



Invited review

A review of Australia's natural gas resources and their exploitation

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ABSTRACT

Australia's gas resources are large enough to support projected domestic and export market growth beyond 2030 and are expected to grow further. Most (around 92 per cent) of Australia's conventional gas resources are located in the Carnarvon, Browse and Bonaparte basins off the north-west coast.

Large coal seam gas (CSG) resources exist in the coal basins of Queensland and New South Wales. Tight gas accumulations are located in onshore Western Australia and South Australia, while potential shale gas resources are located in the Northern Territory, Western Australia and South Australia.

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1. Introduction

Natural Gas is currently the third largest global energy source and its consumption is expected to increase substantially in coming decades. Investment in natural gas continues to grow due to its availability, versatility and because it is a cleaner energy source compared to coal and crude oil. In Australia, gas is the third largest energy resource exploited after black and brown coal.

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Large coal seam gas (CSG) resources exist in the coal basins of Queensland and New South Wales. Tight gas accumulations are located onshore in Western Australia and South Australia, while potential shale gas resources are located in the Northern Territory, Western Australia and South Australia. This paper reviews conventional and several unconventional gas resources in Australia, their exploitation for export projects, their value in providing energy security and their potential for reducing greenhouse emissions. In

doing so it addresses the community, environmental and safety issues associated with the exploitation of Australia's gas resources.

2. Australia's gas resources in a global context

Production of natural gas from countries such as the Russian Federation, Qatar, China and the US will primarily continue to feed the world's demand for gas, although due to recent investment, Australia will to play an increasingly important role within the ever-changing global gas markets. It is set to become the world's second biggest exporter of LNG by 2015 (BREE, 2012a). Natural gas is currently the third largest global energy source and its consumption is projected by some to rise by as much as 3.4% per year to 2030 (Australian Government Department of Energy and Resources, 2011).

As the world moves towards a lower carbon economy, gas is becoming a fuel of choice, particularly for power generation, in many regions. Gas is an attractive choice for emerging economies aiming to meet rapid growth in demand in fast-growing cities as urbanization increases. The increase in gas consumption in emerging economies will result from rapid economic growth and associated urbanization and industrialization, direct gas consumption and the growth thirst to satisfy power generation demands (BREE, 2012a).

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The International Energy Agency (IEA) (2012) forecast that gas consumption is set to reach 3.9 tcm (137.7 tcf) by 2017, this reflects its greater use in power generation. Gas-fired electrical generation is typically characterized by lower capital expenditures, shorter construction times, greater flexibility in meeting peak demand, lower carbon emissions and higher thermal efficiencies relative to other substitute fossil fuels. Gas-fired generation can also serve to complement renewable energy sources, and help to overcome intermittency problems associated with renewable energy sources such as solar and wind (BREE, 2012a). While substantial growth in gas demand is projected to come from electrical generation, it will depend on the price of gas relative to substitute fuels, as well as domestic policy settings regarding nuclear energy and carbon pricing, and other carbon limiting regulations or measures. Factors such as commitments to energy security, climate change and local pollution issues will have substantial bearing on the setting and adaptation of policy (BREE, 2012a).

Recent energy-related policy developments in China, particularly those outlined in its 12th Five Year Plan (2011–2015) highlight that China's policymakers are actively encouraging diversification of the electrical generation mix away from coal, towards gas, renewable energy sources and nuclear power (IEA, 2011a). According to the IEA, The Chinese government aims to increase its share of gas in domestic energy consumption to 8.3% of the total by 2015. China's domestic production is set to increase 60% between 2010 and 2016, however this will only account for around half of the incremental increases in demand, so the deficit will have to be met by gas imports (IEA, 2011b). In a similar manner, the Indian Government plans to increase the share of gas in its energy mix of its economy. Such policy changes, if realized, should have a significant, positive impact on demand for Australia's gas resources.

Table 1 highlights Australia's gas industry in a global context. Globally, natural gas has a proved reserves life index of 64 years, whereas Australia's proved reserve life index is 84 years. The IEA (2012) estimates that there are nearly 404 tcm (14,285 tcf) of remaining recoverable resources (including all resource categories) of conventional gas worldwide, which is equivalent to almost 130 years of production at 2011 rates. Table 2 shows that Russia, Iran and Qatar together hold around half of the world's proved gas reserves. Australia accounts for around 1.8% of global proved gas reserves and in a ranking of major gas resource-holding nations is positioned at No. 11 (Table 2). The largest gas producers are the Russian Federation and the United States. Australia produced

Table 1

Snap shot of Australia's gas resources in a global context according to BP's Statistical Review of June 2012 (BP, 2012). Note: (*) Australia's pipeline trade includes imports from East Timor Offshore Joint venture, but not domestic internal trade.

Status & exploitation of natural gas resources			
Global	Trillion cubic feet (tcf)	Billion cubic meters (bcm)	
Gas reserves (Proven)	7359	208,400	
Gas production	115	3276	
R/P ratio (years)	64	64	
Gas consumption	113	3223	
Gas pipeline trade	24.5	965	
LNG trade	11.6	331	
Australia	Percentage of Global	Trillion Cubic Feet (tcf)	Billion Cubic Meters (bcm)
Gas reserves (Proven)	1.8%	132.8	3800
Gas production	1.4%	1.59	45
R/P ratio (years)		84	84
Gas consumption	0.7%	0.82	23
Gas pipeline trade*	0.9%	0.22	6
LNG trade	7.8%	0.9	26

Data source: BP Statistical Review June 2012.

Table 2

Proved natural gas reserves as of 1st Jan 2012 ranked by country for the top 25 resource holders, based upon data from the BP Statistical Review of June 2012 (Wood et al., 2012).

Proved natural gas reserves for top 25 countries ranked at 1 Jan 2012					
Total world	7361	208	100%	100%	63.6
Country	Trillion Cubic Feet (tcf)	Trillion Cubic Metres (tcm)	Share of total	Cumulative share of total	Reserves/ Production (R/P) years
Russian Federation	1575	44.6	21.4%	21.4%	73.5
Iran	1169	33.1	15.9%	37.3%	>100
Qatar	885	25.0	12.0%	49.3%	>100
Turkmenistan	859	24.3	11.7%	61.0%	>100
US	300	8.5	4.1%	65.0%	13.0
Saudi Arabia	288	8.2	3.9%	68.9%	82.1
United Arab Emirates	215	6.1	2.9%	71.9%	>100
Venezuela	195	5.5	2.7%	74.5%	>100
Nigeria	180	5.1	2.5%	77.0%	>100
Algeria	159	4.5	2.2%	79.1%	57.7
Australia	133	3.8	1.8%	80.9%	83.6
Iraq	127	3.6	1.7%	82.6%	>100
China	108	3.1	1.5%	84.1%	29.8
Indonesia	105	3.0	1.4%	85.5%	39.2
Malaysia	86	2.4	1.2%	86.7%	39.4
Egypt	77	2.2	1.1%	87.8%	35.7
Norway	73	2.1	1.0%	88.7%	20.4
Canada	70	2.0	1.0%	89.7%	12.4
Kazakhstan	66	1.9	0.9%	90.6%	97.6
Kuwait	63	1.8	0.9%	91.5%	>100
Uzbekistan	57	1.6	0.8%	92.2%	28.1
Libya	53	1.5	0.7%	92.9%	>100
Azerbaijan	45	1.3	0.6%	93.6%	85.8
India	44	1.2	0.6%	94.1%	26.9
Netherlands	39	1.1	0.5%	94.7%	17.2
Sum of top 25 Countries	6969	197.3	94.7%		
Rest of World	392	11.1	5.3%		

Data Source: BP Statistical Review June 2012; David Wood & Associates.

around 1.58 tcf in 2011, accounting for around 1.4 per cent of world gas production (BP, 2012).

The share of unconventional gas in total global gas production is projected to rise from 13% in 2009 to 22% in 2035. However, these projections are subject to a great deal of uncertainty, particularly in regions where unconventional gas production is yet to occur or is in its infancy. Environmental concerns and policy constraints also have the potential to limit unconventional gas output particularly in Europe. The future of unconventional gas production and the extent to which it is developed over the coming decades is heavily dependent on government and industry response to environmental challenges, public acceptance, regulatory and fiscal regimes, and widespread access to expertise, technology and water (BREE, 2012a).

Given that unconventional resources are more widely dispersed than conventional resources, patterns of future gas production and trade may change. This is because all major consuming regions have estimated recoverable gas resources that are much larger than those estimated only five years ago (BREE, 2012a). Shale gas projects have contributed significantly to increased production in the US over the past 5 years. There is an expectation that rapid exploitation of shale gas developments are also likely to occur in other regions of the world. China is the only country with estimated shale gas resources greater than the US. The IEA has stated that Chinese shale reserves are the world's largest, estimated to be around 36.10 tcm (1,275 tcf) (GasToday, 2012), though exploitation activities remain in their infancy due to challenges not present in the US.

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