



Australian Government
Department of Resources,
Energy and Tourism

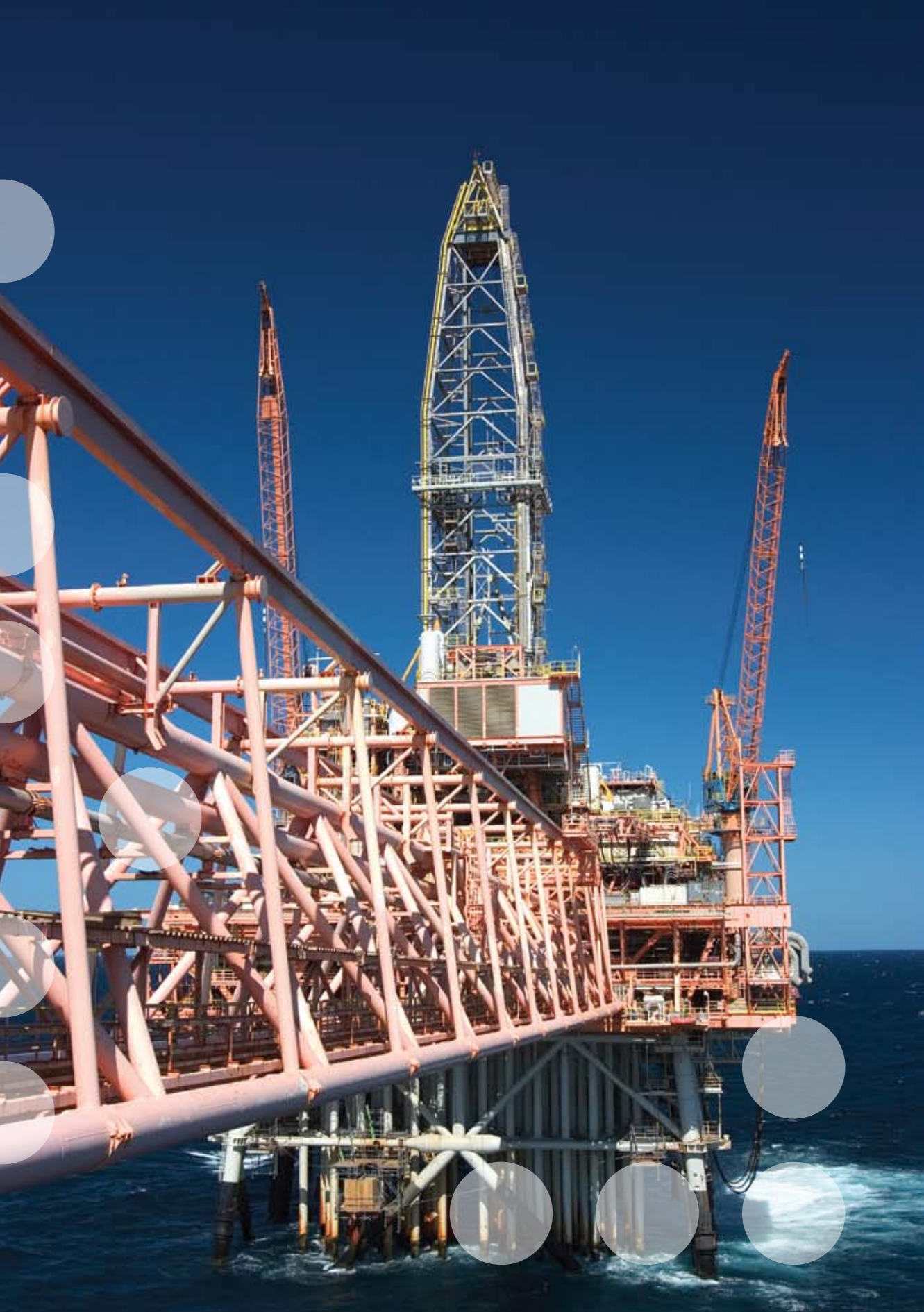
AUSTRALIAN LIQUEFIED NATURAL GAS (LNG) – CLEAN ENERGY FOR A SECURE FUTURE





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Foreword by the Australian Minister for Resources, Energy and Tourism

The technical, economic and environmental advantages of liquefied natural gas (LNG) have made it a global fuel of choice. Abundant gas resources and an excellent record as a safe and secure supplier make Australia a preferred provider of natural gas to the Asia-Pacific region. Further, the Australian LNG industry has proven itself to be one of the most socially and environmentally responsible industries in the world.

Global trade in LNG is increasing. Over the next 20 years, the industry can expect existing buyers to significantly increase their consumption and strong growth in markets such as China and India. In recent years, Australia's credentials as a competitive and reliable supplier have been reinforced through long-term deals secured in the Asia-Pacific region by Australian LNG producers. In turn, this will facilitate further sales, allowing Australia to achieve a greater share of the global LNG market.

As global demand for LNG increases, Australia's abundant gas resources and excellent record as an LNG supplier will serve us well in providing safe, secure and clean energy on an internationally competitive basis.

The Australian, Western Australian and Northern Territory Governments, and the industry, share a vision for a strong, internationally competitive LNG industry. Australia's demonstrated technological expertise and track record for safe LNG delivery is reinforced by a stable operating environment that encourages investment.

The Australian LNG industry has the potential to attract up to A\$60 billion in new project investment over the next 10 years, providing significant, long-term benefits from employment, regional development and exports.

This publication outlines the structure, performance and growth prospects of the Australian LNG industry. I look forward to working closely with all involved to see this potential realised.



The Hon Martin Ferguson AM MP

Minister for Resources and Energy
Minister for Tourism



Overview

Liquefied natural gas (LNG) is widely recognised as a clean, safe and convenient form of energy, which can be readily supplied to distant markets. Global LNG trade expanded more than fivefold over the past two decades to reach 7.45 trillion cubic feet (Tcf) in 2006, comprising over 7 per cent of global gas consumption.¹

Gas now accounts for one quarter of the world's primary energy consumption. In 2006, world natural gas consumption reached 100.6 Tcf, equivalent to over 2,055 million tonnes of LNG. The demand growth of natural gas is outstripping all other fossil fuels with global demand projected by the International Energy Agency (IEA) to grow to 169.4 Tcf per annum by 2030.

LNG will play a major role in power generation and industrial development in the Asia-Pacific region over the coming decades with strong demand growth expected in China, Korea, Taiwan, India, the west coast of the United States and Mexico. Globally, new LNG production capacity will be required with the estimated shortfall between existing supply and future demand likely to be around 26 million tonnes per annum (mtpa) by 2010 and 82 mtpa by 2015.

To date, the bulk of LNG trade has been conducted on the basis of long-term contracts. As the diversity of suppliers and consumers has grown, so too has the use of the spot market for trades. While spot sales have offered increased flexibility in procurement, the tight supply and demand situation has recently produced spot prices well in excess of long-term contract terms. As more LNG projects come on stream, it is expected that liquidity will return to the spot market and it will take a more prominent role in LNG trade.

Australia has a well-deserved reputation as a reliable, secure and competitive supplier of LNG, as evidenced by the delivery of over 2,250 shipments to Japan since 1989. Australian LNG competes in a global market with exports from Indonesia, Malaysia, Algeria, Qatar, Trinidad and Tobago, Nigeria, Brunei, Oman and the United Arab Emirates.

With a stable political environment, robust economy and abundant gas reserves, Australia will play an increasingly important role in meeting the world's burgeoning need for natural gas.

Key Statistics

- Australia produced around 1.4 per cent of the world's natural gas in 2006, and is the third largest LNG exporter in the Asia Pacific region, exporting 15.2 million tonnes of LNG in 2007 worth over A\$5.2 billion.
- Australia's reserves of natural gas were estimated at 153 Tcf as at 1 January 2006.²
- Australia's LNG supply capacity has doubled from 2003 to reach 15.6 mtpa following the completion of the Darwin LNG plant in February 2006.
- With the commissioning of a fifth production train at the North West Shelf and the completion of the Pluto LNG Project, capacity will reach 25 mtpa by the end of 2010.
- The IEA estimates that Australian LNG supply capacity could increase to over 60 mtpa by 2015, if currently planned projects proceed.

1 BP Statistical Review of World Energy, June 2007

2 Geoscience Australia, 2006

What is LNG?

LNG is natural gas, primarily methane, which has been cooled to its liquid state at minus 161°C. Liquefying natural gas reduces the volume it occupies by more than 600 times, making it a practical size for storage and transportation in specifically designed and built tankers. It is transported to dedicated LNG receiving terminals which have the capacity to store and re-gasify the LNG for supply to markets. LNG (the liquid itself) is not flammable or explosive.

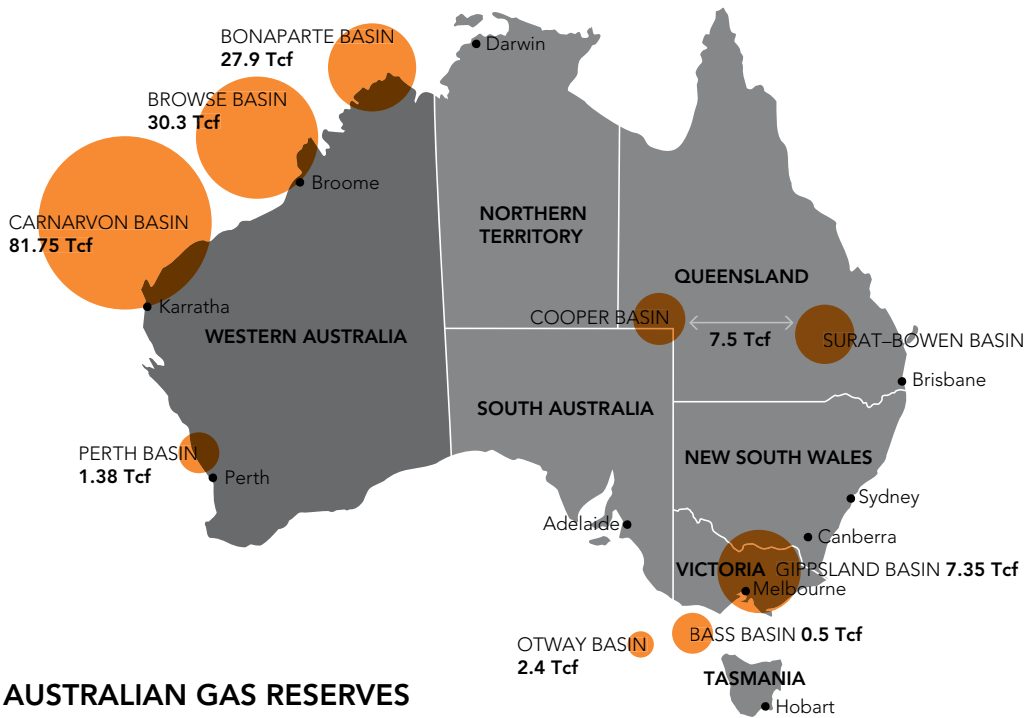
Australia's Natural Gas Resources

Australia has substantial natural gas resources with reserves estimated at over 150 Tcf, which is equivalent to more than 100 years of production at current rates.

Australia's natural gas consumption is approximately 1 Tcf per annum. Most of Australia's domestic demand is located in the south and east, whereas more than 90 per cent of the natural gas reserves lie in large offshore basins off the coast of Western Australia. The country's principal natural gas producing areas are the Carnarvon Basin, off the north-west coast of Western Australia; the Gippsland Basin, off the coast of Victoria; the onshore Cooper Basin, in the north-east of South Australia; onshore Surat-Bowen Basin in Queensland; and Bayu-Undan in the Joint Petroleum Development Area between the Northern Territory and Timor-Leste.

Natural gas production in Australia has increased steadily over the past two decades to reach over 1.4 Tcf, equivalent to 28 million tonnes of LNG, in 2006. This represents an average annual growth in gas production of around 6.5 per cent since 1980.³

Australia currently has two LNG export hubs, the North West Shelf Project (11.9 mtpa) and the Darwin LNG plant (3.7 mtpa) which supply approximately seven per cent of world LNG trade and 10 per cent of the Asia-Pacific market, with LNG exports in 2006 valued at over A\$5 billion. Australia exports over 30 per cent of its natural gas production in the form of LNG, mostly to Japan under long-term contracts. LNG is also exported to South Korea under a mid-term contract and spot sales have been made to Spain, Turkey, India and the USA. In August 2002, the Chinese Government signed a 25-year supply agreement with the North West Shelf Venture to supply 3.3 mtpa to the Guangdong Province, the first shipment of which was delivered in May 2006.



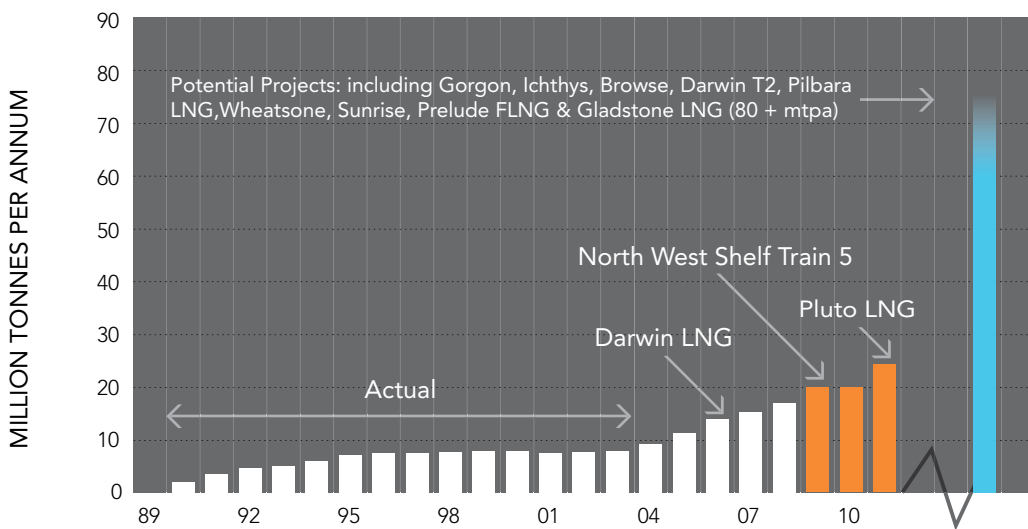
Australia has a strong gas reserves base with significant potential for further gas discoveries. Australia will continue to develop its reputation as a reliable and competitive exporter of energy with a proven track record in building large resource projects.



Planned and Potential LNG Projects

There are currently two LNG projects under construction in Australia the fifth train of the North West Shelf Project and Pluto LNG. A number of other projects are under consideration including the Greater Gorgon, Wheatstone, Greater Sunrise, Gladstone LNG, Prelude, Browse and the Pilbara LNG Project.

Based on IEA projections, Australia will become the world's third largest LNG exporter early next decade, behind Qatar and Nigeria. If all planned projects proceed, annual exports could exceed 80 mtpa (3.9 Tcf), almost four times the current capacity.



North West Shelf

The North West Shelf Project, located near Dampier in Western Australia is a A\$20 billion investment, operated by Woodside Energy. The North West Shelf Project reached a production capacity of 11.9 million tonnes of LNG in 2005 following the completion of the fourth production train. A 4.4 mtpa fifth train will be operational from late 2008. At over 16 mtpa, the North West Shelf Project will contain one of the largest plants in the world.

The North West Shelf offshore facilities include two of the world's largest gas production platforms: North Rankin A and Goodwyn A, located 135 kilometres from the onshore operations. The extensive onshore processing facility incorporates gas processing plants, five LNG trains, storage facilities and load-out jetties to produce a wide inventory of gas and liquid products.

The North West Shelf began LNG production in 1989. The venture has since delivered over 2,200 cargoes to markets including Japan, Korea and China. In 2003, the partners finalised a mid-term contract to supply 0.5 mtpa of LNG to South Korea for 7 years. In 2006, the North West Shelf Venture started supplying the Guangdong province LNG terminal as part of its 25-year contract to supply 3.3 mtpa, worth up to A\$25 billion over the life of the contract.

The North West Shelf Venture has two development projects underway to extend the life of the North West Shelf – the Angel development and North Rankin 2 project. The development of the A\$1.6 billion Angel gas and condensate field will result in a third offshore platform to tie in to North Rankin and three new production wells. The North Rankin 2 project will include a new platform and modifications to the process modules on the existing North Rankin A platform to create one interconnected facility. The project will recover the remaining low-pressure gas and extend the life of the North Rankin and Perseus gas fields to 2035. The North West Shelf Venture has taken a final investment decision for the development, approving a total investment of A\$5 billion. The project start up is expected in 2013.

Bayu-Undan

Bayu-Undan is a major gas and condensate field in the Timor Sea, located approximately 500 kilometres northwest of Darwin in the Northern Territory. It is situated in the Joint Petroleum Development Area, which is an area of shared jurisdiction between Timor-Leste and Australia established by the Timor Sea Treaty.

The field was discovered in 1995, and has expected reserves of 4 Tcf of gas and 550 million barrels of condensate. The Bayu-Undan project, operated by ConocoPhillips, has two development phases – a liquids phase and a gas phase. Production of liquids commenced in April 2004. The gas phase involves piping the gas to a site near Darwin, where it is processed into LNG for export. The plant has a 3.7 mtpa capacity and started exporting LNG in February 2006.

The project has contracts in place to export over 3 mtpa of LNG to the Tokyo Electric Power Company and the Tokyo Gas Company for 17 years from 2006. It is expected to generate some, A\$5 billion of revenue for Timor-Leste and about \$500 million for Australia over a 20-year field life.

Pluto

In July 2007, Woodside announced that it would proceed with its 90 per cent owned Pluto LNG Project at a cost of A\$12 billion. The project will use gas from the Pluto and Xena gas fields located 190 kilometres off the coast of Western Australia and 90 kilometres south-west of the North West Shelf Goodwyn Platform. The fields contain in excess of 5 Tcf of gas.

The initial LNG train currently under construction (on Burrup Peninsula connected by 180 kilometres pipeline to a platform in 85 metres of water) will produce 4.3 mtpa, with first exports expected in late 2010. A long-term sales agreement was signed in August 2007 to supply Japan's Kansai Electric with 2 mtpa and Tokyo Gas with 1.75 mtpa for 15 years.

Greater Gorgon

The gas fields in the Greater Gorgon region are located approximately 100 kilometres south-west of the North West Shelf and about 200 kilometres offshore from Western Australia. Gas resources in the Greater Gorgon region are significant, with more than 40 Tcf identified.

The initial development is likely to involve three 5 mtpa LNG trains on Barrow Island, sourcing gas from the Gorgon region and the more distant Jansz field. LNG production is currently scheduled to commence sometime after 2013. Initial plans to export gas from the Greater Gorgon fields include targeting markets on the west coast of North America and in North Asia. Supply agreements have been announced with Japan, China, Mexico and India. The project is a joint venture with Chevron (operator) owning 50 per cent, ExxonMobil 25 per cent and Shell 25 per cent.

A key component of the Gorgon development is the underground sequestration of carbon dioxide. The project received Australian Government approval, under strict environmental conditions, in October 2007 to establish a processing facility on Barrow Island.

Wheatstone LNG

In March 2008, Chevron announced plans to develop a new LNG Project based on its 100 per cent owned Wheatstone discovery. The proposal includes at least one 5 mtpa LNG train, with capacity to expand, located on the northwest coast of mainland Australia. The Wheatstone field was discovered in 2004 and has an estimated 4.5 Tcf of gas reserves. Front-end engineering and design is expected to commence in 2009.

Browse Gas

The Browse Gas Project comprises the very large and remote gas fields of Torosa, Brecknock and Calliance, located in the Browse basin 750 kilometres northeast of the North West Shelf fields. Reserves are estimated at 20.5 Tcf. Development options under consideration include the construction of offshore facilities connected by pipeline to an onshore LNG plant located on the Kimberley coast. The Browse Gas Project, operated by Woodside Energy (joint venture BP, BHP Billiton, Chevron and Shell), could be in production from 2013. Woodside has announced agreements with PetroChina and CPC of Taiwan to supply 2-3 mtpa over 15-20 years, primarily from the Browse Project. The final investment decision is expected in 2010.

Ichthys LNG

The INPEX-operated Ichthys gas field, also located in the Browse Basin, lies over 200 kilometres off the Kimberley coastline in Western Australia. The field contains an estimated 12.8 Tcf of gas and over 527 million barrels of condensate.

INPEX and its joint venture partner Total E&P (24 per cent) are investigating a number of development options, including building an LNG plant on the Maret Islands in Western Australia or piping the gas to a plant in Darwin. The plant would initially produce 7.2 mtpa, with first exports expected in 2012 with plans to supply the Japanese market.

Pilbara LNG

The Scarborough gas field, operated by ExxonMobil, is located 300 kilometres offshore from Exmouth in Western Australia. Gas was first discovered at this site in 1979. Reserves of about 7 Tcf have been identified.



In September 2004, BHP Billiton, which owns 50 per cent of Scarborough, selected a site for a proposed LNG plant in the Pilbara region, approximately 4.5 kilometres southwest of Onslow in Western Australia as part of the company's pre-feasibility study into the development of the Scarborough resource. Drilling continued in 2007 and environmental and technical studies are providing valuable data for development plans and assessment.

Greater Sunrise

The Sunrise and Troubador gas fields, known jointly as the Greater Sunrise field, are located offshore in the Bonaparte Basin, 350 kilometres north-west of Darwin. Some parts of the Greater Sunrise field extend into the eastern area of the Joint Petroleum Development Area shared between Australia and Timor-Leste. The Greater Sunrise field contains an estimated 300 million barrels of condensate and 8.4 Tcf of gas.

Consistent with the terms of the Timor Sea Treaty, an International Unitisation Agreement (IUA) for the Greater Sunrise petroleum field was signed by both countries on 6 March 2003. The International Unitisation Agreement provides a financial framework and international legal basis for the joint development of the Greater Sunrise field.

On 12 January 2006, the Certain Maritime Arrangements in the Timor Sea (CMATS) treaty was signed by Timor-Leste and Australia. By signing this treaty, Timor-Leste and Australia have agreed to a moratorium on boundary issues for 50 years.

Following ratification in both countries' parliaments, the IUA and CMATS entered into force on 23 February 2007. Subsequently the operator, Woodside Energy, has mobilised a project team to assess development options for the Greater Sunrise field.

Gladstone LNG and Coal Seam Methane

Five separate LNG projects for the east coast of Australia have been announced since July 2007, which would see coal seam methane (CSM) gas from Queensland's Surat and Bowen Basins utilised as an LNG feedstock and exported.

In July 2007, Santos announced a proposal to construct a A\$7 billion LNG facility at Gladstone in Queensland. The project is for a single 3-4 mtpa train. A final investment decision is expected in 2009, with first exports anticipated in 2014. The project has been given major project status from the Queensland State Government.

In early 2008, Queensland Gas announced an alliance with BG Group to build a 3-4 mtpa LNG plant on the Queensland coast. A final investment decision is expected in 2010, with first LNG in 2013.

Three smaller projects have also been announced. Sunshine Gas, following a pre-feasibility study, signed a heads of agreement with Sojitz Corporation to jointly develop a 0.5 mtpa LNG plant at Gladstone. LNG International has also announced plans to build a 1.4 mtpa LNG plant with the final investment decision expected by the end of 2008, first LNG could be as early as 2011. The Canadian company LNG Impel have announced plans for a 0.7-1.3 mtpa plant costed at up to A\$5 billion.

More generally, CSM is now an important component of the eastern states gas market. Production increased by 41 per cent and 2P reserves increased by 49 per cent to approximately 7.5 Tcf over the 12 months to May 2008. Current CSM production and reserves are largely in Queensland although production is rapidly growing in NSW. It is expected that both production and reserves in both these states will continue to increase at a high rate for the next 3-5 years. CSM production accounted for 17.3 per cent of all gas production in the eastern Australia in 2007 and is rising steadily.

Exploration is underway in South Australia and Tasmania with potential also in Western Australia and to a lesser extent in the Northern Territory. The brown coals of Victoria appear to hold little economic potential for direct gas production in the short to medium term.

Government Support

Under Australian and international law, rights to petroleum are owned or held by governments but assigned to private interests. Australian governments neither undertake petroleum projects nor engage in commercial petroleum exploration or development.

The continued development of the LNG industry and securing new export markets is a high priority for the Australian Government.

Market Studies

The Department of Resources, Energy and Tourism and its predecessors commissioned a number of market studies over recent years to support LNG market development. Recent studies include:

- Natural Gas in India: Prospects for LNG Imports 2007
- Natural Gas in Taiwan: Prospects for LNG 2006
- The Asia Pacific LNG Market: Issues and Outlook 2004
- LNG in Korea: Opportunities for Growth 2003
- Natural Gas in Eastern China: The Role of LNG 2003

Petroleum Regulation (Exploration and Development)

Australia's recognised advantages as a supplier of LNG include its stable political environment and low sovereign risk. A legislative regime backed up by a strong, independent legal system provides for orderly exploration and development of Australia's petroleum resources in offshore areas under Commonwealth jurisdiction.

Offshore petroleum operations beyond coastal waters are governed by Commonwealth legislation known as the *Petroleum (Submerged Lands) Act 1967* (PSLA). The PSLA has been rewritten to simplify the presentation of the legislation after more than 40 years of operation and amendments. This will improve its user friendliness and reduce compliance and administrative costs, without changing any major policies or the current management regime. The rewritten Act, the *Offshore Petroleum Act 2006*, and related Acts will come into effect during 2008, and the PSLA will be repealed.

It sets out a basic framework of rights, entitlements and responsibilities for governments and industry. The legislation allows for five types of title to be granted to companies:

- exploration permits;
- retention leases;
- production licences;
- pipeline licences; and
- infrastructure licences.

Administration of the legislative and regulatory regime is managed under cooperative arrangements between the Commonwealth and the states/Northern Territory, with oversight by the Ministerial Council for Minerals and Petroleum Resources.

Foreign Investment in LNG Projects in Australia

The Australian LNG industry has benefited from high levels of overseas investment. The Australian Government fully supports foreign investment in Australian LNG projects, provided that it satisfies the general foreign investment policy guidelines. Australia's foreign investment policy and broader policies, such as those relating to taxation, are designed to encourage investment and development, while at the same time, benefit the Australian community and investors alike. However, commercial agreements over the level and terms for foreign investment in any LNG project are matters for the commercial parties.

Petroleum and Geoscience Information

There is continuing high potential for further large discoveries of oil and gas in Australia. Offshore exploration only began in earnest in the 1960s and Australia remains under-explored.

Explorers in Australia have access to major geoscientific datasets, which provide a sound basis for delineating prospective areas and defining targets for testing. These include government-generated geoscientific maps, datasets, digital databases and company reports of previous exploration.

The Australian Government, through Geoscience Australia, each of the states and the Northern Territory, have a range of highly-developed datasets which are publicly available. These typically include petroleum occurrences, resources, geological features and tenement boundaries. A high proportion of the information is available in digital form and via the Internet.

Royalties and Petroleum Resource Rent Tax

Petroleum production projects operating in Australia are subject to a resource charge, which aims to provide the Australian community with a fair and reasonable return from the development of non-renewable petroleum resources.

Australia's fiscal arrangements are among the more competitive petroleum taxation regimes applied worldwide and provide a community return commensurate with the petroleum industry's assessment of Australia's prospectivity.



Petroleum Resource Rent Tax

The Australian Government applies the Petroleum Resource Rent Tax (PRRT) to petroleum projects in Australia's offshore areas beyond coastal waters. The only exceptions are the North West Shelf Project area and the Joint Petroleum Development Area, the latter situated between Australian and Timor-Leste where other arrangements apply.

PRRT is a profit-based tax which is applied at a rate of 40 per cent to a petroleum project's net income (less exploration and general project expenditure) and is a deductible expense for company tax purposes.

The Australian Government announced amendments as part of the 2007-08 Budget aimed at improving the operation of the PRRT. These include:

- 1 a functional currency rule, enabling a PRRT taxpayer to calculate its PRRT liability in a foreign currency;
- 2 deductibility of 'black hole' exploration expenditure, ensuring all exploration expenditure is deductible for PRRT purposes; and
- 3 external petroleum provisions, which will remove inconsistencies where a petroleum project processes petroleum sourced from another petroleum project for a tolling fee and the two projects overlap.

These measures are expected to commence in 2008.

Royalties

Where the PRRT does not apply, petroleum royalties are collected by Australian state and territory governments on all petroleum production which occurs within their jurisdictional boundaries. This includes onshore production and any territorial sea production occurring within three nautical miles from the continental shoreline. The rate of royalty is normally set at 10 per cent of the net well-head value of the petroleum produced. Commonwealth petroleum royalties also apply to production from the North West Shelf Project area in Australia's offshore region, at a rate of 10-12.5 per cent of the well-head value.

LNG Safety and Security

LNG is not flammable or explosive in liquid form. When LNG is warmed up and turned back into natural gas it is flammable within a very limited range. If the mixture of natural gas with air contains less than 5 per cent natural gas, it cannot burn because it is too lean. If the mixture of natural gas with air contains more than 15 per cent natural gas, it cannot burn because it is too rich. LNG has been safely handled for many years. New technology has facilitated further measures to ensure safety both onshore and offshore. Australia has been supplying LNG since 1989 and has an enviable record for safety and reliability. Over 2,200 shipments have been dispatched without incident.

National Offshore Petroleum Safety Authority

The National Offshore Petroleum Safety Authority began operations on 1 January 2005. The Safety Authority covers Commonwealth and State waters and is accountable to Commonwealth, State and Northern Territory ministers.

The Authority aims to improve safety across the offshore petroleum industry and deliver best practice safety regulation for Australia.

Australia's Safety Regime

Australia's offshore petroleum industry operates under a safety case regime. A safety case is a sophisticated, comprehensive and integrated risk management system in which operators accept responsibility for the ongoing management of safety. The regulator's key functions are to promote safety and health, and to inspect workplaces in the industry. Safety cases are central to this and form the rules by which the safe operation of the facility is governed.

Australia's Maritime Security

From 2004, the Australian Government implemented a series of initiatives to further strengthen offshore maritime security. Key initiatives included amendments to the *Maritime Transport Security Act 2003* to include offshore facilities and the establishment of the Border Protection Command.

Under the *Maritime Transport and Offshore Facilities Security Act 2003* offshore oil and gas facilities are required to have security plans based on a security risk assessment similar to those required by port facilities and ships. The Border Protection Command was established on 31 March 2005 to link Australian Defence Force capabilities with existing civil maritime surveillance and regulatory roles that are undertaken or coordinated by the Australian Customs Service. The underlying principle to these initiatives is that the Australian Government has direct responsibility for counter-terrorism prevention, interdiction and response in all offshore areas in Australia.