Natural Gas: Energy for the New Millennium
Natural Gas: Energy for the New Millennium

Mike Roarty
Science, Technology, Environment and Resources Group
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<th>Description</th>
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<tr>
<td>AGA</td>
<td>Australian Gas Association</td>
</tr>
<tr>
<td>ACCC</td>
<td>Australian Competition and Consumer Commission</td>
</tr>
<tr>
<td>BEAM</td>
<td>Boral Energy Asset Management</td>
</tr>
<tr>
<td>COAG</td>
<td>Council of Australian Governments</td>
</tr>
<tr>
<td>CNG</td>
<td>Compressed natural gas</td>
</tr>
<tr>
<td>GFCV</td>
<td>Gas and Fuel Corporation of Victoria</td>
</tr>
<tr>
<td>GJ</td>
<td>Gigajoule</td>
</tr>
<tr>
<td>IPART</td>
<td>Independent Pricing and Regulatory Tribunal (New South Wales)</td>
</tr>
<tr>
<td>LNG</td>
<td>Liquefied natural gas</td>
</tr>
<tr>
<td>LPG</td>
<td>Liquefied petroleum gas</td>
</tr>
<tr>
<td>MJ</td>
<td>Megajoule</td>
</tr>
<tr>
<td>NWS</td>
<td>North West Shelf</td>
</tr>
<tr>
<td>ORG</td>
<td>Office of the Regulator General (Victoria)</td>
</tr>
<tr>
<td>PJ</td>
<td>Petajoule</td>
</tr>
<tr>
<td>PNG</td>
<td>Papua New Guinea</td>
</tr>
<tr>
<td>SAGASCO</td>
<td>South Australian Gas Company Ltd</td>
</tr>
<tr>
<td>SECWA</td>
<td>State Electricity Commission of Western Australia</td>
</tr>
<tr>
<td>VENCorp</td>
<td>Victorian Energy Corporation</td>
</tr>
<tr>
<td>WAPET</td>
<td>West Australian Petroleum Exploration Pty Ltd</td>
</tr>
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</table>
Major Issues

The explosion in September 1998 at the Longford plant in Victoria disrupted Victorian gas supply for almost two weeks. The gas disruption had a major impact on Victorian industry and the broader economy. Victorian industries which lost their energy source were forced to close, and in addition, component manufacturers and suppliers to Victorian industry in other States also closed as there was no demand for their products during this period. Businesses such as restaurants and hotels, along with householders, lost their energy supply for water, space heating and cooking. What became obvious following this incident was that the State of Victoria had no alternative gas supply. The Victorian Government along with business and the public have a heightened sense of importance of energy security following this crisis, and are likely to pursue options to improve security and alternative supply options.

The Australian gas industry is being subjected to major restructuring, somewhat akin to the Australian electricity industry. The restructuring has followed the findings of the 1990 Commonwealth's National Gas Strategy and the 1991 Industry Commission Report on Energy Generation and Distribution. Both highlighted the scope for reform of both gas and electricity industries in order to increase competition and efficiency to lower energy prices to both industry and domestic users. The restructuring process to date has involved the breakup of a number of government owned single entity organisations into competing corporatised bodies, namely transmission, distribution or retailing businesses. Significant progress has been made in respect to 'third party access' legislation enabling independent operators to negotiate on commercial terms to access transmission pipelines. The supply of gas from the upstream sector comprising exploration for, and development of, gas reserves is dominated by private sector organisations. Many of these organisations control extensive production and potential production areas and own vital gas processing facilities. The marketing of gas including transmission, distribution and retailing is a combination of both public and private sector enterprises. The operations of transmission of gas via high pressure pipelines and distribution via low pressure reticulation systems within towns, cities and regional districts are natural monopolies.

Many industry commentators have maintained that the pace of restructuring has been slow. National access legislation to gas pipelines, one of the primary initiatives in the industry restructuring process which is not as yet finally concluded, was originally envisaged as being completed by June 1996.
Restructuring in the upstream gas industry sector has also been slow and implementing significant change presents major challenges. Present operators are in many cases joint venturers with title to large exploration tenements. They also control and own the gas processing facilities. A case in point is the Cooper Basin where a consortium dominated by Santos Ltd and Delhi Petroleum has been producing natural gas and liquid petroleum since the mid 1950s. Other examples include areas such as the Gippsland Basin located offshore of the Victorian southeast coastline. The challenge will be for third parties to obtain acreage in these proven gas and petroleum provinces and successfully develop competing supplies of both gas and petroleum. Furthermore, following success with exploration and development of gas and oil reserves, access to established processing facilities will need to be obtained on fair and equitable commercial terms.

With increasing competition in the upstream sector of the gas industry, gas quality will become an increasingly important consideration. Discoveries of gas deposits by newer industry participants will likely be of a different nature and composition (hydrocarbon and moisture content) to present producers. For subsequent treatment and transportation of any new gas, satisfactory third party access arrangements will need to be negotiated.

Australia has abundant reserves and resources of natural gas although they are unevenly distributed across the country. The bulk of reserves are located offshore from northwestern Western Australia (Carnarvon and Browse basins) well removed from Australia's industrial and domestic markets. New South Wales is presently the only mainland State that does not have its own natural gas reserves. Australia has much more gas than it does petroleum on which it is now partly import dependent. The largest onshore accumulation of gas reserves is in the Cooper/Eromanga basins in central Australia (see Map 1 page 6). It is this source that supplies the gas markets in South Australia, New South Wales, the Australian Capital Territory and Queensland. The offshore reserves of the Gippsland Basin supply the Victorian markets and Victoria is by far the largest gas user of any of the States. The reserves of both the Cooper/Eromanga and Gippsland basins are considerable but could be depleted substantially at present rates of consumption by around 2020. At that stage, unless substantial new reserves are found, gas will need to be transported either from Western Australia, the Timor Sea or from Papua New Guinea (PNG) or a combination of any of these (see Map 2 page 13).

Australia has an extensive network of pipelines covering Australia (see Map 1) with three distinct interconnecting networks:

- the eastern Australia network incorporating South Australia, New South Wales, the Australian Capital Territory, Queensland and Victoria
- the central network incorporating the Northern Territory and
- the western network incorporating Western Australia.
These pipeline networks are not presently linked. A number of new pipelines and extensions to existing pipelines have recently been built and a number of major new pipelines are planned. The Australian Gas Association states that at present new pipeline proposals totalling some 11,000km in length are at various stages of consideration. If all of these projects proceeded, it would entail an investment of around $6 billion.

Consumption of natural gas in Australia has been increasing since 1969 when gas was first transported by pipeline from Roma to Brisbane in Queensland. Gas consumption in 1997 stood at 817.8 (petajoules) PJ, with industry accounting for 355 PJ or 43 per cent of the total. Other major end use sectors include electricity generation, minerals processing and mining, and the residential and commercial sectors. Consumption of natural gas in Australia is projected to increase around threefold by 2030. Gas has environmental advantages in addition to a price advantage relative to electricity, which will be an increasing driver for gas industry expansions. The continuing pressure brought about by the need to limit greenhouse gas emissions following the Kyoto and Buenos Aires Conventions, favours the development of gas powered power stations over coal fired power stations.

A consortium led by Woodside Petroleum Limited has developed extensive gas and oil deposits on the North West Shelf (NWS) and is Australia’s single and major exporter of liquefied natural gas (LNG). The project depends on continuing growth markets in both Japan and other Asian countries, in particular Korea. There are potential new markets in China. The possible development of nuclear power plants in Japan is however a negative for the expansion of the Australian LNG export business.

The development of both liquefied petroleum gas (LPG) and compressed natural gas (CNG) vehicles have been important in the transportation sector. These vehicles have environmental advantages in that they have considerably lower carbon dioxide emissions (the principal greenhouse gas) and unlike diesel they emit no particulate matter. The disadvantage is that there are far fewer outlets for these fuels than for petrol and diesel, especially in the case of CNG. Both these fuels are used extensively in major cities, CNG is being used extensively in bus fleets and LPG in taxi fleets. These fuels presently have a price advantage because of their excise free status. This status of course could be removed with a change in government policy. The changing of the fuel taxing equations such as the present planned reductions in the price of diesel fuel could impact negatively with the further advancement of LPG and CNG vehicles.
Introduction

The aim of this paper is to outline a number of current issues pertaining to the Australian gas industry, provide an insight into future developments and provide a broad overview of the Australian gas industry as it currently stands.

The foremost issue in the natural gas industry arises from the recent Victorian gas crisis. Because of the proximity of large gas reserves located offshore in southeast Victoria, in the Gippsland Basin, Victoria has used this gas as its primary energy source since the 1970s. The disruption of essential gas supply to Victorian industry, commercial businesses and householders resulting from the Longford gas plant explosion clearly indicated the vulnerability of single source supply with little to no backup.

The Australian gas industry in 1998 is a mixture of private and public sector entities and like a number of other infrastructure industries is being subjected to major restructuring. The overall objectives of restructuring are to deliver both cheaper prices through increased competition and to offer a wider choice of service. The restructuring process to date has involved the breakup of a number of the government owned single entity organisations into competing corporatised bodies and the passing of 'third party access' legislation at Commonwealth and State levels. The supply of gas from the upstream is dominated by private sector bodies. The marketing of gas including transmission, distribution and retailing is a combination of both public and private sector enterprises.

Natural gas is becoming an increasingly important energy source. In 1996-97 it contributed 17.7 per cent of primary energy consumption in Australia and is projected to increase that share to 28 per cent by 2030. Natural gas has a competitive edge over electricity in that it is around half the price in terms of the delivery of an equivalent amount of energy. Furthermore Australia has extensive reserves of gas which can be used to Australia's competitive advantage.

Composition of Natural Gas

Natural gas occurs in underground reservoirs, sometimes associated with oil, but often not. Oil exploration efforts in Australia have yielded gas on a number of occasions with little or no oil. Such deposits are called non-associated gas. The exploitation of natural gas as an energy source is comparatively recent except in the United States; vast quantities have
been 'flared' as a waste product to facilitate crude oil production. As recently as 1985 some nine per cent of international gas production was treated in this fashion, the majority of this being in Nigeria, Iran and Saudia Arabia.\textsuperscript{3}

Unprocessed natural gas is composed of the lighter hydrocarbon fractions, mainly methane (CH\textsubscript{4}) with some ethane (C\textsubscript{2}H\textsubscript{6}). Depending on the source of the gas it may contain minor amounts of propane (C\textsubscript{3}H\textsubscript{8}), butane (C\textsubscript{4}H\textsubscript{10}) and pentane (C\textsubscript{5}H\textsubscript{12}). Other constituents may or may not be present, such as the longer chain hydrocarbons, nitrogen (N\textsubscript{2}), carbon dioxide (CO\textsubscript{2}) and hydrogen sulphide (H\textsubscript{2}S). Pure methane is colourless, odourless and lighter than air. Impurities such as hydrogen sulphide can give natural gas an odour. The composition of natural gas used in Melbourne in 1996–97 was 91.2 per cent methane, 5.2 per cent ethane, 0.6 per cent butane, 0.8 per cent nitrogen and 2.2 per cent carbon dioxide.\textsuperscript{4}

Ethane, propane, butane, and pentane are known as natural gas liquids. Propane and propane/butane mixtures are both known as liquid petroleum gas (LPG). The propane/butane mixtures can vary up to around 50 per cent of each. Ethane is widely used as a petrochemical feedstock. Where the natural gas is low in these liquid hydrocarbons it is known as a 'dry' gas, in contrast to what is known as 'wet' gas if the gas contains quantities of both propane and butane. A 'sour' gas contains more than one part per million hydrogen sulphide and is characterised by a foul smell. Australian natural gas is generally 'sweet' due to a low hydrogen sulphide content.

**Energy Units used in the Natural Gas industry**

Gas measurement units are often extremely large and it is customary for units to be prefixed with an exponential factor. Commonly used exponential prefixes are outlined in Appendix 1.

Gas reserve and resource figures are quoted in either cubic feet or cubic metres of gas and these figures can be quoted in large numbers such as billions or trillions of cubic feet.

The conversion factor for cubic metres to cubic feet is outlined below:

\[
\text{one cubic metre (m}^3\text{)} = 35.315 \text{ cubic feet (f}^3\text{)}
\]

Following the conversion of cubic feet to cubic metres, it is customary for the resultant figure firstly to be converted to megajoules (MJ) and subsequently to petajoules (PJ). Petajoules is a standard unit used in the natural gas industry. From Appendix 1, one MJ = 10\textsuperscript{6} joules and one PJ = 10\textsuperscript{15} joules. A joule is the basic unit of energy and relates to a unit of work done. MJ can be converted to PJ by dividing by a factor of 1x 10\textsuperscript{9}. 

2
The conversion of cubic metres of gas to MJ depends on the nature and composition of the gas, and varies depending on where the gas is sourced. As New South Wales gas is sourced from South Australia there is no separate figure for New South Wales. The following factors apply to Australia's present gas reserves and resources:

<table>
<thead>
<tr>
<th>State</th>
<th>MJ per cubic metre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Australia</td>
<td>38.2</td>
</tr>
<tr>
<td>Victoria</td>
<td>38.6</td>
</tr>
<tr>
<td>South Australia</td>
<td>39.1</td>
</tr>
<tr>
<td>Queensland</td>
<td>39.6</td>
</tr>
<tr>
<td>Northern Territory</td>
<td>40.4</td>
</tr>
</tbody>
</table>

Production of liquefied natural gas (LNG) which is produced on the North West Shelf of Western Australia is quoted in tonnes. To convert tonnages to joules, the following factor is used:

\[
\text{one tonne LNG} = 54.4 \text{ gigajoules (GJ)}. \]

The comparison of natural gas and electricity costs in terms of equivalent units of delivered energy is outlined in the Prices section.

**Inherent Advantages of Natural Gas**

Natural gas is a clean burning energy source offering significant environmental and cost advantages over other fossil fuels. Natural gas is viewed as an efficient, environmentally friendly energy source that will play a major role in future power generation and industrial development in Australia and South East Asia.

Natural gas combines with oxygen on burning to release heat, carbon dioxide and water, as with all other fossil fuels such as coal, petrol and diesel. However, the burning of natural gas releases by far the least amount of carbon dioxide of equivalent energy released. Of the four common primary fossil fuel energy sources, natural gas emits 55 kilograms of carbon dioxide per gigajoule (GJ) of energy produced compared to 68, 91 and 95 kilograms of carbon dioxide for petroleum, black coal and brown coal respectively. With ever increasing pressure to reduce or contain greenhouse gas emissions (of which carbon dioxide is the principal gas) following the Kyoto Protocol of the Framework Convention on Climate Change agreed to in December 1997, natural gas has significant comparative advantage for use in electrical power generation. In addition, the burning of natural gas produces little particulate matter and no fly ash as is produced with the burning of coal. The burning of gas as opposed to the burning of coal contributes significantly to the improvement of local air quality.
Australia's LNG export industry replaces other higher density fossil fuels like coal and oil that would otherwise be used for power generation in countries like Japan. Although the LNG production process adds to Australia's Greenhouse emissions, the global environment is better off when Australian LNG is used in preference to other fuels.

Although the use of liquefied natural gas and compressed natural gas in the transportation sector is relatively small at present, any increase in market share into this sector would result in an improvement in present tail pipe emissions, which cause major environmental problems, particularly in major urban centres and cities.

Industry Structure

The natural gas industry is widely dispersed across Australia and gas is produced in all of the mainland States, apart from New South Wales. Tasmania at present has no natural gas industry. The major gas producing basins in Australia are offshore northwest Western Australia (Carnarvon and Browse basins), offshore southeast Victoria (Gippsland basin) and onshore central Australia (Cooper/Eromanga basins) (see Map 1).

Australia's natural gas industry has five major elements: production, transmission, distribution, retailing and consumption. Production involves the exploration for and development of gas reserves in Australia's various sedimentary basins. Transmission involves the transportation of gas from the well head or production area in high pressure large diameter pipelines to decompression plants or city gate points prior to distribution to customers (industrial, commercial and householder) in low pressure small diameter distribution lines. Many of Australia's transmission pipelines have compressor stations located at regular intervals along the length of the pipeline in order to boost pressure throughout the pipeline as required. Decompression plants are usually located on the outskirts of major industrial or residential areas.

Production, transmission, distribution and retailing entities are generally either separately owned or operated as 'ring-fenced' entities within a larger organisation. Gas pipelines cross extensive parts of Australia with three distinct interconnecting networks. New pipelines and extensions to existing pipelines have recently been built which is gradually extending the network. The construction of a number of additional major pipelines is under consideration.

The industry structure is outlined in broad terms on a State-by-State basis in Appendix 2.
Gas Transmission Pipeline Network

Natural gas pipelines were introduced to the United States in the 1920s, following the development of the oil and gas industries, and became increasingly important as the use of natural gas grew in the early post-World War Two era. However, they did not appear in Australia until the late 1960s when Australia's oil and gas industries were being developed.

The present transmission pipelines networks, consisting of around 15 300km of high pressure pipelines is shown on Map 1.

The pipelines networks cross extensive parts of Australia with three distinct interconnecting networks:

- eastern Australia incorporating South Australia, New South Wales, the Australian Capital Territory, Queensland and Victoria
- the central network incorporating the Northern Territory and
- the western network incorporating Western Australia.

These pipeline networks are not presently linked. New pipelines and extensions to existing pipelines have been built relatively recently including the important linkage connecting New South Wales and Victoria via the Wagga Wagga to Wodonga pipeline. The Australian Gas Association maintains that at present, new pipeline proposals totalling some 11 000km in length are at various stages of consideration. These projects would entail an estimated investment of around $6 billion. These proposals include the Chevron and BHP Westcoast pipelines (see Proposed new pipelines and other developments section below). New pipelines serve both to extend the existing network as well as tap into new gas resources, the Chevron pipeline proposal being a case in point. The Westcoast proposal would also serve as a duplication of supply, by more effectively linking the Cooper/Eromanga and Gippsland Basins to supply both New South Wales and Victorian consumers. A recent paper published by the Australian Gas Association outlines the main natural gas pipelines in Australia, detailing year commissioned, length, capacity and ownership.
Estimated Australian Gas Reserves as at 31 Dec 1996 = 92,063 PJ (BRS 1998)

Source: Australian Gas Association

Map 1: Australia’s High Pressure Transmission Networks and Sedimentary Basins

Natural Gas: Energy for the new millennium
Proposed new pipelines and other developments

Major new proposals include the possible building of two large pipeline transmission projects enabling gas to be transported from PNG to Queensland and from the Gippsland Basin in Victoria (Longford) to Wilton in New South Wales.

One proposal, the Chevron Gas Pipeline is to bring gas from the Kutubu gas fields located in the central highlands of Papua New Guinea across Torres Strait to North Queensland and along the east coast to the Queensland industrial areas of Townsville and Gladstone. The project participants in the PNG Gas Pipeline Project are Chevron Asiatic Limited and BHP Petroleum (PNG) Pty Ltd, together with a number of smaller participants. The development of the Kutubu fields would have a number of major benefits for both PNG and Queensland. PNG would have a major resource development project from which it could earn valuable export income and Queensland, and more particularly North Queensland, would have access to gas reserves much closer than the Cooper Basin sourced gas. Another major advantage is that this pipeline would provide a second major alternative gas source for Queensland as well as for other States, adding greatly to the security of gas supply. Another proposal is the building of a pipeline from Longford, Victoria to Wilton, New South Wales, which would link supply from the Gippsland Basin to the Sydney market. The project proponents of this East Australian Pipeline proposal are BHP Petroleum and Westcoast Energy.

Another new development is the pending relinquishment of oil and gas exploration tenements covering the South Australian portion of the Cooper/Eromanga Basin by the South Australian Government in early 1999. The South Australian Government’s aim is to markedly increase competition in the upstream sector of exploration for, and development of, gas and oil fields in the Cooper/Eromanga Basin. The expiry in February 1999 of Petroleum Licences 5 and 6 covering 73,000 square kilometres, including all of the South Australian Cooper Basin, will mark the end of an important era in the history of petroleum exploration in Australia. Since the first exploration licences were awarded in 1954, Santos Ltd and joint venture partners have drilled more than 1100 exploration and development wells and brought 119 oil and gas fields on stream.

With the Cooper Basin now servicing the natural gas needs of South Australia, New South Wales, the Australian Capital Territory and southeast Queensland, the Basin now stands as the hub of the major gas production, processing and transmission system in Australia.

Legislative Changes, Restructuring and Access Arrangements

Legislative changes, restructuring and access arrangements are important components of efforts directed towards improving the operation and efficiency of the natural gas industry. With the use of natural gas forecast to increase substantially in the new millennium,
structural changes to present industry arrangements will enable increased competition and provide greater security of supply of such an essential energy source.

The major aims of the restructuring process are fourfold:

1. To restructure the government owned gas businesses, leading to a break up of single entity organisations into competing corporatised bodies. The Victorian Government has expressed its intention to privatise the State owned gas assets, as it has with its electricity assets.

2. To increase competition both in the upstream and downstream sectors of the natural gas industry in order to have both competing suppliers and retailers of natural gas.

3. To introduce regulatory controls over the natural monopoly components of the natural gas businesses such as the operation of the transmission and distribution systems.

4. To implement a 'third party' access and regulatory regime in order that third parties that explore for and develop gas fields can access existing processing facilities, together with pipeline and distribution networks for agreed tariffs such that their gas can be marketed.

The 'third party access' arrangements have involved extensive Commonwealth and State legislative processes. In 1995, the Council of Australian Governments (COAG) established a Gas Reform Taskforce to draw up a National Third Party Access Code for Natural Gas Pipeline Systems (the National Access Code). The aim was to establish a single set of rules for access to all transmission and distribution pipelines and it is regarded as the key element in achieving free and fair trade in natural gas. This process was deemed necessary to encourage the development of a nationally integrated and competitive natural gas market. Other broader objectives were the removal of legislative and regulatory barriers to trade, the commercialisation of remaining government owned utilities, structural separation (or ring-fencing) of the natural monopoly elements in the gas industry and reform of the distribution franchise arrangements.

The National Access Code (approved by COAG on 7 November 1997 and known as the Code) will be given effect by legislation (the Gas Pipelines Access Law) in each jurisdiction. Legislation pertaining to pipeline access has been passed in a number of jurisdictions including the Commonwealth (Gas Pipelines Access (Commonwealth) Act 1998), South Australia, New South Wales and the Northern Territory. Complementary legislation in other jurisdictions is in process. The Australian Competition and Consumer Commission (ACCC) will be the transmission regulator once the relevant jurisdiction has proclaimed its legislation and is hence covered by the Code. The ACCC will be the relevant transmission regulator of 'covered' natural gas pipelines in most Australian States (Western Australia is to set up its own regulator). Many industry commentators have maintained that the pace of restructuring has been slow. National access legislation to gas
pipelines, one of the primary initiatives in the industry restructuring process, was originally envisaged as being completed by June 1996.

Impact of the Victorian Gas Crisis

The explosion at the Longford Esso/BHP gas processing facility near Sale, Victoria in September 1998 severally disrupted the entire Victorian gas supply. Gas supply was restored on 5 October, in the first instance to industry and business facilities and to domestic users in the following days. The gas crisis followed an earlier problem in June also resulting in disrupted gas production. This problem related to an ice blockage at the Longford plant. The chronology of events of the major crisis is as follows:

25 September: Explosion kills two workers at the plant and injures seven, cutting gas supplies to the State.

2 October: $100 million Federal Government assistance package announced for Victorians affected by gas shortages.

12 October: Victorian government announces a Royal Commission into the two gas stoppage incidents in order to determine the cause of the 25 September explosion and the subsequent loss of supply.

The Royal Commission will examine a range of contributing factors before making recommendations in February 1999. A former High Court judge, Sir Daryl Dawson, will conduct the Royal Commission. The Commission will also examine risk management and emergency procedures, any policy changes that have been made, and any breaches by Esso/BHP of relevant statutes of regulations. Recommendations by the Royal Commission may include proposed changes to State laws or administration.

Only very small amounts of gas were available to Victorians during the gas crisis. This supply came from the recently completed pipeline link from Wagga Wagga to Wodonga (bringing gas from the Cooper/Eromanga Basin via New South Wales), and the gas supplied to the Warrnambool Portland region from the small gas fields in the Otway Basin. Suffice to say that these sources of gas supplied only minimal amounts of gas compared to Victoria's total requirements. The Wagga Wagga to Wodonga linkage effectively connects the supply basins of the Cooper/Eromanga in South Australia to the Gippsland Basin in offshore Victoria although the capacity of the pipeline is only small.

The gas disruption has had a major impact on Victorian industry and the broader economy. A number of reports have suggested the disruption has cost Victorian business about $1.3 billion as well as the massive inconvenience to householders. Victorian industries which had lost their energy source were forced to close and in addition component manufacturers and suppliers to Victorian industry in other States also had to close as there was no
demand for their products during this period. Businesses such as restaurants and hotels along with householders lost their energy supply for water, space heating and cooking.

What became obvious following this incident and the subsequent loss of gas supply was that Victorians had only very limited alternative supply. Supply up until the recent crisis has been continuing uninterrupted from the Esso/BHP joint venture for almost thirty years. During the crisis, the gas reserves were still in the gas fields and the gas distribution systems feeding gas supply to industry and domestic users were still intact. However, the gas processing plant at Longford, a vital link in the chain had been severely damaged. To make matters worse, although only one of three plants exploded (No. 1 plant), vital infrastructure necessary for the operation of the two other plants (Nos. 2 and 3) was damaged. Hence, it was not a matter of simply isolating the damaged plant and continuing to operate the other two plants.

The Victorian Government along with business and the public have a heightened sense of importance of energy security following the crisis, and are likely to pursue options to improve security and alternative options.

Esso/BHP first discovered oil and gas in the Gippsland Basin in 1965 and have a virtual monopoly of supply from this Basin. The Victorian Government is looking to develop other supply options such as an expansion of the present New South Wales gas linkage to enable increased flows of gas from this pipeline if required. Furthermore, a connection with the Victorian southwestern transmission network would allow gas to flow into the main transmission networks from the Otway Basin. Gas supplied from the Gippsland Basin could be stored in suitable sedimentary traps (using reinjection technology) in the Otway Basin and drawn upon if required. Another option that has been put forward by Epic Energy is a plan to eventually continue the Moomba sourced gas from Murray Bridge through Mount Gambier and into southwestern Victoria. This would join the Mount Gambier linkages into southwestern Melbourne.

The underlying rationale of the national restructuring process currently underway is to provide both cheaper gas prices together with alternative and competing sources of supply. At this stage Australia is well behind the United States and other European countries which presently have an interlocking network of pipelines and multiple suppliers. However with continuing progress with the restructuring process in Australia and actions likely to follow in response to the Victorian crisis, alternatives and options will be advanced at a quicker pace than they may have been.

Implications of the Victorian Crisis for Other States

Could an explosion and fire similar to the one that paralysed Victoria's gas supply happen in South Australia and subsequently disrupt supplies from the Cooper/Eromanga Basin to South Australia, Queensland, New South Wales and the Australian Capital Territory?
While nothing is impossible, the producing companies maintain that in the event of a major mishap, supplies would be maintained.

On the surface however, the systems seem vulnerable. There is a one main supplier, and a single processing plant.

The good news is that a number of commentators say the circumstances are different from those in Victoria. The pipelines from Moomba are long and have many days, if not weeks, of supply in the pipelines themselves. If there was a problem at the supply end, the gas contained in the pipeline would be sufficient to continue supply with prudent supervision, whilst repairs were made at the supply end of the chain. The long pipelines are termed 'line-pack' in that they are a source of gas storage in themselves.

Some major facilities are also dual powered. The Torrens Island (electrical power station) in South Australia, for example, is gas fired but can switch over to fuel oil if required.

Other States will be very mindful however of the Victorian situation and would aim not to be dependent on a single source monopoly supply. Plans such as the building of the Chevron PNG pipeline bringing gas from PNG, reducing the dependence of Queensland and, to some extent New South Wales and the Australian Capital Territory on Cooper/Eromanga Basin gas will significantly reduce supply vulnerability. In addition, the building of the pipeline from Longford to Wilton (and connecting Gippsland Basin gas to New South Wales and indirectly to Queensland and South Australia) will add much needed security to these two States.

Supply

Reserves and Resources

Australia has large resources of natural gas. As at the end of 1997 Australia's proven and probable reserves stood at 92 800 petajoules (PJ) with potential additional resources of 29 700 PJ, enough to satisfy Australia's current consumption and export markets for over one hundred years at current levels. However, the gas reserves and resources are distributed unevenly throughout Australia, with the bulk of reserves located offshore from northwest Australia (Carnarvon and Browse Basins), well removed from Australia's industrial and domestic markets. The largest onshore accumulation of gas reserves and resources occur in the Cooper/Eromanga basins (4425 PJ) in northeast South Australia and southwest Queensland and it is this source that currently supplies the largest domestic gas markets that are located in South Australia, the Australian Capital Territory, New South Wales and Queensland. Present initiatives, such as the release of tenement areas and the further development of natural gas pipeline infrastructure aimed at fostering further
exploration for and development of gas reserves, may result in additional gas discoveries in South Australia. Considerable potential gas resources exist in eastern Australia in the form of the little yet utilised coal bed methane deposits in the Bowen and Sydney basins in Queensland and New South Wales. Furthermore, the building of the proposed PNG Chevron pipeline linking PNG to North Queensland (which is much closer geographically that the Eromanga/Copper Basin gas fields) and the industrial areas of Townsville and Gladstone substantially strengthens Australia's access to gas reserves if supplied at acceptable prices. The gas reserves in the central highlands of PNG in excess of 9000 PJ outlined to date are of similar magnitude to that contained in Australia's Gippsland Basin.

Basin Developments

Exploration and development is being undertaken in all gas producing basins in Australia. Presently the bulk of proven reserves are located in the Carnarvon and Browse Basin in offshore Western Australia. Other large gas accumulations that occur away from large centres of population include the Kutubu gas field in the central highlands of Papua New Guinea and the Bonaparte Basin offshore from the Northern Territory.

Whilst there are opportunities for extending gas reserves in eastern Australia, especially in the Cooper/Eromanga Basin where increased competition will begin in earnest in early 1999, there will come a time early in the new millennium when gas will need to be transported from west to east to satisfy demand.

Pipeline Interlinkages

In a major study of gas supply and demand undertaken by the Australian Gas Association, it was concluded that eastern Australia will require additional supplies of gas within the region (including increased production from existing basins and coal seam methane) to meet projected forecast demand between 2000 and 2008. Only preliminary work has been undertaken at this stage to determine the size and extent of coal bed methane deposits. Furthermore there will be a need for longer distance supplies (outside the region) to meet forecast demand to 2030. Options include offshore Western Australia, offshore Northern Territory and Papua New Guinea. Broad directional arrows rather than pipeline linkages are shown on Map 2 to illustrate this notion.
Estimated Australian Gas Reserves as at 31 Dec 1996 = 92063 PJ (BAS 1998)

October 1998

Existing pipelines
Planned pipelines
Reserves are shown as a percentage of total reserves.

From offshore Western Australia and Northern Territory

Potential gas sources for Eastern Australia

Natural Gas: Energy for the new millennium

Source: Modified from Australian Gas Association

Map 2: Potential gas sources for Eastern Australia
Demand

Consumption of natural gas in Australia has increased by 16 per cent from 707 PJ in 1993 to 817.8 PJ in 1997. Consumption of natural gas by market segment for the years 1993 to 1997 is shown below in Table 1.

Table 1: Natural gas use (PJ)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial</td>
<td>309.2</td>
<td>327.2</td>
<td>338.2</td>
<td>336.1</td>
<td>355.0</td>
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<tr>
<td>Commercial</td>
<td>39.6</td>
<td>40.1</td>
<td>43.3</td>
<td>45.7</td>
<td>46.5</td>
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<tr>
<td>Residential</td>
<td>97.8</td>
<td>96.2</td>
<td>104.7</td>
<td>111.3</td>
<td>112.8</td>
</tr>
<tr>
<td>Mining</td>
<td>103.1</td>
<td>105.4</td>
<td>117.3</td>
<td>130.4</td>
<td>133.1</td>
</tr>
<tr>
<td>Electricity generation</td>
<td>136.4</td>
<td>146.3</td>
<td>167.4</td>
<td>151.6</td>
<td>147.6</td>
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<tr>
<td>Transport</td>
<td>6.5</td>
<td>7.8</td>
<td>8.8</td>
<td>9.3</td>
<td>10.6</td>
</tr>
<tr>
<td>Other</td>
<td>14.4</td>
<td>13.8</td>
<td>13.4</td>
<td>12.7</td>
<td>12.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>707.0</td>
<td>736.8</td>
<td>793.1</td>
<td>797.1</td>
<td>817.8</td>
</tr>
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</table>


The industrial sector accounting for 355 PJ or 43 per cent of the total in 1997, was by far the largest end use segment. Other major end use sectors include electricity generation, mining and minerals processing, the residential sector and the commercial sector. Consumption of natural gas in Australia is projected to increase around threefold by 2030. The continuing development and construction of pipelines and competitive marketing both in the upstream and downstream gas sectors will provide the necessary infrastructure and mechanisms for increased demand. It can be convincingly argued that, in addition to the continuing advantage in price that gas currently has in terms of comparable energy delivered per unit of price in comparison to electricity, gas also has environmental advantages. For example, gas has a clean and environmentally friendly energy label in comparison with many other energy sources and emits lower carbon dioxide per unit of energy produced than all of the other fossil fuels. A major gas market is developing with future electricity generating plants being gas driven in preference to coal power.

It is clear from the figures above that the bulk of gas usage is in industrial markets, largely for process heating, followed by gas powered electricity generation, mining and minerals processing and the residential sector. There has been growth in all of these sectors over the years 1993 to 1997. According to the AGA, there were almost three million gas customers in Australia in 1996–97, comprising 2.9 million residential customers, 80,621 commercial and 8,812 industrial customers.

The AGA projects gas demand will continue to grow through the years to 2029–30 and predicts gas usage to be 1495, 1642 and 2112 PJ in the years 2004–05, 2009–10 and 2029–30 respectively. Growth from 1996–97 to 2029–2030 is projected to be 258 per cent.
The above AGA study show that growth over this lengthy time frame is expected to be strongest in the cogeneration and gas powered electricity generation sector. Growth in this sector is expected to increase by 363 per cent to 536 PJ by 2029–30.

Prices

Gas is a relatively cheap energy source and is used industrially, commercially and by householders for a range of uses including process heat, electricity generation, water and space heating and cooking. Demand for natural gas is largely dependent on population and industrial complexes and the major part of demand comes from the eastern Australian seaboard.

Average natural gas prices for the years 1992–93 to 1996–97 are shown in Table 2.

The prices for the three sectors, namely industrial, commercial and residential show marked divergences with industrial prices being less than half the price of residential prices. Commercial prices are around 80 per cent of residential prices.

Table 2: Average natural gas prices 1992–93 to 1996–97 ($/Gigajoule)

<table>
<thead>
<tr>
<th>Year</th>
<th>NSW</th>
<th>Vic</th>
<th>Qld</th>
<th>WA</th>
<th>SA</th>
<th>NT</th>
<th>ACT</th>
<th>Weighted average</th>
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<tbody>
<tr>
<td>Residential</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1993</td>
<td>12.29</td>
<td>8.43</td>
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<td>12.51</td>
<td>9.06</td>
<td>17.52</td>
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<td>12.44</td>
<td>na</td>
<td>10.31</td>
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<td>1996</td>
<td>12.91</td>
<td>9.15</td>
<td>18.6</td>
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<td>13.37</td>
<td>19.5</td>
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<tr>
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<td>na</td>
<td>15.09</td>
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<td>20.00</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>1993</td>
<td>9.58</td>
<td>6.6</td>
<td>12.63</td>
<td>14.32</td>
<td>6.89</td>
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<tr>
<td>1997</td>
<td>9.44</td>
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<td>12.98</td>
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<tr>
<td>Industrial</td>
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<td></td>
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<tr>
<td>1993</td>
<td>5.24</td>
<td>3.67</td>
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<tr>
<td>1994</td>
<td>5.21</td>
<td>3.75</td>
<td>7.11</td>
<td>3.71</td>
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<td>7.73</td>
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<tr>
<td>1995</td>
<td>5.04</td>
<td>3.76</td>
<td>7.04</td>
<td>3.61</td>
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<td>8.35</td>
<td>4.27</td>
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<tr>
<td>1996</td>
<td>5.13</td>
<td>3.71</td>
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</tr>
<tr>
<td>1997</td>
<td>5.25</td>
<td>3.68</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>9.18</td>
<td>4.38</td>
</tr>
</tbody>
</table>

a: Average prices are based on gross utility value divided by volume of utility sales. They should not be interpreted as tariffs or contract prices. Note: weighted average is calculated by use in each State times price divided by number of States. 1992–93 = 1993, na not available, np not published.


The above tabulation shows little change in the average weighted annual prices for the years 1992–93 through to 1996–97 for the commercial and industrial sectors and a slight rise in the residential sector. There is a marked variation in prices between the States with
Victoria exhibiting the cheapest prices for all classes of customers and Northern Territory being the dearest.

Comparative analysis by the Australian Gas Association (AGA) of gas and electricity prices for residential and commercial customers, indicated that gas prices were around 2.5 times cheaper than for the equivalent electricity prices in terms of per unit of delivered energy in 1996–97.

There are many claims and counter claims regarding the cost competitiveness of competing energy sources and it remains a continuing difficulty for all energy users (industrial, commercial and householders) to accurately compare costs of different energy sources. One of the main reasons for this difficulty is the use of different energy units in the different energy industries, namely the kilowatt hour (kWh) for electricity and the megajoule (MJ) for gas.

For broad comparative purposes only, household users in the Australian Capital Territory are presently paying 1.0274 cents per MJ to AGL Retailing for gas in comparison to paying 8.22 cents per kWh to ACTEW for electricity.

Using a conversion factor of

\[
1 \text{kWh} = 3.6 \text{MJ}
\]

natural gas is 2.2 times \((8.22/1.0274 \times 3.6)\) cheaper than electricity for the delivery of an equivalent energy unit in the Australian Capital Territory.

It must be noted that various tariffs are available for different users. Industrial tariffs are considerably lower than household tariffs. Also, many electricity users have access to cheaper off-peak tariffs (for part of their total electricity usage) that are considerably cheaper than the peak load tariffs. As a general rule, industrial users of both gas and electricity are charged considerably lower tariffs because of their much higher usage.

**Liquefied Natural Gas**

The Liquefied Natural Gas (LNG) export industry is of great importance to Australia. The development of the LNG sector followed the development of the natural gas fields on the North West Shelf (offshore northwestern Australia) for the Western Australian market. The reserves of natural gas, discovered in the early 1970s, were substantial and as such were found to be able to support a sizeable export LNG business in addition to the supply of natural gas to the West Australian market. The North West Shelf project has been Australia’s largest resources development involving capital expenditure of around $12
Natural Gas: Energy for the New Millennium

billion to date. The first phase of development involved construction of one of the world's largest capacity offshore gas production platforms, North Rankin A. The LNG development was undertaken by a consortium led by Woodside Petroleum Ltd, the same consortium with some additional participation as had developed the natural gas industry for the domestic Western Australian market. Other project participants include BHP Petroleum (North West Shelf) Pty Ltd, BP Developments Australia Ltd, Chevron Asiatic Limited, LNG (MIMI) Pty Ltd and Shell Development (Australia) Pty Ltd.

Australia's LNG industry began in 1989 when the first cargoes of LNG were shipped from the North West Shelf to Japan. Cooling natural gas in what is called a processing train to minus 161 degrees celcius produces LNG. The gas is changed from the gaseous state to liquified form and maintained at atmospheric pressure at this temperature. The volume is reduced to one six hundredth and is transported in purpose built ships. On arrival at its destination, LNG is regasified in specifically built receiving stations and made available for use in either power generating plants or for distribution.

The LNG is presently a $1.5 to $2 billion a year business. In 1985, and extending into the next four years, the first two of an eventual three LNG processing trains, four LNG storage tanks and a loading jetty were built. Following commencement of LNG exports to Japan in 1989, construction of a third LNG processing train was completed in 1992 and the project's second offshore platform, Goodwyn A, commenced production in early 1995.

Australia's contribution to the world LNG trade, through the North West Shelf gas project in Western Australia, is currently around 7.5 million tonnes per annum and accounted for around 11 per cent of the world trade and 14 per cent of the regional trade in Asia in 1996. The North West Shelf joint venture has 20 year contracts with eight Japanese utilities.

The joint venture is assessing the potential of extending the term of existing LNG contracts beyond 2009 and of expanding sales from as early as 2003, with the addition of the construction of LNG trains 4 and 5. This project would involve capital expenditure in the vicinity of $8.5 billion. Basic engineering design is proceeding to schedule and once these two larger trains with an additional 3.4 million tonne capacity are operational, the total LNG capacity of the joint venture would be increased to 14.3 million tonnes and export earnings could double to just under $4 billion per annum. Recent market developments have cast some doubt on the scheduling of this expansion and the joint venture partners have conceded the dates may need to be pushed forward.

A major LNG proposed development, the WAPET $9 billion Gorgon LNG venture will tap into gas fields that have been discovered some 400km to the west of the present North West Shelf fields. Production is unlikely to begin prior to 2004. One positive recent development for this venture, together with further proposals to establish LNG ventures in the Timor Sea, has been the announcement of the Chinese Government's commitment to LNG as a fuel source for Guangdong province in southern China. China has flagged a demand of some 3 million tonnes of LNG per annum from 2004-05 and Australia is a
preferred source. The Gorgon venture however would require larger contract volumes than 3 million tonnes to justify such a huge development.7

A further proposed LNG development is a 3.5 million tonne a year project in association with the committed condensate and LPG project which is expected to start up by early 2002 based on the Undan-Bayu fields in the Timor Sea. Project participants include BHP Petroleum and Phillips Petroleum of the US.

At present Australia is one of only nine countries that export LNG and there are only 10 importing countries. However, several other countries are expected to enter the industry either as producers or consumers or customers over the next several years. Japan and Korea are the two largest importers of LNG, accounting for 58 and 14 per cent respectively.

Conclusions

The Victorian gas crisis caused by a plant explosion at Longford in September 1998 has had a major negative impact on the Victorian economy and the broader economy as a whole. Victorian industries which lost their energy source were forced to close and component manufacturers in other States were also forced to close as there was no demand for their products. The crisis clearly demonstrated the vulnerability of a supply system of an essential service with no alternative options. The Victorian Government along with business and the public have a heightened sense of the importance of energy security following this crisis, and are likely to pursue options to improve security and alternative supply options.

The Australian gas industry is being subjected to major restructuring, somewhat akin to the Australian electricity industry. The restructuring process to date has involved the breakup of a number of the government owned single entity organisations into competing corporatised bodies, namely transmission, distribution or retailing businesses. Significant progress has been made in respect to 'third party access' legislation whereby independent operators negotiate on commercial terms to access transmission pipelines. However, many industry commentators have maintained that the pace of restructuring has been slow. National access legislation to gas pipelines, one of the primary initiatives in the industry restructuring process which is not as yet finally concluded, was originally envisaged as being completed by June 1996. Little progress has been made to date on the issue of reform of the upstream sector although development in South Australia relating to the relinquishment of long held exploration tenements is a positive step.

Australia has abundant reserves and resources of natural gas although they are unevenly distributed across the country. The bulk of reserves are located offshore from northwestern Western Australia (Carnarvon and Browse basins), well removed from Australia's industrial and domestic markets. Australia has much more gas than it does petroleum on
which it is now partly import dependent. The largest onshore accumulation of gas reserves is in the Cooper/Eromanga basins in central Australia. The reserves of both the Cooper/Eromanga and Gippsland basins are considerable but could be depleted substantially at present rates of consumption by around 2020. At that stage unless substantial new reserves are found, gas will need to be transported either from Western Australia, the Timor Sea or from Papua New Guinea (PNG) or a combination of any of these (see Map 2).

Australia has an extensive network of pipelines covering Australia (see Map 1) with three distinct interconnecting networks:

- the eastern Australia network incorporating South Australia, New South Wales, the Australian Capital Territory, Queensland and Victoria
- the central network incorporating the Northern Territory, and
- the western network incorporating Western Australia.

These pipeline networks are not presently linked. A number of new pipelines and extensions to existing pipelines have recently been built and a number of major new pipelines are planned. The Australian Gas Association states that at present new pipeline proposals totalling some 11 000km in length are at various stages of consideration. If all of these projects proceeded, it would entail an investment of around $6 billion.

Consumption of natural gas in Australia is projected to increase around threefold by 2030. Gas has environmental advantages in addition to a price advantage relative to electricity, both of which will be increasing drivers for gas industry expansions. The continuing pressure brought about by the need to limit greenhouse gas emissions following the Kyoto and Buenos Aries Conventions favours the development of gas powered power stations over coal fired power stations.

The NWS is Australia's single and major exporter of liquefied natural gas (LNG). The project depends on continuing growth markets in both Japan and other Asian countries, in particular Korea. There are potential new markets in China although the possible development of nuclear power plants in Japan is a negative for the expansion of the Australian LNG export business.
Endnotes


Appendix 1: Exponential units and conversion factors

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Prefix</th>
<th>Exponential</th>
</tr>
</thead>
<tbody>
<tr>
<td>k</td>
<td>kilo</td>
<td>$10^3$</td>
</tr>
<tr>
<td>M</td>
<td>mega</td>
<td>$10^6$</td>
</tr>
<tr>
<td>G</td>
<td>giga</td>
<td>$10^9$</td>
</tr>
<tr>
<td>T</td>
<td>tera</td>
<td>$10^{12}$</td>
</tr>
<tr>
<td>P</td>
<td>peta</td>
<td>$10^{15}$</td>
</tr>
<tr>
<td>E</td>
<td>exa</td>
<td>$10^{18}$</td>
</tr>
</tbody>
</table>
Appendix 2: Industry structure on a State-by-State basis

Victoria

The Esso/BHP joint venture found oil and natural gas in the Gippsland Basin off the southeast coast of Victoria in 1965 and subsequently began producing natural gas for the Victorian Government's Gas and Fuel Corporation of Victoria (GFCV) in 1969. The joint venture has been supplying gas to the GFCV and more recently to one of the corporatised components, VENCorp. The joint venture has had a near monopoly of gas supply to Victoria since 1969 and up until the recent gas crisis, no major security issues arose.

Production

The Esso/BHP joint venture produces over 98 per cent of Victoria's gas. The rest comes from gas reserves in the Otway Basin located offshore in Western Victoria, which supply gas to Warrnambool and Portland. Esso/BHP also operate the major processing plant at Longford near Sale in Victoria. This plant processes all of the Gippsland Basin gas prior to transmission and distribution. Cutlus Petroleum owns and operates a small on-shore production facility at Port Campbell, which processes the gas from the western Victorian Otway Basin field.

Transmission, Distribution and Retailing

From 1 July 1997 the GFCV was broken up into a number of components. These include a transmission operator, Transmission Pipelines of Australia (TPA); three distributors namely Westar, Stratus and Multinet; and three gas retailers namely Kinetik Energy, Energy 21 and Ikon Energy. The distributors and retailers presently have designated franchise areas. TPA has a 1600km network of transmission pipelines in Victoria. The provision of overall regulatory control and management is provided by a new created entity, namely the Victorian Energy Corporation (VENCorp).

A new regulatory framework was recently established in Victoria to give customers protection in terms of price and service. The independent Office of the Regulator General (ORG) will regulate service and pricing of the three gas distributors and retailers while the Australian Consumer and Competition Council (ACCC) will regulate gas transmission.
South Australia

The South Australian Gas Company Ltd (SAGASCO) was established in 1861 and from 1863 began supplying what is called town gas produced from the burning of black coal. Supply of gas from the Cooper/Eromanga Basin began in 1969 following the building of the Moomba to Adelaide pipeline by SAGASCO. Boral Limited purchased SAGASCO from the South Australian Government in 1993.

Production

Gas from the Cooper Basin is produced by a joint venture in which Santos Ltd is the operator and major partner in the joint venture and the associated processing plant located at Moomba. Gas from the Cooper/Eromanga Basin is supplied via pipeline to South Australia, Queensland and New South Wales. Boral Energy Resources operates the Katnook gas fields which supplies gas to Mount Gambier and Katnook in the Otway Basin off the southeast coast of South Australia.

Transmission, Distribution and Retailing

South Australia is mainly supplied from gas reserves in the Cooper/Eromanga Basin. Gas taken from the Queensland portion of the basin is transmitted to Moomba by pipeline owned by the South West Queensland (SWQ) Joint Venture and operated by Santos. The pipeline from Moomba to Adelaide is owned and operated by Epic Energy.

Natural gas is retailed in South Australia by Boral Energy Limited and distributed by Envestra Ltd. Envestra was formed in August 1997, when the natural gas distribution networks of Boral, the Gas Corporation of Queensland (GCQ) and Centre Gas Pty Ltd were combined into one organisation. Envestra owns and operates around 8500km (around 6500km of pipelines in South Australia) of natural gas distribution networks in South Australia, Queensland and the Northern Territory supplying around 400 000 customers. Envestra has contracted Boral Energy Asset Management Ltd (BEAM) to operate, maintain and expand its distribution networks.

New South Wales and the Australian Capital Territory

New South Wales is the only mainland State that produces no natural gas. All gas used in New South Wales and the Australian Capital Territory comes from the Cooper/Eromanga Basin located in northeast South Australia and southwest Queensland from a consortium dominated by Santos Ltd.
Gas consumed in New South Wales is transmitted from the Cooper/Eromanga Basin by the Moomba/Sydney pipeline. The pipeline is owned and operated by East Australia Pipeline Limited (51 per cent owned by AGL in conjunction with TPA Victoria, 49 per cent) and all distribution lines both within New South Wales and the Australian Capital Territory are owned by AGL Limited.

Gas is marketed in New South Wales and the Australian Capital Territory by AGL Retail Energy, a fully owned subsidiary of AGL Limited. AGL Limited connected its 750,000th and 60,000th customers respectively in New South Wales and the Australian Capital Territory during 1996–97.8

Queensland

Queensland is a State of Australian gas industry firsts: Australia’s first discovery of natural gas was in Roma, Queensland in 1899. Australia’s first commercial gas-fired power station was located in Roma, in 1961. Queensland was the first State to reticulate natural gas, which began when the pipeline from Roma to Brisbane was officially opened in March 1969.

Production

Gas is supplied to Queensland from both the Cooper/Eromanga Basin in South Australia and southwest Queensland and the Bowen/Surat Basin in southeast Queensland.

In the Cooper/Eromanga Basin in southwest Queensland, production licences are held mainly by Santos, Esso and Boral Energy Resources, with Santos the dominant partner in the joint venture and operator of the gas production and the Moomba processing facilities for the joint venture. The joint venture also treats gas imported at its Moomba plant from the Jackson field in southwest Queensland en route to Adelaide and Sydney.

Queensland also has large reserves of coal seam methane, that is methane gas encased in pockets and preferential layers within the coal seams. The tapping and subsequent use of coal seam methane has decided environmental benefits in addition to the economics of using a product now largely wasted during coal production. Methane is a particularly potent greenhouse gas and its use is far preferential to its venting. Supplies of coal bed methane are extensive and are yet to be fully evaluated. A 21km pipeline from the Moura mine to the PG&E Queensland pipeline was commissioned in December 1995 for the express purpose of linking coal bed methane gas into the Queensland pipeline networks. Coal bed seam methane was supplied for the first time in February 1996.
Transmission, Distribution and Retailing

The Moomba (SA) to Ballera (Qld) pipeline is operated by Santos Ltd. A 756km pipeline from Ballera to Wallumbilla was completed by Epic Energy in late 1996, connecting the Cooper/Eromanga Basin gas fields to Brisbane and a new pipeline from Ballera to Mount Isa was completed by AGL Pipelines in 1998. The Wallumbilla to Gladstone and Rockhampton pipeline is owned and operated by PG&E Queensland Gas Pipeline. The PG&E Queensland Pipeline also connects the Denison Trough (supplying coal bed methane gas) in the Bowen Basin to Rockhampton and Gladstone.

A central southern pipeline extending from Gilmore to Barcaldine is owned and operated by Energy Equity Ltd.

Natural gas is distributed in Queensland by both Allgas Energy Ltd and Boral Energy Ltd, a wholly-owned subsidiary of Boral Ltd. Allgas distributes to south Brisbane, the Gold Coast, Toowoomba and Oakey, whilst Boral Energy distributes to north Brisbane, Ipswich, Gladstone and Rockhampton.

Local Government authorities distribute gas in Roma and Dalby. Natural gas is purchased from producers in the Cooper/Eromanga basin and the Surat Basin.

Western Australia

In 1966 WAPET discovered gas in the Perth basin and, following the building of the Dongarra to Perth pipeline, began supplying gas to Perth in 1971. Since that time the massive North West Shelf (NWS) oil and gas fields in the Carnarvon Basin have been developed. Supply of natural gas to Perth from the NWS Project began in 1984 and liquefied natural gas exports began in 1989. The NWS Project, incorporating a domestic gas supply plant and a major natural gas liquefaction and export facility has been Australia's single largest resource development to date. The project is operated by Woodside Petroleum Limited.

Production

The Carnarvon and Perth Basins provide most of Western Australia's gas supply. In the Carnarvon Basin the Goodwyn and North Rankin fields are operated by Woodside as part of the North West Shelf (NWS) Gas Project. The project has two parts: the domestic gas market and the LNG export market. The Carnarvon Basin also contains the Tubridgi gas field which is operated by Boral Energy Resources Ltd, the Harriet gas field which is operated by Apache Oil Australia Pty Ltd and the Griffin field which is operated by BHP.
Gas is also supplied to Perth from the Perth Basin. The Woodada, Beharra Springs and Dongarra fields are located onshore in the Perth Basin, between Perth and Geraldton. The Woodada field is operated by Consolidated Gas. Beharra Springs is operated by Boral Energy Resources. The Donagara licence is held and operated by CMS Energy Corporation.

Transmission, Distribution and Retailing

Western Australia is mainly supplied by gas from the offshore fields in the Carnarvon Basin via the 1530km Dampier to Perth pipeline and extending to Bunbury to the south of Perth. This pipeline was purchased by Epic Energy from Alinta Gas in March 1998 for $2.4 billion. A pipeline also owned by Epic energy runs further north from Dampier to Port Hedland where it supplies gas to the Port Hedland power station.

Another major pipeline, some 1380km in length, extends from Dampier on the northwest coast of Western Australia to Kalgoorlie. This pipeline is owned by the Goldfields Gas Transmission Joint Venture and was completed in 1996 and operated is by AGL Pipelines (WA).

Gas is distributed to over 364 000 domestic, commercial and industrial customers in Western Australia by the state-owned corporation, AlintaGas, which began operation on 1 January 1995. Gas was previously distributed before that time by Australia’s only dual energy distributor, the State Energy Commission of Western Australia (SECWA).

The 219km pipeline from Karratha to Port Hedland was sold by Pilbara Energy Pty Ltd (a subsidiary of BHP) to Epic Energy (Pilbara Pipeline) Pty Ltd in March 1998. Epic Energy plans to construct a 24 km extension from the NWS facilities on the Burrup Peninsula to the inlet for the Karratha to Port Hedland pipeline, to enable natural gas to be supplied to the BHP hot briquette iron plant.

Northern Territory

The Northern Territory’s first gas discoveries were made in the mid 1960s. The Mereenie field was the first of these fields to be discovered (1964) followed by the discovery of the Palm Valley field (1965). These fields are located 250 and 150km west of Alice Springs respectively.
Production

Natural gas in the Northern Territory is mainly supplied from the Amadeus Basin located to the south of Alice Springs. Gas is supplied to Alice Springs and Darwin via transmission pipeline. Gas is supplied by a joint venture comprising Magellan Petroleum Australia Ltd and Santos Ltd. Production from the Palm Valley gas field to fuel the Alice Springs power station began in 1983.

Ninety nine per cent of gas presently used in the Northern Territory is for electricity generation, and 95 per cent of electricity is generated using gas. The remainder is reticulated by Centre Gas, a subsidiary of Boral Ltd, to commercial and residential customers in Alice Springs and by NT Gas in Darwin.

The Northern Territory also has extensive and as yet undeveloped gas fields located offshore in the Bonaparte Basin to the southwest of Darwin. The two major fields discovered to date are the Petrel gas field discovered in 1969 and the Tern field discovered in 1971.

Transmission, Distribution and Retailing

NT Gas Pty Ltd, on behalf of the Amadeus Gas Trust, operates the transmission pipeline some 1557km in length and one of the longest in Australia carrying gas from the Amadeus gas fields to Darwin. NT Gas is 96 per cent owned by AGL Ltd.

The 146 km pipeline from the Palm Valley gas field to Alice Springs is also operated by NT Gas on behalf of Holyman Limited.

In March 1996 natural gas was reticulated in Darwin for the first time, when NT Gas began distribution to customers in Darwin’s Trade Development Zone.

In addition to gradually increasing demand in the major population centres, projects such as the development of the McArthur River Mine which uses gas to supply on site power necessitated the building of a spur transmission line from Daly Waters to McArthur River. The power station is operated by Energy Developments Limited for the Northern Territory’s Power and Water Authority.

Glossary

augmentation
Additional capital works undertaken to increase capacity.

cogeneration
The generation of electricity as a by-product of another process in the industry. It involves the recovery of heat or primary energy that would otherwise be wasted.

'covered' pipelines
Pipelined covered under the National Access Code.

distribution
The process of transferring gas via low pressure pipelines from the city gate to the consumer, whether it be industrial, commercial or household.

downstream
The sector incorporating transmission, distribution and retailing of natural gas.

joule
A basic unit of energy within the SI system and used extensively in the natural gas industry. It is defined as the energy conveyed by one watt of power for one second. For unit multiples see Appendix 1.

linepack
Gas quantities contained within the pipeline.

natural monopoly
Arises where the entire output of a market can be supplied at a lower cost by one supplier than by any combination of two or more firms. Reflects the presence of economies of scale and or/scope.

processing train
Processing plant where natural gas is converted to LNG.

ring-fencing
The internal separation of business functions within an enterprise for management and accounting purposes.

reinjection
The process of pumping gas back underground into either previously depleted gas fields or other porous sedimentary layers.

transmission
The process of transferring gas via high pressure pipelines from the processing facility located at or adjacent to the gas fields to the city gate.

third party access
The process whereby a gas producer or purchaser gains access to processing, transmission and distribution systems on fair, reasonable and commercial terms in order to market competing supplies of natural gas.

town gas
A manufactured gas produced from the burning of coal.

upstream sector
The sector incorporating exploration for and development of natural gas deposits.