG TERMINAL PIPELINE FLOW

TJ/day

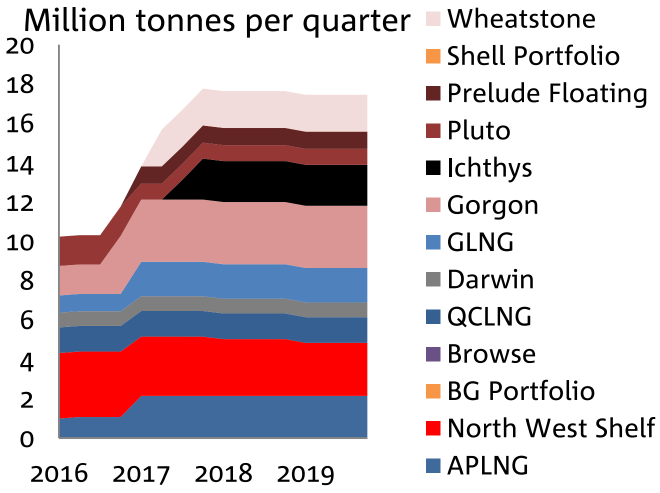


AUSTRALIAN LNG EXPORT VOLUME FORECASTS

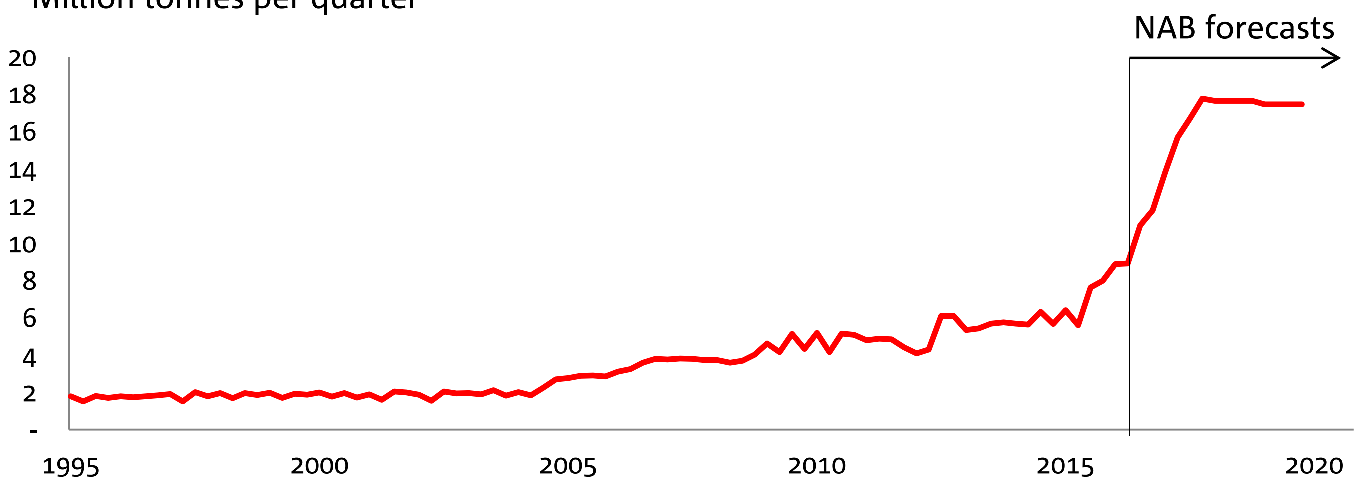
CONTRACTED LNG SUPPLY



FORECAST OUTPUT PER TERMINAL



AUSTRALIAN LNG EXPORT VOLUME



Source: Bloomberg, Poten & Partners, APPEA, Department of Industry, Australian Bureau of Statistics Oxford Institute for Energy Studies and NAB Group Economics

Our forecasts for LNG export volumes consider both the nameplate capacity of Australian LNG terminals, contracted sales volumes and the prospect that some customers may take less than contracted volumes suggest.

Australia is significantly ramping up LNG production capacity, with new terminals in Western Australia, Queensland and the Northern territory opening over the coming two years. This will give Australia the world's largest LNG nameplate production capacity – in the order of 85 million tonnes per annum (mtpa) when all terminals are completed, around 20% of global capacity.

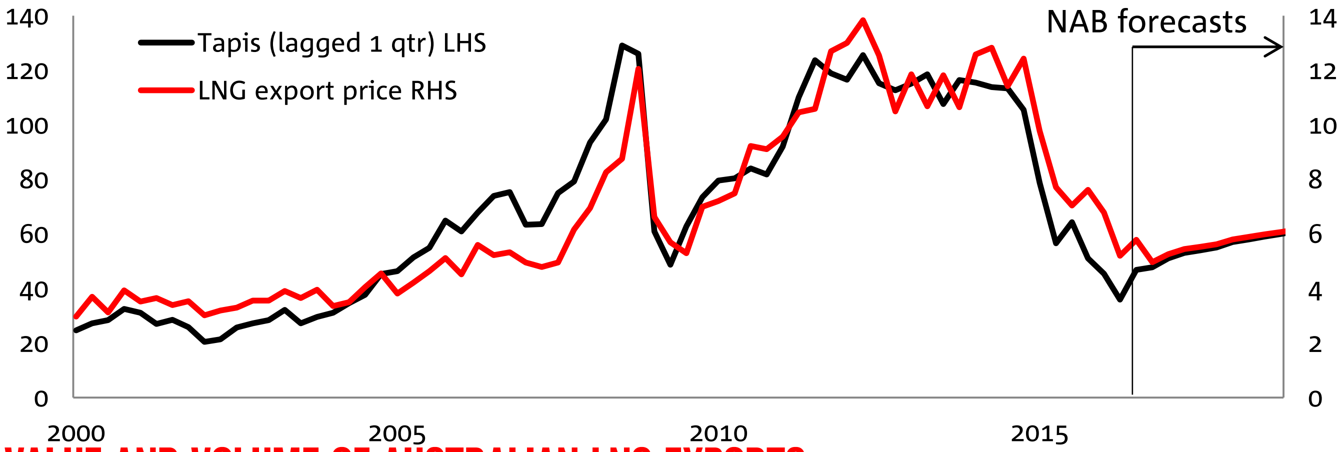
Contracted volumes are likely to be lower, reflecting that while most production is tied up in long term contracts, there may be lower than expected demand for spot cargoes in the face of international competition and expanding global supply.

Australia exported 27.6 million tonnes of LNG in 2015 and likely over 40 million tonnes in 2016. We forecast that exports will total around 64 million tonnes in 2017 and over 70 million tonnes in 2018.

AUSTRALIAN LNG EXPORT PRICE AND VALUE FORECASTS

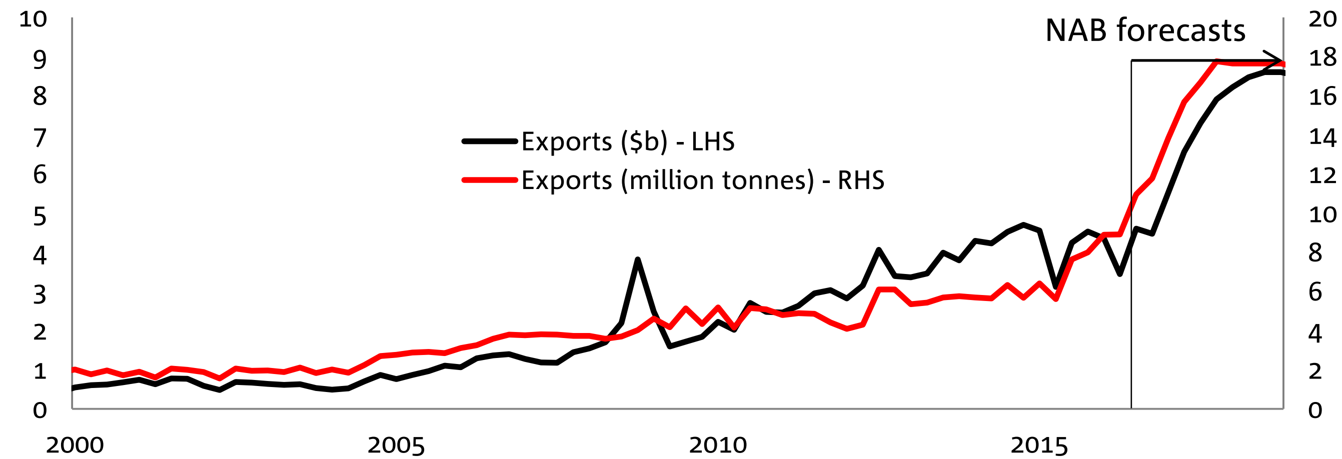
NAB LNG EXPORT PRICE INDICATOR AND LAGGED OIL PRICES

USD/bbl (LHS), USD/GJ (RHS)



VALUE AND VOLUME OF AUSTRALIAN LNG EXPORTS

AUD billion per quarter (LHS), million tonnes per quarter (RHS)



Source: Bloomberg, Poten & Partners, APPEA, Department of Industry, Australian Bureau of Statistics and NAB Group Economics

We have developed an Australian LNG export price indicator based on Australian Bureau of Statistics international trade data and LNG cargoes. A history of this series from 2000 is shown to the left.

East Asian LNG prices have fallen significantly since mid-2014 on the back of lower oil prices, to which many LNG contracts are tied. For example, most Japanese LNG contracts are based on the Japan Crude Cocktail (JCC) – the import price of crude oil into Japan.

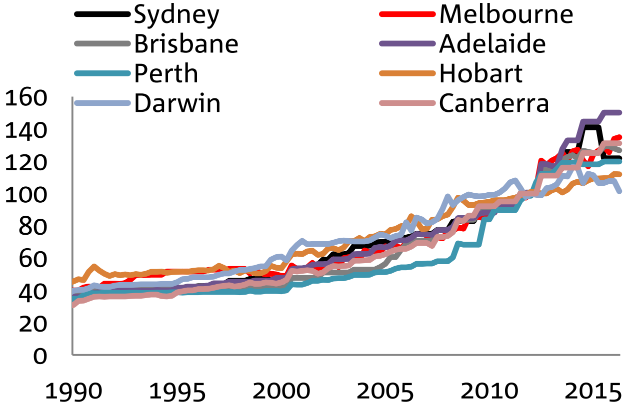
We expect crude oil prices to remain reasonably subdued in USD terms for at least the next two years. A lower AUD will provide some limited support to local prices. We forecast the AUD to reach 0.70 USD by the end of 2017.

We expect the NAB LNG export price indicator to recover gradually, in line with our forecasts for a slow recovery in oil prices. We place the Australian LNG export prices at around AUD8/GJ by the end of 2016, heading closer to AUD9/GJ by the end of 2018. In export value terms, the lower prices will be offset by the increased supply. We see the value of Australian LNG exports at approaching AUD17 billion in 2016, a slight increase on 2015. However, the value of exports should climb steadily in 2017 and 2018.

IMPLICATIONS FOR DOMESTIC GAS MARKETS

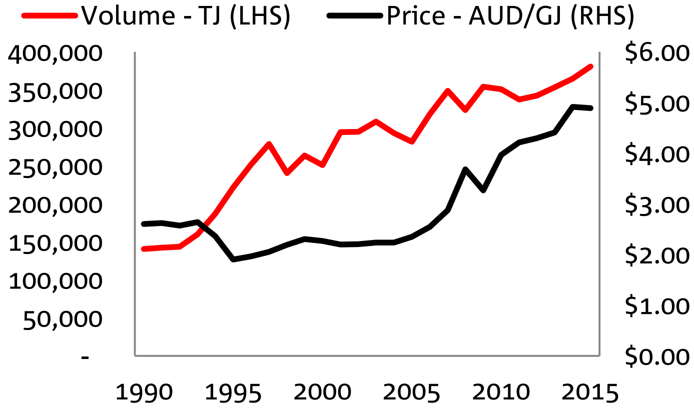
GAS CPI (INC. OTHER FUELS)

Index number



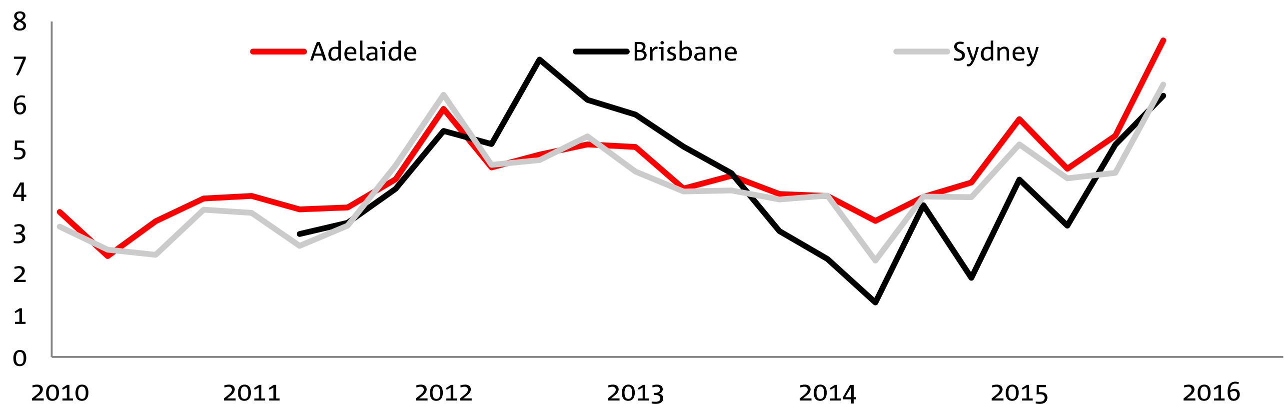
WA DOMGAS SALES AND PRICES

At injection Dampier-Bunbury Pipeline



AEMO SHORT TERM TRADING MARKET QUARTERLY AVERAGE PRICE

AUD/GJ



Source: AEMO, IMOWA Gas Bulletin Board, WA Department of Mines and Petroleum, Australian Bureau of Statistics

Although residential gas prices have increased across Australia over the past 15 years following a period of relative stability in the 1990s, they remained underpinned by low wholesale prices struck through stable long term contracts. These contacts are confidential and public price data is not available, however it is generally considered in the industry that eastern Australian wholesale gas was contracted at around AUD2-4/GJ.

Although LNG export prices are hovering in the AUD6-8/GJ range at present (including the costs of liquefaction etc.), reports suggest that gas suppliers are offering long term wholesale contracts at up to AUD10/GJ on the expectation of a recovery in LNG export prices in the coming years. Spot prices on AEMO's Short Term Trading Market also reached and even exceeded export prices last year, although this also relates to elevated gas demand from a cold winter and elevated demand for gas fired generation in South Australia (reflecting a number of factors).

Should spot and domestic contract prices move consistently into the AUD 8-10/GJ range, alongside trend increases in other costs, the price of gas for residential customers in Australia's five largest cities could increase by more than 50% by 2020.

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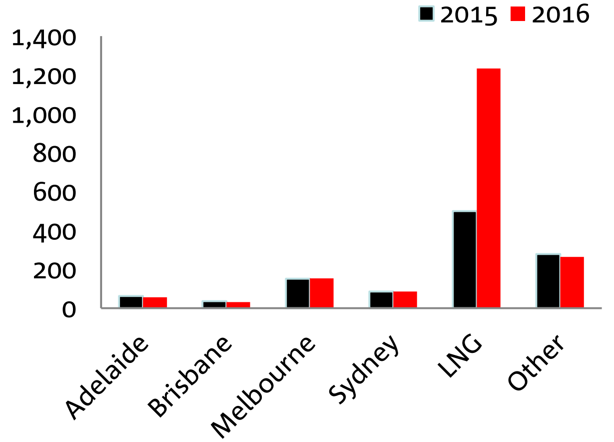
IMPLICATIONS FOR DOMESTIC GAS MARKETS

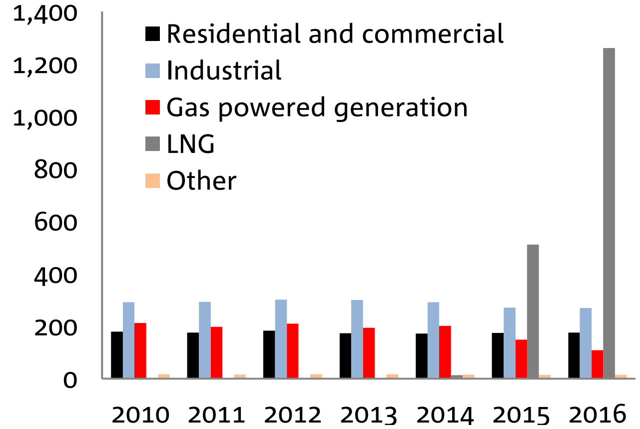
GAS DEMAND BY LOCATION (AEMO)

PJ per annum



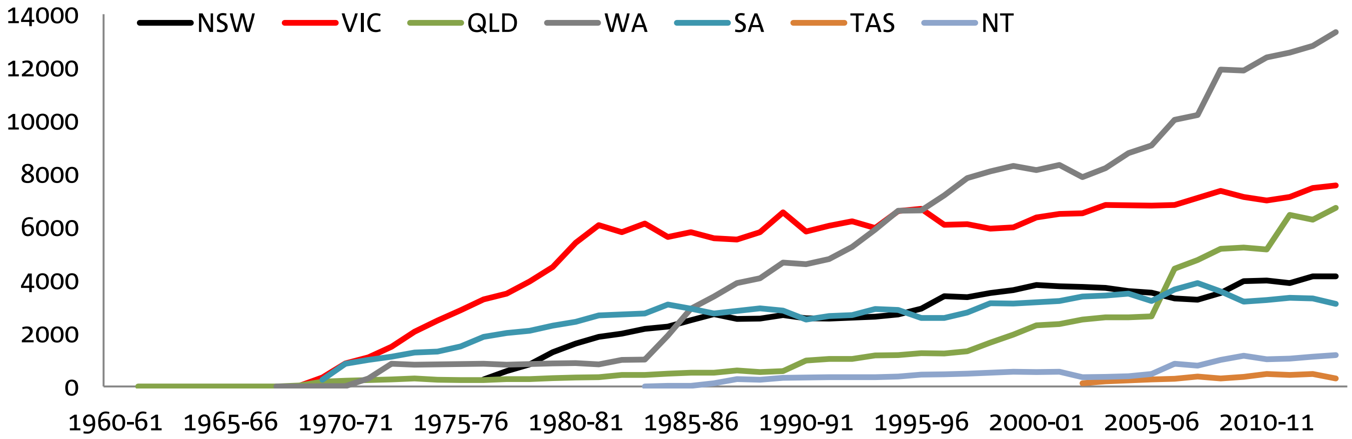
GAS DEMAND BY USE (2016 F'CAST)

PJ per annum



GAS CONSUMPTION BY STATE (INC. LNG)

Millions of cubic metres per year



Gas demand in eastern Australia has been traditionally split between residential and commercial, industrial and gas powered electricity generation, industrial demand being the single largest component. Residential and commercial use gas use for cooking, space and water heating has remained relatively stable, although changes in the relative price of gas compared to electricity can lead to fuel substitution, especially for water and space heating.

The impact of higher prices will differ across different parts of the country. AEMO's forecast gas demand by location shows that Melbourne tends to use around twice as much gas as Sydney, reflecting historic factors and climate.

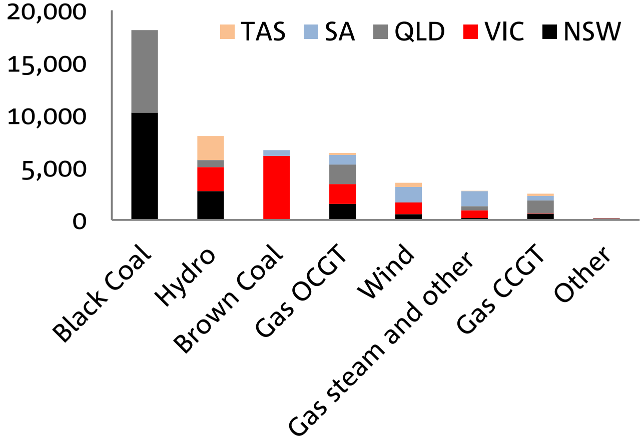
Industrial demand continues to face challenges from a wind-down in manufacturing, but the more than doubling of wholesale gas prices will increase input costs for gas intensive producers.

Source: AEMO, IMOWA Gas Bulletin Board, WA Department of Minerals and Petroleum, Department of Industry and Australian Bureau of Statistics

AUSTRALIAN LNG EXPORTS: IMPLICATIONS FOR ELECTRICITY MARKETS

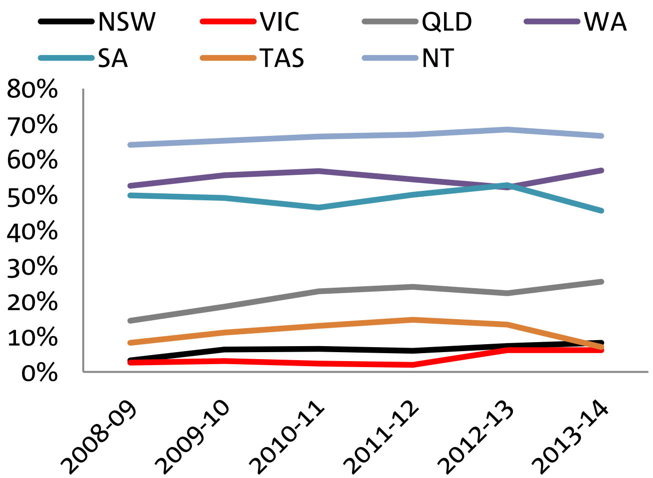
NEM INSTALLED CAPACITY BY TYPE

MW



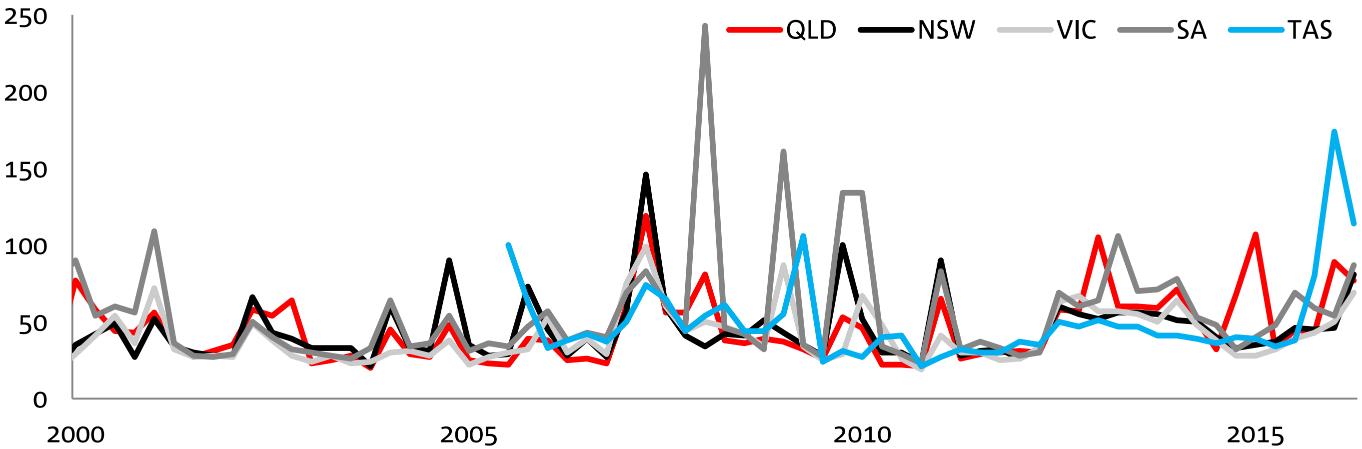
GAS SHARE OF GENERATION

Share of total state generation



NEM SPOT PRICE

AUD/MWh, volume weighted, quarterly



Source: AEMO, Department of Industry, AER and NAB Group Economics

There are three main types of gas-fired electricity generators: open cycle gas turbines (OCGT), combined cycle gas turbines (CCGT) and gas steam generators.

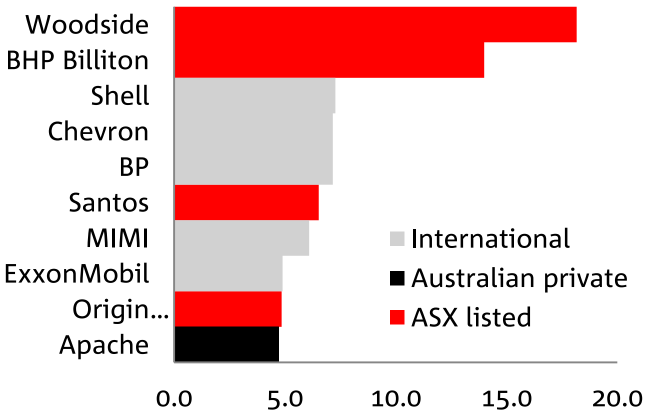
OCGTs are gas turbines, not unlike aircraft jet engines, with high fuel costs but with relatively low capital costs and the ability to dispatch with little notice. This makes them ideal for summer peak demand periods when wholesale electricity prices are high. CCGTs are also gas turbines but with a heat recovery system and boiler, improving their efficiency and lowering opex but making them more suited to intermediate loads when prices are lower. Gas steam generators use gas to fire a boiler and drive a turbine.

Higher fuel costs will increase the short run marginal cost (SRMC) of gas fired generators. This will increasingly squeeze gas steam and CCGTs out of the National Electricity Market bid stack, making these generators less viable (although this may be partly offset depending on the withdrawal of coal fired generation). This is particularly an issue in South Australia, which has a high dependence on gas steam generators. OCGTs are likely to remain the marginal bidders during peak summer periods, but with a higher SRMC we expect that wholesale prices will remain higher for longer and hit the market price cap more often. This will affect residential prices at the margin, but will be mitigated as with wholesale costs are around 20-30% of a total bill.

IMPLICATIONS FOR THE AUSTRALIAN ECONOMY

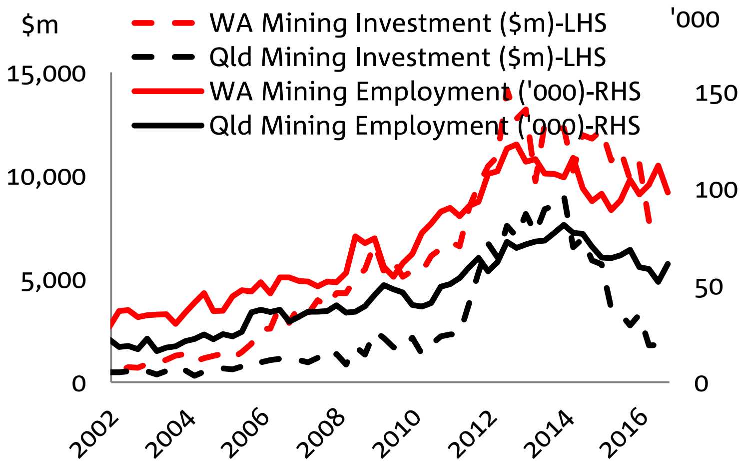
GAS EXTRACTION BY OWNERSHIP

Share of total gas (%) 2014-15



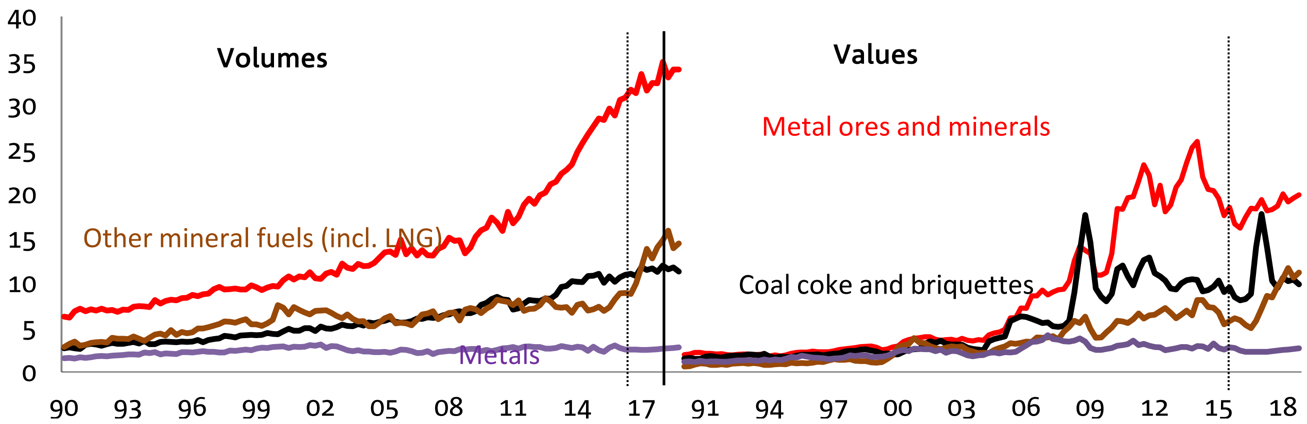
MINING EMPLOYMENT BY STATE

Investment (LHS), employment (RHS)



AUSTRALIAN EXPORTS BY CATEGORY

AUD billions



Source: Bloomberg, Department of Industry, Australian Bureau of Statistics and NAB Group Economics

The value of Australia's LNG exports are forecast to exceed that of coal by late 2017, making it the second largest export item after iron ore. In volumes terms, LNG exports will overtake coal by June 2017 as exports ramp up.

LNG exports will contribute significantly to real GDP growth in coming years, alone contributing 0.6, 1.0 and 0.3 ppts to annual GDP growth in 2016, 2017 and 2018 respectively, before flattening off at a high level.

However, we expect benefits to national income to be somewhat smaller. There is a high level of foreign ownership in the Australian gas and petroleum sector, although a number of major producers are ASX listed. Nonetheless, there is likely to be some benefit to domestic shareholders.

With many projects complete or nearing completion, investment will decline sharply from here, as will mining employment (see our note on mining employment). This will particularly affect the economies of Western Australia, Queensland and the Northern Territory. The Northern Territory's outsize dependence on a single LNG project is a particular risk as construction nears completion.

As noted earlier, higher gas CPI (even with low oil prices) could potentially weigh on consumption and reduce profitability for manufacturing.

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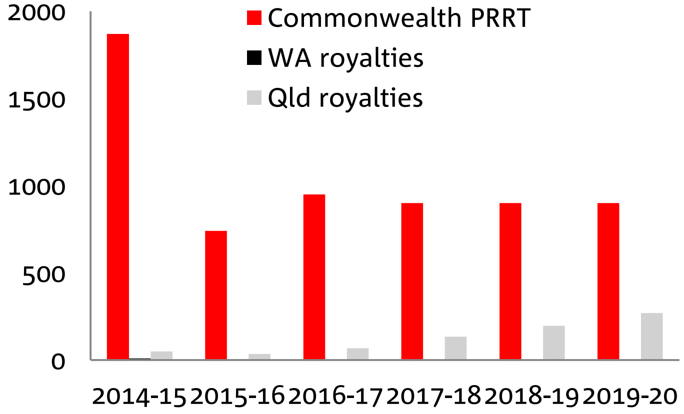
IMPLICATIONS FOR PROFITABILITY AND GOVERNMENT REVENUE

DIRECT TAXES ON GAS PRODUCTION

AUD millions annually

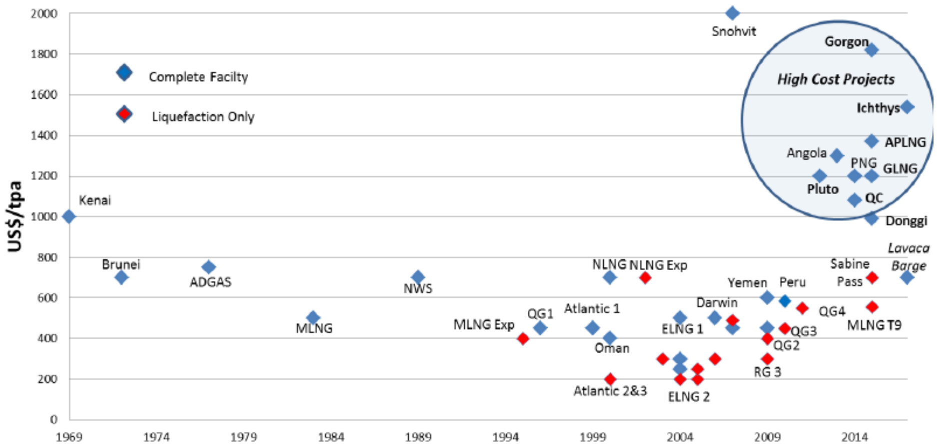


NET INCOME – SELECTED PRODUCERS

AUD millions annually

LNG TERMINAL CAPITAL COST TRENDS

Calculations by Brian Songhurst, Oxford Institute for Energy Studies



Source: Bloomberg, Oxford Institute for Energy Studies, Commonwealth and state budget papers, Australian Bureau of Statistics

With LNG export prices remaining moribund – a function largely of low oil prices – industry profitability has taken a hit. This has been compounded by the relatively high capital cost of Australian LNG terminals compared to their international peers. Analysis by the Oxford Institute for Energy Studies shows Australian LNG terminals among the costliest in the world on a USD per tonnes per annum basis.

This bodes ill for direct tax revenues from the LNG industry as the Petroleum Resource Rent Tax (PRRT) operates as a tax on profits. MYEFO projects only $900 million in annual PRRT revenue by the end of the forward estimates period. Likewise, state petroleum royalties are not expected to raise much revenue. While LNG producers will also be subject to other taxes (such as company tax, payroll tax etc.), it is unlikely that the sector will contribute substantially to government revenues for many years despite Australia becoming the world's largest LNG exporter.

In November 2016, the Commonwealth Treasurer announced a review into the PRRT, to report in April 2017 with recommendations for reform of the arrangements. The review will consider the "need to provide an appropriate return to the community on Australia's finite oil and gas resources while supporting the
development of those resources."