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**M. J. Kimber Consultants Pty. Ltd.**



**DEVELOPMENT OF AUSTRALIA'S NATURAL  
GAS RESOURCES:**

**A POSSIBLE MODEL FOR CARBON CAPTURE  
TRANSPORTATION  
&  
STORAGE**

**for**

**Commonwealth Department  
of  
Resources Energy & Tourism**

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# DEVELOPMENT OF AUSTRALIA'S NATURAL GAS RESOURCES: A POSSIBLE MODEL FOR CARBON CAPTURE & STORAGE

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## 1 INTRODUCTION

Australia's natural gas industry began in October 1900 when gas was discovered in a water bore near the hospital in the town of Roma in Queensland. Encouraged by this unexpected gas find, petroleum exploration proceeded spasmodically in the Surat Basin and other basins in Australia through to the 1950s. However, it was not until the 1960s that gas was found in any significant quantities. Moderate to large gas reserves were found during 1960 to 1965 in Surat (Queensland), Gippsland (offshore Victoria), Cooper (South Australia), Perth (Western Australia) and Amadeus (Northern Territory) basins. A few years later, gas reserves were found in the Carnarvon (Western Australia) and the Otway (Victoria) basins.

None of these gas finds was able to be commercialised without the strong support of governments – either directly, with significant amounts of government ownership or supply underwriting, or indirectly through facilitation of land access and support for major gas consumers.

This report will describe the role of governments in the development of the Australian natural gas industry in some detail and, in a more general sense, government roles in the industry in North America, United Kingdom and France.

The report will then explore the pros and cons of government involvement in the carbon capture, transport and storage industry and the roles government might take in terms of investment, ownership of assets and, most importantly, the ways in which government might bear the start up and underwriting risks in what will be initially a high risk, low return environment.

### 1.1 Brief from DRET

M.J. Kimber Consultants Pty. Ltd. was asked by the Department of Resources Energy and Tourism (DRET) to prepare a report that addressed:

1. Brief history and commercial development of major gas fields in Australia (all relevant jurisdictions);
2. Brief background on commercial and political drivers for gas field development;
3. History of commercial and political drivers for gas pipeline development, including financing, contracts, government guarantees and special purpose legislation;
4. Identification of constitutional issues that have had an impact on gas pipeline development;
5. History of economic regulation of gas pipelines, including reference to legislation;
6. History of technical regulation of gas pipelines, including reference to legislation;

7. Discussion of the transition of the natural gas pipeline industry from largely government ownership and control to the private sector, including legislative actions;
8. Brief review of the history of gas transmission in the USA, Canada and the UK, drawing parallels with Australia where appropriate; and
9. Drawing on history and experience, provision of a summary of options that may be available for the development of pipelines for carbon dioxide.

## 2 EXECUTIVE SUMMARY

The development of the natural gas industry in Australia and in many other first world economies was initiated and sustained by mostly direct, and sometimes indirect, government involvement. This involvement was necessary to mitigate what private firms would regard as unacceptable risks. Governments also decided that the ready availability of a very flexible and valuable energy source was essential for the development of their economies, the improvement of the standards of living for their populations, and the provision of services and infrastructure for the long term benefit of their constituents.

Governments' involvement was seldom criticised by their constituents, even when inefficiencies were pointed out by market economists. In most cases the state-owned corporations were profitable and provided a strong revenue stream to assist consolidated revenue. Governments usually secured windfall gains when the state-owned corporations were privatised – the Victorian government was particularly successful on this score.

In most cases, the initial financing of the state-owned corporations was not a charge against the government's budget – financing was done via the issue of government guaranteed bonds or debt underwritten by government. Once the state-owned corporation began to get significant cash flow in excess of its costs, this cash was re-invested in new infrastructure works to extend its network and improve its market share against alternative fuels.

In the case of the natural gas industry, the pipeline cost was often paid directly by government, and the government-backed "take-or-pay"<sup>1</sup> gas supply contracts with the private sector exploration and production firms underwrote their ability to raise debt and equity. In short, the government back-stopped all costs of setting up the infrastructure.

Thus, it would seem logical that if government wants to mandate CO<sub>2</sub> capture, transport and storage for all CO<sub>2</sub> emitters in a clearly risky economic environment, even in good economic times, then government should underwrite the infrastructure necessary to implement that mandate.

M.J. Kimber Consultants Pty. Ltd. suggests that only government, and most appropriately, the Commonwealth, can initiate this process using an approach similar to that adopted by the Commonwealth's Pipeline Authority in 1973, or South Australia's Pipelines Authority of South Australia in 1967.

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<sup>1</sup> A take or pay contract implies that a party contracts to pay for the supply of a good or service, irrespective of the amount of the service that that party actually takes. Such contracts guarantee a revenue stream for the counterparty and thus a risky project being developed by the counterparty can be banked.

In summary, the various parts of the value chain – capture, transport and storage – could be set up as follows:

- A statutory authority could be established to manage the commercial transactions of the value chain and build, own and operate the main transport links between source and storage, comprising inlet and intermediate compressors, long distance pipeline and associated facilities;
- Carbon capture processing plants should be integrated with the source of CO<sub>2</sub> for operational reasons, so it is apparent that these plants should be owned and operated by or on behalf of the source owner – either state governments or private sector;
- The source owner would enter into a contract with a government owned “waste disposal” firm to take away the CO<sub>2</sub> for a price that should, in the long term, compensate the government firm for the cost of building and operating the inlet compressors, the pipeline system and associated facilities.
- The government firm would then enter into take-or-pay contracts with the sequestration field owner and operator for disposal of the CO<sub>2</sub>. This will represent a pass-through cost to the emitter for actual quantities of CO<sub>2</sub> put into storage. The government would take the volume risk on both the pipeline and the storage

The government-owned statutory authority that was charged with the responsibility of building and operating the CO<sub>2</sub> transport system could raise funds by issuing bonds – perhaps called “Green Bonds” or “Carbon Bonds”. The latter name is perhaps a better marketing option since it could be related to the strength of a carbon bond in a diamond, or a manifestation of the stability of putting the CO<sub>2</sub> away for ever.

Financing might also be available by the use of Infrastructure Bonds, in a form similar to those that were issued in the 1990s for large investments in pipelines, roads and water projects. These offered significant taxation advantages for investors.

The finance industry complained some years ago when the sale of Treasury Bonds ceased, and perhaps these Carbon Bonds could fill that gap, provide some security for investors who are spooked by the stock market and, since the Carbon Bonds will be outside government's budget appropriations, they might draw less political heat than if the CCS were to be funded directly from the budget.

The government might see that the issue of bonds provides some political advantages in that they do not appear in the deficit, although they do represent a government liability.

In the long term, and when the financial climate is right, the assets that comprise the CCS value chain could be privatised and the bonds redeemed in the same manner in which the natural gas industry was privatised after some 20 years of public ownership.

As to technical matters, it is clear that the current Australian standards<sup>2</sup> for the design, construction and operation of petroleum pipelines can be directly transferred to all facets of design, construction and operation of CO<sub>2</sub> pipelines, with only minimal changes to context, not basic engineering and technological matters, provided the appropriate research is done to underpin the specific engineering, technology and safety aspects for CO<sub>2</sub>.

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<sup>2</sup> The relevant over-arching standard is *AS2885 Pipelines – gas and liquid petroleum*

All Australian jurisdictional legislation that addresses technical matters for petroleum pipelines can be easily adjusted to accommodate CO<sub>2</sub> pipelines, since, under a CoAG agreement<sup>3</sup> all jurisdictions are required to use the Australian standard as the reference point.

Economic regulation has been applied in a coordinated way (through CoAG) to gas pipeline systems since 1997. This form of regulation can best be described as “cost of service” price setting, where the regulator determines what the regulatory value of an asset is, whether new capital investments are “prudent” and, most importantly, the rate of return that the pipeline owner is permitted to earn. While this approach is probably appropriate for large stable, well established networks with little growth and predictable throughputs, it is not applicable to pipelines and facilities where their throughputs are very uncertain, expansions are significant and costs are not predictable; that is, in circumstances that are likely to be encountered in the early years of the development of a carbon capture, transport and storage network.

If the carbon capture, transport and storage network is privatised, an economic regulatory regime may be appropriate, but it needs to be applied with care and in clear recognition of the riskiness of the environment. A better solution would be the development of a clearly defined policy of transparency of process for tariff setting in association with guaranteed non-discriminatory access, such as that which was applied to Duke Energy’s Eastern Gas Pipeline in 2000.

### **3 DISCOVERY & DEVELOPMENT OF AUSTRALIA’S GAS FIELDS**

Australia’s gas discoveries and developments have been typified by a significant amount of state parochialism. No cross border gas sales were made until 1976, when gas from the Cooper Basin was delivered to Sydney – after the Premier of Victoria had stepped in to prevent Esso-BHP from selling Gippsland Basin gas to New South Wales at a price lower than that negotiated for Victorians.

So in order to understand the development of the natural gas industry, one must address Australian state politics and the role of governments in attracting industrial development and providing services to their constituents without necessarily benefiting the nation as a whole and often distorting price signals in the process.

This section addresses the history of each significant gas producing basin in Australia and how it was developed, with a view to showing the importance of government intervention in kick-starting energy developments and how this intervention has been slowly and unevenly withdrawn, leaving some parts of the industry still beholden to governments, if not directly, then through complex economic regulation.

All jurisdictions in Australia have been directly or indirectly involved in all gas developments, despite beliefs to the contrary that most have allowed private industry to provide the infrastructure. The involvements vary from outright ownership of all infrastructure downstream of the gas processing plant to the customer’s premises, to the requirements on statutory authorities to write contracts with producers and pipeline companies to underwrite field development, pipeline construction and power station

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<sup>3</sup> Hobart, 25 February 1994, CoAG agreed that: In relation to free and fair trade in gas the Council (inter alia) [they would] adopt AS 2885 to achieve uniform national pipeline construction standards.

construction. In some cases there was considerable coercion of large gas consumers to take gas supplies to provide support for the infrastructure provided by the government.

This section addresses gas developments in each jurisdiction (except ACT<sup>4</sup>) and explains the various methods by which those jurisdictions developed gas industries in their areas of influence and includes comments on the following issues:

1. Brief history and commercial development of major gas fields in Australia (all relevant jurisdictions);
2. Brief background on commercial and political drivers for gas field development;
3. History of commercial and political drivers for gas pipeline development, including financing, contracts, government guarantees and special purpose legislation;

The gas producing basins and their corresponding markets to be addressed are, in order of development:

<b>Gas Producing Basins and Markets</b>	<b>1<sup>st</sup> Year of Operation</b>
1. Surat Basin and supply to Brisbane via the Roma to Brisbane Pipeline	1969
2. Gippsland Basin and supply to Melbourne via the Longford to Dandenong Pipeline	1969
3. Cooper Basin and supply to Adelaide via the Moomba to Adelaide Pipeline	1969
4. Perth Basin and the supply to Perth and Pinjarra via the Dongara to Pinjarra Pipeline (a.k.a. WANG, now Parmelia Pipeline)	1971
5. Cooper Basin and supply to Sydney via the Moomba to Sydney Pipeline	1976
6. Amadeus Basin and supply to Alice Springs via the Palm Valley to Alice Springs Pipeline	1983
7. Carnarvon Basin and supply to south west WA via the Dampier to Bunbury Pipeline	1984
8. Amadeus Basin and supply to Darwin via the Palm Valley to Darwin Pipeline	1986
9. Bowen-Surat Basin and Denison Trough supply to Gladstone via the Queensland State Gas Pipeline	1990
10. Gas supply to Tasmania from the Gippsland Basin	2002

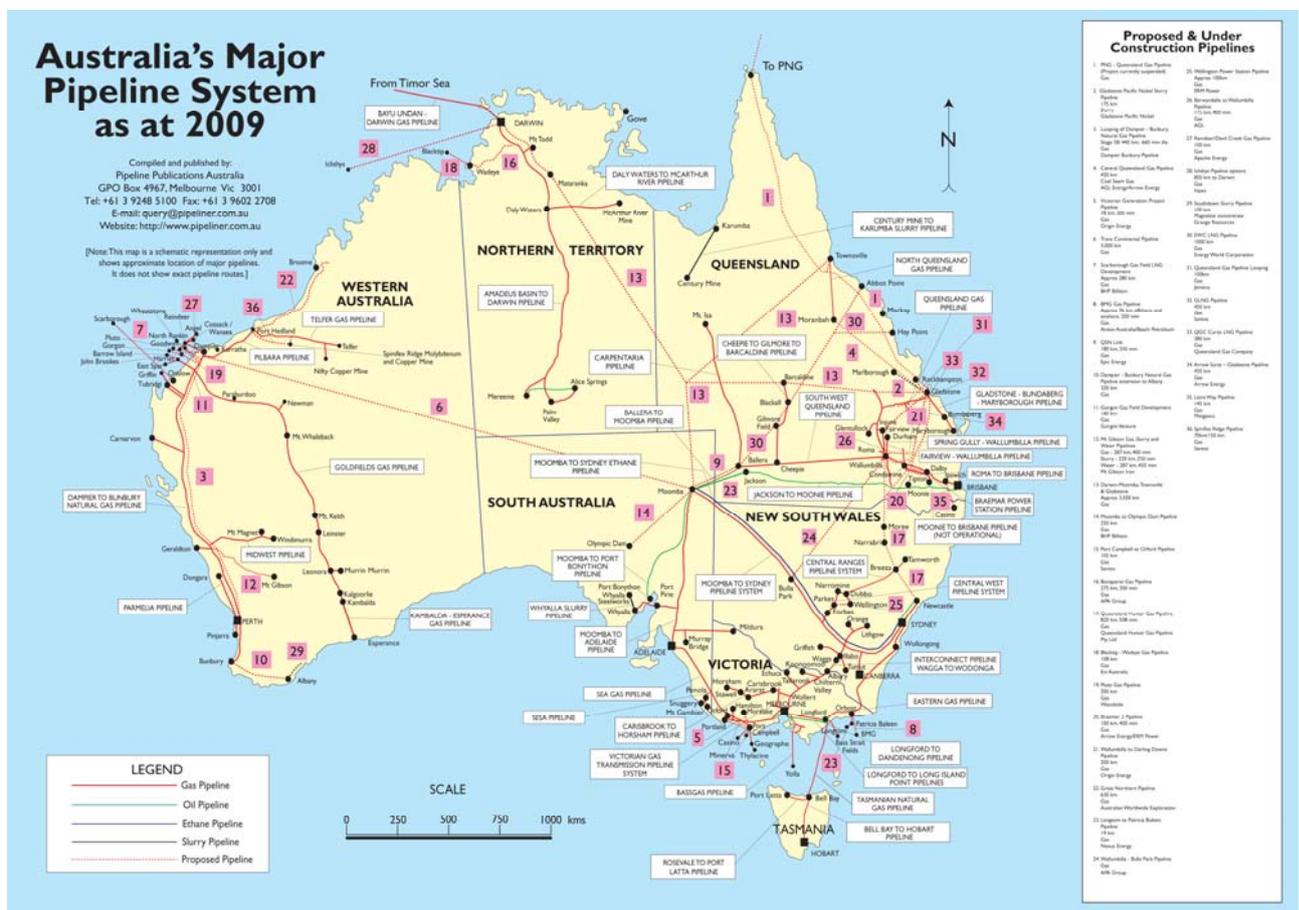
The locations of these gas fields and the corresponding pipeline networks associated with them are shown in Figure 1. The chronology and details of the initial gas finds are shown in Table 1

<sup>4</sup> ACT government offered significant inducements to AGL to reticulate gas in ACT and the Commonwealth Pipeline Authority built the lateral pipeline from the Moomba Sydney Pipeline.

Table 1 - Significant gas discoveries in Australia, 1960 - 1980

Basin	Year of discovery	Discovery Well
Surat	1960	Pickanjinie 1
Cooper	1963	Gidgealpa 2
Gippsland	1965	Barracouta 1
Perth	1964	Yardarino 1
Amadeus	1965	Palm Valley 1
Bonaparte	1969	Petrel 1
Carnarvon	1971	North Rankin 1
Browse	1971	Scott Reef 1
Otway	1979	N. Paaratte 1

Figure 1 Natural gas and liquid petroleum pipelines in Australia



Kimber Consultants acknowledges the *Australian Pipeliner* and Pipeline Publications Australia for permission to use this map

### 3.1 Surat Basin and supply to Brisbane via the Roma to Brisbane Pipeline – 1969

The Surat Basin had been known as a gas and oil prone region since 1900, when, near the town of Roma, a water drilling rig struck gas. However, apart from a brief period of

production of gas in 1906, for street lighting and underwritten by the Roma Town Council, the Surat Basin's gas resources were not commercially developed until 1969.

By 1965, Associated Australian Resources<sup>5</sup> (AAR) and its predecessor companies had defined gas reserves<sup>6</sup> of about 120 PJ<sup>7</sup>. It was determined that this would be adequate to supply domestic markets in Brisbane, Ipswich and Toowoomba, but inadequate to justify a 440 km pipeline from Roma to Brisbane.

By 1967, the Queensland government had persuaded the Dow Chemical Company and Swift & Company to build a nitrogenous fertiliser plant at Gibson Island on the Brisbane River. It was to have used naphtha as a feedstock, but the possibility of a natural gas supply at possibly lower and more stable prices encouraged the developers of the plant to negotiate for gas supply from AAR. This opportunity, together with a contract with Allgas Energy for domestic gas supply, and an offer from the Queensland government to facilitate land access and other incentives, encouraged AAR to enter into a contract for the supply of around 30 PJ over a period of 15 years. AAR formed a joint venture with South Union Gas Company of Texas, USA, to establish Associated Pipelines and to commit to building a pipeline from Roma to Brisbane.

It might be said that this was an entirely private enterprise, but the Queensland government provided a great number of incentives in the background and there was strong commercial support through a take-or-pay contract with the fertiliser plant.

Since the Roma to Brisbane Pipeline was built, it has continued to be expanded and has passed through a number of owners (CSR, AGL and APA Group) and it continues to be a commercial success, based entirely upon bi-lateral gas transportation contracts with robust counter-parties to underwrite the debt on the pipeline – specifically, the capacity expansions.

### **3.2 Gippsland Basin and supply to Melbourne via the Longford to Dandenong Pipeline - 1969**

Gas was first discovered in commercial quantities in the offshore Gippsland Basin on 18 February 1965 in the Barracouta 1 well.

The Gas and Fuel Corporation of Victoria, a Victorian state government public authority, established by the Gas and Fuel Corporation Act of 1950<sup>8</sup>, had been keeping a close eye on the exploration of the Gippsland Basin and initially began talks with Esso in October 1965 and subsequently with BHP when the latter secured its 50% interest. Esso was keen to develop the gas on its own terms and to deal directly with industrial consumers. However, the then Premier of Victoria, Sir Henry Bolte stepped in during 1966, with a pre-emptive move on both the Gas and Fuel Corporation and Esso with the direction, subsequently enforced by legislation that<sup>9</sup>:

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<sup>5</sup> AAR was made up of Australian Associated Oilfields (AAO) and Associated Freney Oil Fields (AFO) and Union Oil Group

<sup>6</sup> *Petroleum in Australia – the First Century* published by APEA, ISBN 0 90827 14 0, 1988, p.313

<sup>7</sup> PJ = petajoule or approximately 1 billion cubic feet (bcf) of natural gas (coal seam or conventional)

<sup>8</sup> Enacted by the Victorian Parliament on 6 December 1950

<sup>9</sup> Proudley, R., *Circle of Influence – A History of the gas industry in Victoria*, Globe Press Pty Ltd, ISBN 0 909905 06 3, 1987

- (a) The producer would not be permitted to sell gas to industry in Victoria, except to associated companies of the producer.
- (b) The producer would not be permitted to sell Victorian gas to other States at a field price lower than that agreed with the Corporation.

A letter of intent was finally agreed to in March 1967 with a view to commencement of supply in March 1969.

The Victorian government rejected the Gas and Fuel Corporation's proposal to build the transmission pipeline from the Esso-BHP gas processing plant at Longford; instead it established an independent statutory authority, the Victorian Pipelines Commission, funded from the State budget, with the Gas and Fuel Corporation acting as an engineering consultant. History records this as a very uneasy relationship, particularly in respect of haulage tariffs charged by the Victorian Pipelines Commission. The two state government owned public corporations were represented by very strong, competitive and feisty chief executives, with threats of duplication of each other's transmission pipelines.

In the event, the Gas and Fuel Corporation "won" and in 1971 the Act that established the Victorian Pipelines Commission was repealed and its assets assumed by the Gas and Fuel corporation.

### 3.2.1 Comments on the role of government in the development of the Victorian natural gas industry

It must be said that there was much wastage of effort in this whole process, which could have been avoided by sensible government policy. However the Victorian Government profited immensely from its ownership of the Gas and Fuel Corporation and the one-sided contract negotiated between the Corporation and Esso-BHP. The gas purchase price at the processing plant was set at what, at the time, seemed to be a relatively high price (higher than the Cooper Basin price), but which rapidly became a very low price during the oil price crisis in the 1970s. Further, a large proportion of the contracted quantity was at a fixed price, with no escalation.

Only some of the benefits of this low price were passed on to customers. As part of the enabling Act for the Corporation, the Victorian government levied a "tax" on it, which, by 1996 was nearly \$1 billion per year<sup>10</sup>. The Hilmer reforms of the 1990s and the privatisation of the Victorian gas and electricity industries changed that.

Despite all the inefficiencies in the emergence of the natural gas industry in Victoria, it is clear that the benign monopoly rights conferred on the Gas and Fuel Corporation (and to a lesser extent, the Victorian Pipelines Commission) facilitated a high level of penetration of natural gas into Victoria, and the complex network of pipelines that were built by the Corporation from its strong revenue flow and enhanced by its excellent lobbying skills still serves the state well. These assets and their earning capabilities resulted in a very high price when the Corporation's assets were privatised in 1997.

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<sup>10</sup> Referred to as the Public Utilities Contribution and levied on the State Electricity Commission as well.

### 3.3 Cooper Basin and supply to Adelaide via the Moomba to Adelaide Pipeline – 1969

Gas was first discovered in the Cooper Basin by Delhi Corporation (in a joint venture with South Australian and Northern Territory Oil Search (SANTOS)) at the Gidgealpa 2 well in December 1964. It should be noted that the Gidgealpa 1 well was dry, and it was only after some encouragement by the South Australian government that Delhi Corporation continued its exploration program with the spudding of Gidgealpa 2.

Within a short time, five more wells were drilled in the Gidgealpa field to prove that it was a commercial find. By 1968, the Moomba gas field had been found and determined to be commercial also.

At that time the South Australian government was wrestling with the future of its electricity supplies. Additional generating capacity was needed and yet South Australian had no more developable coal resources – expansion of the Leigh Creek coal field was deemed uneconomic, nuclear power was being considered and imported NSW coal was discounted because of previous supply issues during miners' strikes. Gas provided an ideal alternative.

The possibility of a new source of fuel for power generation was very attractive to the South Australian government. It was a rapid convert to the advantages of natural gas, and was determined to do all it could to develop its local resources.

#### 3.3.1 Comments on the role of government in the development of the South Australian natural gas industry

The South Australia government enacted the Natural Gas Authority of South Australia Act<sup>11</sup> in mid 1967, for that Authority to buy and sell petroleum and to own and operate an 800 km pipeline from Moomba to Adelaide, with the prime purpose of supplying gas to the newly built Torrens Island electricity generating station. In enacting this legislation, the South Australian government sought and received Loan Council approval for an allocation of \$20 million and additional grant funding of \$15 million.

The Natural Gas Authority of SA was a statutory authority with representatives of the gas producers and its customers on its board.

The South Australian Government, through the Electricity Trust of South Australia and the Natural Gas Authority, entered into a long term take-or-pay contract with the Cooper Basin partners (principally Santos and Delhi) for the purchase of about 2,000 PJ for 25 years. This enabled the partners to begin development of the Moomba and Gidgealpa gas fields and to design and build a gas processing plant to remove carbon dioxide, water and other contaminants from the gas stream.

It is likely that the Cooper Basin gas fields would not have been developed until very much later, were it not for the direct and substantial involvement of the South Australian government, through the combination of a large take-or-pay contract for gas supplies and the use of statutory authorities to provide the infrastructure.

These underpinnings (and contract for supply of gas to NSW) also allowed Santos and its partners to develop the Cooper Basin liquids scheme in the 1980s. However, these

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<sup>11</sup> This Authority was renamed the Pipelines Authority of South Australia under amended legislation

developments occurred after the South Australian government became directly involved in exploration and production through the purchase, in 1975, of the Commonwealth's 50% interest in Delhi's Cooper Basin production interests and 25% of its exploration interests.

The Commonwealth had bought into a financially troubled Delhi in 1974, through the Commonwealth's Petroleum and Minerals Authority (a Rex Connor creation to "buy back the farm") but was forced to divest its share when the High Court determined that the enabling act for the Petroleum and Minerals Authority was unconstitutional.

The South Australian government retained its share of the ownership of Delhi until 1981, when CSR purchased Delhi.

In 1995, the South Australian government sold the assets of the Natural Gas Authority of SA (then called Pipelines Authority of South Australia) to Tenneco Energy (US based gas pipeline firm) for \$304 million.

### **3.4 Perth Basin and the supply to Perth via the Dongara to Pinjarra Pipeline (a.k.a. WANG or Parmelia Pipeline) – 1971**

Gas was found by Western Australian Petroleum (a joint venture between Ampol and Caltex and known as WAPET) in the northern on-shore section of the Perth Basin near Geraldton in the Yardarino 1 well in 1964, and subsequently, commercial reserves were proved up at nearby Dongara.

In 1969, the Western Australian government entered into a State Agreement with Western Alumina N.L. through legislation entitled *Alumina Refinery (Pinjarra) Agreement Act (WA) 1969* for the latter to establish an alumina refinery at Pinjarra, to process bauxite from nearby deposits.

The Western Australian government provided significant incentives to Western Alumina in respect of land, railways and other transport and port developments. The government also undertook to facilitate the supply of natural gas to the company.

In the event, Western Alumina contracted for the supply of gas from WAPET, which partly underpinned field development and the construction of a pipeline from Dongara to Pinjarra, via Perth and Kwinana. The Western Australian government's State Electricity Commission was encouraged to enter into a contract for gas supply to its Kwinana electricity generating station.

#### **3.4.1 Comments on the role of government in the development of the Western Australian Perth Basin natural gas industry**

The Western Australian government was not directly involved in the development of the Perth Basin other than through its statutory authority, the State Electricity Commission of Western Australia (SECWA), as the purchaser of a proportion of the gas supply by means of a long term take-or-pay contract for fuel for the Kwinana electricity generating station. The government was much more directly involved in the development of the Carnarvon Basin's North West Shelf gas in the 1980s.

### 3.5 Cooper Basin and supply to Sydney via the Moomba to Sydney Pipeline – 1976

When the Victorian government refused to allow Gippsland Basin gas to be delivered to New South Wales markets, the proponent, the Australian Gas Light company (AGL), turned to South Australia's Cooper Basin and obtained permission from the then Premier of South Australia, Don Dunstan, to secure a minimum of 2,000 PJ from gas fields within South Australia (and some small fields that crossed the Queensland border).

The Cooper Basin partners entered into a Letter of Agreement with AGL in 1971 for a 30 year supply of gas under take-or-pay arrangements and AGL commenced planning for a the Moomba to Sydney Pipeline. Little progress on land acquisition and design had been made on the pipeline by the time the Whitlam Labor government was elected in 1972. Immediately after that election, the Commonwealth began plans to develop a gas pipeline transmission system owned and operated by a Commonwealth statutory authority – the Pipeline Authority. The first pipeline in this network was to be the Moomba to Sydney Pipeline.

The *Pipeline Authority Act* was enacted in May 1973 and the resulting statutory authority, the Pipeline Authority, began work on taking over, on behalf of the Commonwealth, all the contracts, intellectual property and designs developed by AGL. These activities were financed by loans from the Commonwealth.

The take-over process was rancorous and pitted government against the private sector, but despite this, the Moomba to Sydney Pipeline went into service in December 1976, having been delayed by about 6 months, not by the bickering, but due to severe flooding along the pipeline route from the Cooper Creek at Innamincka to the Lachlan River at Condobolin.

#### 3.5.1 Comments on the role of government in the development of the New South Wales natural gas industry

Clearly, the direct involvement in the Moomba to Sydney Pipeline by the Commonwealth's Pipeline Authority was significant. It enabled AGL to be removed from the difficulties of raising debt in the difficult mid-1970s and all debt was priced based on the Commonwealth's AAA rating. The initial loans from Treasury were re-financed in the 1980s by the issue of Pipeline Authority Bonds with terms of 5 to 10 years. All expansions of the Moomba to Sydney Pipeline were financed similarly in the private debt market, and supported by the Commonwealth's credit rating. Thus the cost of debt was minimised and this benefit was passed on to AGL.

AGL also had the benefit of support from the New South Wales government, in that gas prices to consumers were controlled by a relatively benign NSW Gas Council that was required to pass on AGL's costs to consumers, which it did without too much questioning.

There were significant benefits to New South Wales as a result of the delivery of natural gas to the Newcastle, Sydney and Wollongong regions, because gas for the domestic and commercial markets was being "manufactured" from naphtha, which was very expensive at the time, because of the so-called "oil price shock" of the 1970s. Fuels for industrial purposes were coal and fuel oil.

The Pipeline Authority was privatised in 1994. It was one of the first Commonwealth corporations to be privatised. Its assets were sold to a consortium of AGL (51%), Nova (a

Canadian pipeline company)(25%) and Petronas (Malaysian state-owned petroleum company)(24%) for \$534 million.

A subsidiary of the Pipeline Authority, Pacenco Pty Ltd, was instrumental in the development, design and construction of the Moomba to Botany Ethane Pipeline for ICI in the years 1993 to 1996. Thus, the Commonwealth provided a catalyst for further hydrocarbon development and utilisation in New South Wales and South Australia.

### **3.6 Amadeus Basin and supply to Alice Springs via the Palm Valley to Alice Springs Pipeline – 1983**

Natural gas was found by Magellan Petroleum in the Palm Valley 1 well in the Amadeus Basin, west of Alice Springs in 1964, but it was not until 1983 that these gas fields were developed as a source of fuel for the Alice Springs electricity generating station.

The Northern Territory government was directly involved in this gas development through what is now known as the Power and Water Authority (PAWA), the owner and operator of a small electricity generating station in Alice Springs. Prior to natural gas availability, this station was using distillate as fuel, which was becoming increasingly expensive, since it had to be brought Alice Springs by rail from Adelaide.

In 1983, the Northern Territory government called for expressions of interest for the supply of gas to the Alice Springs electricity generating station. Both the gas producers (Magellan et al.) and pipeline firms responded. In the event PAWA was required to enter into a 15-year take-or-pay contract with Magellan and its partners, and an outsider, TNT Bulkships, received the contract to build and operate the 145 km pipeline between the gas field and Alice Springs.

In 1993, a very small LNG plant was built in Alice Springs to supply LNG by road transport to Yulara under a 15 year, take-or-pay contract for fuel for PAWA's dual fuel electricity generating station at the Yulara tourist resort. The LNG plant is reported to produce about 3,000 tonnes of LNG per year.

A small amount of gas is reticulated to some parts of the town of Alice Springs.

#### **3.6.1 Comments on the role of government in the development of the gas supply to Alice Springs**

Neither the Palm Valley gas field, the pipeline to Alice Springs, nor the LNG plant would have been developed without government underwriting and support by means of long term take-or-pay contracts. These contracts allowed the developers of the resource and the pipelines to minimise equity contributions by providing de facto government credit support for large amounts of debt for field development and construction of pipelines and facilities.

### **3.7 Carnarvon Basin and supply to south west WA via the Dampier to Bunbury Pipeline – 1984**

Gas was first found in the Carnarvon Basin in the North Rankin field in 1971 by Woodside Petroleum and various partners. It was in moderately deep water some 135 km offshore and 1500 km from the nearest major domestic gas market. The prospect of the export of liquefied natural gas (LNG) was considered to be the only commercial option for

Woodside and its partners, but that would require substantial investment and may have been beyond a small company such as Woodside.

However, these were not the only impediments to development – the Whitlam Labor government’s Minister for Minerals and Energy, the Hon. R.F.X. Connor decided in 1973 that no export permit would be issued as part of his overall plan for the supply of North West Shelf gas to the eastern states via the so-called Trans-continental Pipeline. Hard-heads in the Commonwealth’s Pipeline Authority looked at the proposal for such a pipeline and determined that it would be sub-economic until, at the earliest, 2010, given the then current view of future gas demands and reserves and prospects in the Cooper-Eromanga, Gippsland, Bowen-Surat and Otway Basins. Despite this, the concept remained a policy fixture.

After the demise of the Whitlam government in 1975, Woodside and its partners reviewed the prospect of development of the North Rankin and adjacent fields in close association with the Western Australian Government for domestic gas supply. The gas fields in the north Perth Basin were being rapidly depleted and the Charles Court government was keen to develop a gas-based mineral processing industry in the south west of Western Australia, and to augment the state’s coal and oil based energy supplies with “cheaper” gas.

The Western Australian government’s State Electricity Commission of Western Australia was nominated to take the lead on negotiating a gas supply contract and to build a 1500 km pipeline from an on-shore gas processing plant near Dampier to Bunbury (adjacent to bauxite deposits and alumina refineries and passing major electricity generating stations and other industrial and mineral processing plants).

The State Electricity Commission of Western Australia became the State Energy Commission of Western Australia (SECWA) and in 1980, entered into 25 year take-or-pay contract with Woodside and its partners, while the latter attempted to raise the necessary finance, with the assistance of its joint venture partners. SECWA also encountered some difficulty with financing the pipeline (which ultimately cost around \$800 million) and looked at foreign sources of debt, which was linked to material purchase and construction contracts.

SECWA also entered into a foundation shipper take-or-pay contract with Alcoa for a significant portion of the pipeline’s capacity.

The contract between the North West Shelf partners and SECWA for the so-called “Dom(estic)Gas Project”, unwritten by the Western Australian state government provided the under-pinning for the LNG export project.

It was not all smooth sailing. Only about a year after the gas began flowing in 1984, it was clear to all concerned that the extremely bullish gas market forecasts were seriously in error. These forecasts had been incorporated in the contract between the North West Shelf partners and SECWA and the 95% take-or-pay requirement and modest gas banking rights left little margin for error. The state of Western Australia was at serious risk of default on that contract and the LNG export phase of the project was also at risk.

The WA state government called for the assistance of the Commonwealth to meet its obligations and to help with negotiations between the parties. In the event, the Commonwealth amended the *Petroleum (Submerged Lands) Act* in 1985 to hand over to the WA state government a guaranteed amount of \$117.1 million (\$1985) in royalty

payments over a 20 year period from 1985 to 2005. The Commonwealth also provided substantial taxation and other concessions (such as the ability to “park” gas finds for 15 years without proceeding with development) to the joint venture partners.

### 3.7.1 Comments on the role of government in the development of the gas supply to south west WA

From the evidence, it seems that the North West Shelf gas reserves would not have been developed in the 1980s without the financial support and extra-ordinary facilitation by both the Western Australian and Commonwealth governments. It is doubtful that any company would have had the requisite credit support to undertake such a large and risky project based upon an uncertain domestic demand.

Unfortunately for Australia, many aspects of the project were untidy, *ad hoc*, ill-considered and not necessarily good business practice; this resulted in unnecessary costs of many hundreds of millions of dollars of both government and investors’ money. Some of those problems continue today with on-going disputes on gas and pipeline haulage prices.

The lesson one can draw from this is that all aspects of a complex interconnected financial and engineering project must pass a robust business-case test. Market estimates must be sound (cautious, even), capital and operating costs must be well grounded in fact and experience, contracts must balance risk and reward and be sufficiently flexible to manage uncertainty.

Above all, such projects must be managed by professionals within a corporate structure who are free of political influence and are able to take both an overall view and yet manage details to ensure consistency within the complexity. Further, transparency and good governance are absolutely essential to such transactions.

## 3.8 Amadeus Basin and supply to Darwin via the Palm Valley to Darwin Pipeline – 1986

Gas was first found in the Amadeus Basin in 1964 – in two regions, Palm Valley (gas only) and Mereenie (gas and oil). The Palm Valley field was developed to supply Alice Springs in 1983. Several years later both fields were developed further to supply gas for electricity generation in Darwin. The project to develop the fields and to build and operate the 1500 km pipeline was underwritten by the Northern Territory government through its statutory authority, the Power and Water Authority (PAWA).

PAWA was planning to build a coal fired electricity generating station in Darwin until a consortium known as NT Gas, made up of Westpac Bank (then called Bank of NSW), AGL, CSR, Nabalco (owner of the alumina refinery near Nhulunbuy in East Arnhem Land), Moonie Oil (also known as International Oil, with interests in the Amadeus and Surat Basins) and Boral offered a pipeline from the Amadeus Basin, provided the Northern Territory would guarantee to cover all costs. The Northern Territory was attracted to this because a gas fired electricity generating station would be less expensive than a coal fired station – lower capital cost and lower fuel cost, given the cost of transport of relatively small amounts of coal by coastal shipping. This meant that the proponents – some of whom represented the gas producers – had a benchmark price and were able to ensure that the project was very attractive to investors.

NT Gas consortium took construction risk and then sold the pipeline to Australia's four major banks which entered into a leveraged lease arrangement with NT Gas, which then took on the role of the operator.

The financial arrangements were complex and turned out to be most beneficial to the owners and operator. The financial backstop was the Northern Territory government.

Gas reserves of the Amadeus Basin are dwindling and PAWA has sought supplies from the Black Tip gas field in the offshore Bonaparte Basin. APA Group has recently built a pipeline from the onshore gas processing plant at Wadeye (Port Keats) to meet the Amadeus Basin to Darwin pipeline near Katherine. Again, the pipeline was built with Northern Territory government guarantees through its Power and Water Authority.

### 3.8.1 Comments on the role of government in the development of the gas supply to Northern Territory

The Northern Territory government has played a pivotal role in the development of that territory's gas industry. Without its guarantees, it is doubtful that gas would be available in Darwin and other regional towns on the Stuart Highway. In a way, the development of the gas industry in the Northern Territory is similar to that of South Australia, except that the Northern Territory government did not invest in pipeline infrastructure, but it did underwrite the development through its statutory authority, PAWA, just as South Australia did through ETSA.

It is worth noting that the Northern Territory chose to go it alone on these projects – in both cases the Commonwealth's Pipeline Authority offered to build, own and operate the pipelines, but the then Country Liberal Party government of the Northern Territory chose a more ideologically consistent private industry approach that may have cost it more in terms of haulage tariffs.

## 3.9 Bowen-Surat Basin and Denison Trough supply to Gladstone via the Queensland State Gas Pipeline – 1990

The Queensland government has always been keen to encourage industrial and mining developments and have them base their operations in Queensland. Like most jurisdictions in Australia, Queensland was, and continues to be, prepared to offer significant incentives to achieve that aim.

Queensland Alumina Limited (QAL) in Gladstone was using large quantities of distillate for the refining of bauxite to produce alumina<sup>12</sup>. This represented a significant cost to QAL, and its international partners were suggesting that they might not proceed with certain expansion plans for the Gladstone plant if they had to continue to bear the high cost of distillate. Other mineral processing and chemical firms in the Gladstone/Rockhampton regions were also pressing for the government to do something about cheaper energy supplies.

In a departure from the National Party's predilection for the involvement of private industry in development, the then Queensland Government decided to build, own and operate a natural gas pipeline from Wallumbilla (near Roma) to Gladstone and Rockhampton via the Denison Trough (a productive part of the Bowen-Surat Basin

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<sup>12</sup> Coal is used for process heat. Distillate, and subsequently gas, were used for calcining the aluminium hydroxide to aluminium oxide.

between Injune and Rolleston). The pipeline was put into service in 1990 and called the State Gas Pipeline.

Funding for the pipeline was provided by Treasury and haulage tariffs were set at a level such that gas could be delivered to the customers in Gladstone and Rockhampton at prices just below the price of the distillate it replaced. The tariffs were reduced considerably when the pipeline was privatised in 1996 because they included a significant amount of economic rent.

### 3.9.1 Comments on the role of government in the development of the gas supply to Gladstone & Rockhampton

In building and owning the State Gas Pipeline, (now called the Queensland Gas Pipeline) the Queensland government was following in the footsteps of the Commonwealth, Western Australia, South Australia and Victoria.

The Commonwealth's Pipeline Authority also offered to build, own and operate this pipeline, but it was rebuffed, perhaps because the Pipeline Authority was a creation of the Whitlam Labor government. The Pipeline Authority's proposal would have offered lower gas haulage tariffs.

## 3.10 Gas supply to Tasmania from the Gippsland Basin - 2002

In 1998, Duke Energy bought the pipelines owned by Pacific Gas and Electric and commenced an expansion plan of entrepreneurial pipelines that included the Eastern Gas Pipeline to provide competition in the Sydney market. No extra-ordinary assistance was offered by either the Victorian or New South Wales governments – the usual development and environmental approvals were required.

Duke Energy also investigated supply of gas to Tasmania in 1999, at that time the only jurisdiction without gas supply. Duke Energy determined that the project would be sub-economic, but that if gas-fired generation could be established in Tasmania by converting the Bell Bay power station, then a pipeline that connected Tasmania to the mainland would provide a means of arbitraging electricity across Bass Strait and increasing the value of Tasmania's hydro electricity assets. Duke Energy was developing gas fired generation at Bairnsdale and Tallawarra which would form the other leg of the arbitrage arrangement.

In the event, the Tasmanian government directed its statutory authorities, Hydro Tasmania and Aurora to enter into a take-or-pay contracts for the transport of gas from Longford to Tasmanian markets.

Duke Energy was then prepared to take the remaining market risk. But this was undermined because the Tasmanian government underwrote the construction of the electricity cable between Tasmania and the mainland – Bass Link.

### 3.10.1 Comments on the role of government in the development of the gas supply to Tasmania

As a result of the provisions of support to both Bass Link and the Tasmanian pipeline, the Tasmanian government may have been left with some very large contingent liabilities, when support of one or the other would have resulted in significant benefits. The current owner of the Tasmanian pipeline may also be suffering some losses.

That said, it is very doubtful whether gas would have been supplied to Tasmania, were it not for the direct involvement by the Tasmanian government and its statutory authorities.

### **3.11 Other Developments encouraged or influenced by governments**

#### **3.11.1 Goldfields Gas Pipeline**

The Western Australian government was closely involved in the development of gas supply from the North West Shelf gas fields to the mineral province from Paraburdoo to Kambalda. The promoters of the pipeline were three mining companies, Western Mining Corporation, Normandy Mining and BHP Minerals. The mining companies were given considerable encouragement and facilitation through a State Agreement - *Goldfields Gas Pipeline Agreement Act 1994 (WA)* – in terms of approvals, zoning, land access, exemptions from state taxes etc. Other proponents were actively discouraged.

#### **3.11.2 SEA Gas Pipeline**

The South Australian government was very active in the development of a pipeline from the Otway Basin to Adelaide from 2000 to 2004. The primary proponents were Origin Energy and International Power, each of which had electricity generating stations in Adelaide (the former also had most of South Australia's retail gas customers). There was an attempt to exclude TXU, another electricity generator in South Australia, until that firm, in association with Duke Energy, attempted to develop an alternative pipeline.

The South Australian government intervened to encourage Origin and International Power to include TXU in its consortium and discouraged Duke Energy (not an Australian company).

In the event, the pipeline was built by the three proponents – and owners – Origin Energy, International Power and TXU (which became TRUenergy).

## **4 CONSTITUTIONAL ISSUES ON RESOURCE DEVELOPMENT**

There is always the threat that states' rights provided by the Australian Constitution will become an issue when the Commonwealth enacts legislation that proposes to take over activities that the states see as their responsibility, and over which they have sovereign rights. The creation of the Commonwealth Petroleum and Minerals Authority (PMA) under the *Petroleum And Minerals Authority Act (Cwlth) 1973* is a case in point. The PMA was created during the Whitlam Labor government with the intention of "buying back the farm" and to engage in extensive minerals and petroleum exploration and development.

### **4.1 The brief life of the Commonwealth's Petroleum and Minerals Authority**

PMA had wide powers to run a minerals and petroleum business:

Section 12 of the Act states, inter alia:

- (o) *to acquire, upon such terms as the Authority deems fit, an interest in-*
  - (i) *a mining undertaking that is being or is to be carried on the Australian continental land mass or elsewhere by another person or body; or*
  - (ii) *any undertaking other than a mining undertaking that is being or is to be carried on in Australia or elsewhere by another person or body and is an undertaking of a kind that the Authority is authorized by this Act to carry on;*

- (p) to lend moneys, upon such terms and conditions as the Authority deems fit, to a person or body carrying on or intending to carry on-
- (i) a mining undertaking on the Australian continental land mass; or
  - (ii) any other undertaking in Australia of a kind that the Authority is authorized by this Act to carry on,

for use by the body or person in connexion with that mining undertaking or other undertaking;

- (q) to underwrite issues of shares in, or debentures or other securities of, a company carrying on, or intending to carry on, an undertaking of a kind referred to in paragraph (p);
- (r) to enter into a partnership or arrangement for sharing the risks involved in carrying on operations by way of exploration for, or recovery of, petroleum or minerals, and for sharing the petroleum or minerals recovered in the course of carrying on the operations or the profits derived from carrying on the operations;
- (s) to give guarantees; and
- (t) to do anything incidental to any of its powers.

and:

(5) In this section "mining undertaking" means an undertaking in the course of which operations by way of-

- (a) exploration for petroleum or minerals; or
- (b) extraction of petroleum or minerals from its or their natural site, are, or are proposed to be, carried on.

These were very wide-ranging powers and none of the states was willing to have the PMA carry out any activities in their sovereign territories. PMA did begin some work in the Northern Territory (then controlled by the Commonwealth), but the states mounted a High Court challenge to the validity of the legislation

The action was primarily based on Section 57 of the Constitution that deals with the management of a Bill that passes the House of Representatives, but fails to pass the Senate, followed by a double dissolution and the reintroduction of the Bill to a joint sitting of both Houses that then passes the Bill. The action also relates to the Senate in its role as "States' House". In the event, the decision of the High Court was that it declared "*that the Petroleum and Minerals Authority Act 1973 is not a valid law of the Commonwealth.*"

## 4.2 Co-operation with the states and territories

It is therefore very important that any legislation that aims to adopt a "pan-Australian" approach that may appear to threaten the states' and territories' sovereign rights – as might be considered in the context of carbon capture, transport and storage – has to be managed through a co-operative approach, preferably through the Ministerial Council of Energy (MCE) and CoAG.

Aspects that have to be carefully considered include:

1. Subversion of mineral and petroleum exploration and production rights under state law;

2. Subversion of pipeline and electricity line easements and associated rights provided under state law
3. Pipeline licensing is a state issue, even under the Petroleum (Submerged Lands) Act, where states are often assigned administrative functions as a “Designated Authority”
4. Royalties – states and territories may have a view that, like minerals extraction, CO<sub>2</sub> storage might attract royalty payments, namely, the use of common property in the form of the subterranean strata.
5. Use of *Commonwealth Lands Acquisition Act (Cwlth) 1989* for pipeline easement acquisition and for gaining title to land for pump stations, gas field facilities
6. Conflict with mine subsidence legislation
7. Conflict with various environmental legislation.

It may be said that Commonwealth legislation takes precedence over that of the other jurisdictions, but this can always be tested by those jurisdictions in the High Court.

## 5 HISTORY OF ECONOMIC REGULATION OF GAS PIPELINES, INCLUDING REFERENCE TO LEGISLATION

Economic regulation of gas pipelines has been in place since gas distribution pipelines were first put in the streets of towns and cities of Australia. That regulation was mostly benign and usually addressed the price of gas at the retail customer’s cooker or water heater. The pricing methodology was almost always politically inspired and often adjusted in accordance with an electoral cycle.

In the early 1990s there was a move by the Hawke and Keating governments to put in place micro-economic reform to improve Australia’s economy, remove protectionism and address monopolistic practices by governments and those firms that benefited from government sanctioned monopolies.

In 1993 the Commonwealth Government commissioned a report<sup>13</sup>, the so-called “Hilmer Report”, into Australia’s competition policy, with particular emphasis on large infrastructure assets that could be said to exhibit the characteristics of a natural monopoly<sup>14</sup>, such as electricity and gas transmission and distribution systems. This enquiry resulted in a number of significant changes to the *Trade Practices Act (Cwlth) 1974* and the development of specific regulatory legislation for the gas and electricity industries.

During the mid-1990s and in parallel with changes to competition policy in the gas and electricity industries, the Commonwealth, Victorian, South Australian, Queensland and Western Australian Governments embarked on a program of privatisation of some or all of their energy infrastructure assets and retailers. Governments decided that regulation of these privatised natural monopolies was necessary.

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<sup>13</sup> Hilmer F.G., Rayner M.R., Taperell G.Q., National competition policy, Report by the Independent Committee of Inquiry, August 1993, AGPS

<sup>14</sup> By definition, a natural monopoly occurs when it would be socially wasteful for more than one entity provide a good or service (because, over the relevant range of output, costs decline, so that one entity can always provide the good or service at a lower cost than multiple entities).

## 5.1 Privatisation and regulation

A progressive sell-off of government owned energy businesses began in 1994, subsequent to the Hilmer report, along with an increasingly intrusive regulatory regime in the following manner:

- In 1994, the Commonwealth sold the assets of the Pipeline Authority – the Moomba to Sydney natural gas pipeline system;
- in 1995, the South Australian Government sold the assets of the Pipelines Authority of South Australia – the Moomba to Adelaide gas pipeline system;
- in 1996, the Queensland Government sold the Wallumbilla to Gladstone pipeline system;
- in 1998, the South Australian Government sold<sup>15</sup> the power station, transmission and distribution assets and the retail arm of the Electricity Trust of South Australia;
- in 1994 the Victorian Government split the Gas & Fuel Corporation into a gas transmission entity (Gas Transmission Corporation) and a gas distribution and retail entity (Gascor), the latter of which was split into three gas distribution firms and “stapled” gas retail firms as a pre-cursor to privatisation;
- in 1998-9, the Victorian Government sold the assets of the gas transmission entity and the three stapled gas distribution/retail companies. The distribution assets were separated from the retailing firms;
- during 1996-97, the Victorian Government also sold its electricity assets and retail businesses;
- during 1996 - 1997, the Commonwealth and the States of South Australia, Victoria, New South Wales and Queensland agreed to implement common legislation to set up a national electricity market and to allow interchange of electricity between these states and for price regulation – the so-called *National Electricity Law*;
- during 1997 -1998 the Commonwealth and all other jurisdictions except Tasmania, through the CoAG process agreed to implement a regulatory regime for gas transmission and distribution pipelines – the so-called *Gas Pipelines Access Law*. Tasmania joined this group when the prospect of a gas supply became a reality in about 2000; and
- During 2008 – 2009 there were changes to the *National Electricity Law* and *Gas Pipelines Access Law* in which the jurisdictions (except Western Australia) ceded their economic regulatory power to the Australian Energy Regulator (AER) and agreed to enact common legislation.

The AER regulates the wholesale electricity market and is responsible for the economic regulation of the electricity transmission and distribution networks in the National Electricity Market (NEM). The NEM is made up of all states and territories except WA and NT. Further to this, from 1 July 2008, under the *National Gas Law*, the Australian Energy Regulator is the economic regulator for covered natural gas transmission and distribution pipelines in all states and territories except WA. The

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<sup>15</sup> As a politically expedient policy, the power station assets were disposed of by means of long term leases

AER's functions and powers include monitoring compliance, investigations and enforcement of the market<sup>16</sup>.

The legislation and accompanying regulations were considered necessary to ensure that the owners of the assets (service providers) that could be called “natural monopolies” would be compelled to provide access to third parties and would charge access fees (tariffs) at prices set by a process of determining “efficient costs” to equate with “efficient prices”.

Implicit in Commonwealth’s and States’ competition reforms was an understanding that gas transmission and distribution pipelines and electricity transmission and distribution lines (“pipes and wires”) constitute natural monopolies and should be regulated, such that the owners would not seek monopoly rents and to minimise any incentive to build by-passes, thereby wasting scarce capital by duplication.

Further, competition policy reforms recognised that competition should be encouraged at both the supply and retail ends of the market.

The privatisation of the assets of a number of government owned corporations (GOC) prior to agreement between the States and Commonwealth on national regulatory codes for energy infrastructure, meant that each jurisdiction had to implement legislation unique to the assets being sold. For example, the Commonwealth enacted the *Moomba-Sydney Pipeline Sale Act* in 1994 and the South Australian Government amended the *Natural Gas Authority Act 1967* to facilitate the sale of the Moomba to Adelaide Pipeline. These Acts provided a regulatory framework (and hence financial expectations) for bidders and subsequent owners and their debt providers.

In February 1994 the members of the Council of Australian Governments (CoAG) agreed to the objective of achieving free and fair trade in natural gas by 1 July 1996. The primary aim of this plan was to implement a uniform national framework for third party access to natural gas pipelines by that date. However, the reform process faltered and it was not until 7 November 1997 that all members of CoAG settled on an agreement in respect of gas pipeline access. CoAG agreed that the South Australian Parliament would enact “lead” legislation that all other jurisdictions would follow.

During the period from November 1997 to November 1999, all jurisdictions enacted gas pipeline access legislation, based on the *Gas Pipelines Access (SA) Act 1997*. Western Australia chose to enact slightly different legislation that emphasised the roles of state based regulators and appeal mechanisms, rather than the ACCC and the Australian Competition Tribunal.

The application of regulation to gas transmission and distribution pipelines was very much “one size fits all”. All such pipeline systems that existed, or were under construction at the time, were deemed to be regulated by the jurisdictions.

Regulation on some pipelines and distribution systems has been revoked by means of a laborious process through the National Competition Council and jurisdictional Ministers. Only a few revocations have passed these hurdles, but they represented only one major pipeline where competition between pipelines was deemed to exist.

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<sup>16</sup> This paragraph is an extract from DRET Discussion Paper *Governance, Institutional, Legal And Regulatory Frameworks And Community Engagement* April 2009

Pipelines built since 2000, where they are not part of existing regulated pipelines, are not regulated. The failure of the National Competition Council to regulate the Duke Energy's Eastern Gas Pipeline, on the basis of an appeal in 1999 to the Australian Competition Tribunal, represented a watershed in what was previously thought to be an automatic application of regulation to all gas transmission pipelines<sup>17</sup>.

## 5.2 Limitations of economic regulation

It is widely accepted that regulation is a poor substitute for competition, but it does have some other down-sides, particularly in a fledgling industry, where the developers of assets must be able to take risks – make risky investments, estimate demands in new markets, design and build infrastructure using new technology – and be suitably rewarded.

At the time of the development of Australia's natural gas industry – 1965 to 1995 – governments were prepared to bear all, or most, of the risks. Governments were able to underwrite or guarantee debt, using government backed securities. They did not seek to secure a risk premium in their returns and were able to oversize pipelines and facilities to accommodate future market growth, without necessarily seeking an immediate return on that overcapacity.

Regulators often have a different view, driven by the application of cost of service pricing; pipeline capacity must be sized to provide for the pipeline's current throughput for a limited time horizon, additional capital invested by the regulated entity for future capacity cannot earn any rate of return until it is used, and then only at the weighted average cost of capital (WACC) that does not incorporate a credible risk premium. Further, the actual cost of debt is not accommodated by the capital asset pricing model (CAPM) used by regulators.

This disconnect is particularly serious at present (2009/10) because of a high level of risk aversion by lenders. Securing debt for financing a pipeline is expensive: high up-front fees and significant margin (e.g. 350 – 400 b.p. over 10 year bond rate).

Cost of service pricing cannot be satisfactorily applied to a high risk nascent industry, such as the carbon capture, storage and transport industry.

## 6 HISTORY OF TECHNICAL REGULATION OF GAS PIPELINES, INCLUDING REFERENCE TO LEGISLATION

Each of the jurisdictions has a "Pipelines Act" or "Petroleum Act" that defines the licensing requirements for natural gas pipelines. In most cases these acts also cover matters such as design, construction and operational standards, land matters, environment and safety. Currently, all jurisdictions refer to the Australian Standard AS2885 – *Pipelines – gas and liquid petroleum* as a single and sufficient standard<sup>18</sup>.

At its meeting in Hobart on 25 February 1994, the Council of Australian Governments agreed that:

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<sup>17</sup> Australian Competition Tribunal Duke Eastern Gas Pipeline Pty Ltd [2001] ACompT 2

<sup>18</sup> Some jurisdictions are wont to give the technical regulator licence to extend the requirements beyond those required by AS2885. This increases the costs of the pipeline owner and operator.

*In relation to free and fair trade in gas the Council (inter alia):*

5. *agreed to adopt AS 2885 to achieve uniform national pipeline construction standards by the end of 1994 or earlier.*

This underpinned the requirement for all jurisdictional legislation to require compliance with AS2885.

## **6.1 Australian Standards for petroleum pipelines**

The first petroleum pipelines built in Australia relied upon the American Society of Mechanical Engineers (ASME) Code for Pressure Piping-B31. Pipelines built to that standard included: Moonie to Brisbane oil pipeline and Roma to Brisbane, Longford to Dandenong<sup>19</sup>, Moomba to Adelaide, Dongara to Perth and Moomba to Sydney natural gas pipelines.

By 1976, Australia had developed its own standard, based on ASME Code for Pressure Piping B31, and legislation progressively adopted the Australian Standard as it evolved.

The current version of the Australian Standard for petroleum pipelines consists of 5 parts and several closely associated Standards:

- *AS 2885.0 – 2008 Pipelines – Gas and liquid petroleum – Part 0 General requirements*
- *AS 2885.1 Amdt 1 – 2009 Pipelines – Gas and liquid petroleum – Part 1 Design and Construction*
- *AS 2885.2 – 2007 Pipelines – Gas and liquid petroleum – Part 2 Welding*
- *AS 2885.3 – 2001 Pipelines – Gas and liquid petroleum – Part 3 Operations and Maintenance (Public Comment Draft expected mid 2009)*
- *AS 2885.4 – 2003 Pipelines – Gas and liquid petroleum – Part 4 Offshore Pipelines (Currently nearing public comment draft revision)*
- *AS/NZS 2885.5 – 2002 Pipelines – Gas and liquid petroleum – Part 5 Field Pressure Testing (Revision currently in preparation – Expected public comment draft early 2010)*
- *AS/NZS 1518 – 2002 External extruded high-density polyethylene coating for pipes*
- *AS/NZS 3862 – 2002 External fusion-bonded coating for steel pipes*
- *AS 4822 – 2008 External field joint coatings for steel pipes*

The Australian Standards for petroleum pipelines have been developed through comprehensive and rigorous co-operation between representatives of the pipeline industry, government technical regulators and materials manufacturers. Somewhat surprisingly, they do not represent a lowest common denominator approach. On the contrary, they are based on a sound foundation of basic and applied research from Australian, North American and European sources.

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<sup>19</sup> Plus some reliance on British Standards

A paper<sup>20</sup> to an international conference reported on the quality of the Australian Standard as follows:

*“The Australian Standard for petroleum pipelines has been bench marked against standards from USA, Canada, United Kingdom and the International Standards Organisation (ISO) and has been found to be superior in many detailed technical respects to its counterparts elsewhere, and that it better represents the current international state of the art in the design, construction, testing, operation and maintenance of petroleum pipelines.*

*It is accepted by all of the stakeholders as the single and sufficient set of technical requirements. It uses an integral risk assessment and threat mitigation process in design and for the whole of the life of the pipeline in operation and maintenance. It has explicit requirements for the design, documentation, and approval of key processes such as prevention of external interference, control of fracture, and welding procedure qualification. And it assigns responsibility for the key processes to suitably qualified, experienced, and trained people who take responsibility for their actions in writing. Amongst other reasons that has allowed the development of a world’s best practice Standard in Australia is the relatively small and agile committee process, and the involvement of many of the key contributors to the Standard in industry sponsored research projects. This involvement has simultaneously ensured that they are abreast of the latest developments, and that they are able to incorporate those developments in the Standard as and when they happen.”*

Recent work commissioned by the Australian Pipeline Industry Association’s Research and Standards Committee assessed the appropriateness of AS2885 for carbon dioxide pipelines.

That report<sup>21</sup> concludes:

*“..... while there are a number of matters that should be identified in the Standard for use with CO<sub>2</sub> pipelines, there are no substantial technical omissions. The research recommends the Committee responsible for AS 2885 introduces an informative appendix to AS 2885.1 as soon as practical, and that the current revision of AS 2885.3 include guidance on specific operating and maintenance matters for pipelines transporting CO<sub>2</sub>. In a future revision of AS 2885.1 consideration should be given to incorporating specific change to the body of the document. This research [paper] also identifies potential research to develop an understanding of dispersion of CO<sub>2</sub> from pipeline leaks or ruptures. This research will be useful in developing rules to manage the interaction between CO<sub>2</sub> pipelines and the population, and guidance in possible development of technical regulation.”*

## **6.2 Need for research to support the application of the Australian Standard to CO<sub>2</sub> Pipelines**

The above conclusion assumes that the reader understands the philosophy of the Australian Standard, AS2885, and should not be taken to mean that AS2885 can be simply applied to the design, construction and operation of CO<sub>2</sub> pipelines with negligible additional knowledge developed through research.

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<sup>20</sup> L. Fletcher, P. Venton, M. Kimber, I. Haddow, K. Bilston, *Australian Standard AS2885: A Modern Standard For Design, Construction, Welding, Operation And Maintenance Of High Integrity Petroleum Pipelines*

<sup>21</sup> Venton, P., Tuft, P., *Gap analysis for use of AS2885 for CO<sub>2</sub> pipelines*, Australian Pipeline Industry Association Research and Standards Committee, 16 March 2009

The Australian Standard, AS2885, is not a “recipe book” and requires designers and operators to identify and manage all risks by the application of substantiated and credible science. European and British codes and standards are similar.

It would be as well to heed the advice given in a paper presented to the 7<sup>th</sup> International Conference on Greenhouse Gas Control Technologies<sup>22</sup>, in which it was stated:

*“Public perception is that there is significant experience with pipeline design and that CO<sub>2</sub> is relatively benign. Those in the industry know that this is not the case and that special design considerations need to be implemented when constructing facilities for.... pipelining CO<sub>2</sub>.”*

The international pipeline industry knows it does not know a lot of things about CO<sub>2</sub>, and most of those aspects are associated with securing the safety of the public. It would not be prudent to embark on the design and construction of a CO<sub>2</sub> pipeline that does not comply with current standards for public safety. There are also many aspects of CO<sub>2</sub> mixtures that will seriously affect the pipeline and storage industries’ ability to minimise costs by optimising the size of transmission and field distribution pipelines and the location and size of compressors. Hence, there is a lot of very targeted research to be done before Australia would be ready to design its first CO<sub>2</sub> pipeline.

The Australian pipeline industry is firmly of the view that there is sufficient time to carry out this research prior to a commitment to the first CO<sub>2</sub> transmission pipeline.

### 6.3 Legislation applying to petroleum pipelines in Australia

#### 6.3.1 New South Wales

The legislation covering technical regulation of petroleum pipelines in New South Wales is *Pipelines Act (NSW) 1967* and its associated Regulations, *Pipelines Regulations (NSW) 2005*. The latter regulation specifically requires the licensee to comply with the requirements of AS2885 – see sections 3, 16, 18, 26, 40, 41, 42.

#### 6.3.2 Victoria

The legislation covering technical regulation of petroleum pipelines in Victoria is *Pipelines Act (Vic) 2005* and its associated Regulations, *Pipelines Regulations (Vic) 2007*. The latter regulation specifically requires the licensee to comply with the requirements of AS2885; see sections 21,22,34.

It is worthwhile to note that the Victorian Act specifically mentions coverage of CO<sub>2</sub> pipelines, namely, in Section 9 which states:

*This Act applies to -*

*(a) a pipeline for the conveyance of petroleum, oxygen, carbon dioxide, hydrogen, nitrogen, compressed air, sulphuric acid or methanol through the pipeline; and*

*(b) any pipeline declared under section 11 to be a pipeline to which this Act applies.*

#### 6.3.3 Queensland

The legislation covering technical regulation of petroleum pipelines in Queensland is *Petroleum And Gas (Production and Safety) Act (Qld) 2004* and its associated Regulations,

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<sup>22</sup> Barrie, J., Brown, K., Hatcher, P.R. & Schellhase, H.U. 2005. *Carbon Dioxide Pipelines: A preliminary review of Design and Risks* Proceedings of the 7th International Conference on Greenhouse Gas Control Technologies, 5-9 September 2004, Vancouver, Canada.

*Petroleum And Gas (Production and Safety) Regulation (Qld) 2004*. The latter regulation specifically requires the licensee to comply with the requirements of AS2885; see *Schedule 1, Mandatory And Preferred Standards For Safety Requirements*.

This Act also permits other fluids to be transported under its terms in Section 402:

*402 Licence may extend transportation right to other prescribed substances*

*(1) A condition of a pipeline licence may extend its holder's right under section 401 to operate any pipeline in the area of the licence to include the transportation of a substance prescribed under a regulation.*

*(2) However, a substance may be prescribed only if it is similar to petroleum and is suitable for transportation by the pipeline.*

*(3) The condition may impose restrictions on the extended right.*

This means that it can be easily extended to cover CO<sub>2</sub> at the discretion of the appropriate government Minister.

#### 6.3.4 South Australia

The legislation covering technical regulation of petroleum pipelines in South Australia is *Petroleum Act (SA) 2000*, and its associated Regulations, *Petroleum Regulations (SA) 2000*. The latter Regulation specifically requires the licensee to comply with the requirements of AS2885; see Regulation 29.

It is not clear from a brief review whether the definition of “petroleum” can be extended to CO<sub>2</sub> and thus allow the Act and Regulations to be use to cover CO<sub>2</sub>.

#### 6.3.5 Western Australia

The legislation covering technical regulation of petroleum pipelines in Western Australia is *Petroleum Pipelines Act (WA) 1969*, and its associated Regulations, *Petroleum Pipelines Regulations (WA) 1970*. The latter regulation does not specifically mention the use of AS2885. However, compliance with AS2885 is a requirement in most Pipeline Licences.

#### 6.3.6 Tasmania

The legislation covering technical regulation of petroleum pipelines in Tasmania is *Gas Pipelines Act (Tas) 2002*, and its associated Regulations, *Gas Pipelines Regulations (Tas) 1970*. The latter regulation specifically requires the use of AS2885.

#### 6.3.7 Northern Territory

The legislation covering technical regulation of petroleum pipelines in Northern Territory is *Energy Pipelines Act (NT)*<sup>23</sup>, and its associated Regulations, *Energy Pipelines Regulations (NT)*. The latter regulation specifically requires compliance with national and international standards but does not unequivocally demand the use of AS2885.

It is not clear whether this legislation can be extended to CO<sub>2</sub> transport, without some changes.

#### 6.3.8 Australian Capital Territory

There is no specific Act that addresses gas transmission pipelines.

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<sup>23</sup> Northern Territory provides no “year” in the titles of Acts or Regulations

## 7 BRIEF REVIEW OF INTERNATIONAL HISTORY OF GAS DEVELOPMENT

Governments loomed large in the development of the natural gas industry in USA, Canada, Europe, the United Kingdom and France, ranging from providing stable economic incentives to private industry in USA to joint ventures between private firms and governments (Canada) to wholly government owned vertically integrated firms (UK and France).

### 7.1 United States of America

During the 1920s and 1930s, natural gas sources were developed by a large number of small companies, mostly in the southern states of Texas and Louisiana. Finding natural gas, rather than oil, was regarded as a second prize, but none-the-less there was a market for natural gas in the more northerly states, primarily for home heating. The Federal and state governments saw economic advantages in development of natural gas markets and looked to providing some encouragement. The state governments addressed this issue through state ownership of gas distribution companies in their jurisdictions.

The US Federal government became involved in interstate gas trade in 1938, by enacting the *Natural Gas Act*, that gave the Federal Power Commission “FPC” (the forerunner of the Federal Energy Regulatory Commission, “FERC”) jurisdiction over interstate natural gas sales and the setting of haulage tariffs for interstate gas pipelines.

Soon after, the Supreme Court determined that the FPC should also set the price of natural gas sold in the interstate market.

Contrary to normal regulatory oversight, this intervention was to set the price of gas and the haulage tariff high enough to make it attractive for firms to develop gas fields and build interstate pipelines.

The legislation also provided the pipeline firms with a monopoly on the purchase and transport of gas through take-or-pay contracts with the gas producers on the one hand and the so-called local distribution companies “LDC” on the other. This arrangement was very lucrative for the pipeline companies and less so for the gas producers, because ultimately, the regulated prices were lower than the market value of the gas. This prompted a surge in demand, but failed to encourage additional production, and led to a shortage of supply. Because the intrastate market was unregulated, producers attempted to sell most of their production into the intrastate market, thereby exacerbating the shortage in the interstate market.

This market distortion occurred until 1989 when the monopolistic contracts and price controls (for interstate gas) were declared illegal and had to be unwound<sup>24</sup>. FERC then set about using a heavy handed approach to pipeline tariffs with the implementation of a strict cost of service approach and stringent provisions as to the circumstances under which existing pipelines could be expanded or new pipelines built.

Obviously, by the end of the 1980s US Federal government involvement in encouragement and support of the gas industry had ceased.

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<sup>24</sup> FERC Orders 436 and 636 were the primary determinants in the legislative change.

## 7.2 Canada

Canada's primary original natural sources are in the provinces of Alberta and British Columbia, with the majority in the former. The largest market for the gas was in the provinces of Ontario and Quebec for both home heating and industrial purposes. Exports of gas to USA were also significant.

Privately owned exploration and production companies developed gas fields in Alberta in the 1950s and sold gas through take-or-pay contracts to TransCanadaPipeLines (TCPL). TCPL was given a Federal government monopoly to build and operate pipelines from Alberta to Ontario and to sell the gas it transported eastwards from the Alberta border to mostly state-owned local distribution companies in Ontario and Quebec. TCPL also had some ownership in pipelines that took Canadian gas to markets in USA. Initially, TCPL had some Canadian Federal government ownership.

Gas was gathered from all the gas fields by Alberta Gas TrunkLine (AGTL) – initially owned by the provincial government of Alberta and progressively sold down through the 1970s. AGTL also had a province-wide monopoly.

These monopolies were progressively unwound in the early 1980s, but it must be said that the Canadian natural gas industry would not have started as quickly, nor as successfully, as it did, without government involvement.

## 7.3 United Kingdom

Britain had a robust gas industry dating from the 1800s based on gas “manufactured” from coal and, in its last stages, oil. The industry was spread among many small gas utilities, called Gas Boards that made and distributed “manufactured gas”. In the early 1960s gas was found in commercial quantities in offshore fields in the southern North Sea, off East Anglia.

This prompted the British government determine that it would establish a “wholesale” gas company – British Gas Corporation – to enter into take-or-pay contracts with the North Sea gas producers for the purchase of gas and to transport that gas throughout Britain and supply to the Gas Boards which were responsible for distribution and retail sales. All offshore production and pipeline facilities, together with onshore gas processing plants were built by the exploration and production firms, while British Gas built and operated the onshore transmission pipeline and storage system.

In 1973, the British Government decided to amalgamate the Gas Boards under the British Gas banner.

In the late 1970s gas was found offshore, in commercial quantities in the northern section of the North Sea, off the Scottish Coast. Again British Gas entered into take-or-pay contracts to purchase large quantities of gas to facilitate development. British Gas also extended its pipeline system to bring this gas south.

In 1986, British Gas Corporation became British Gas plc, and its shares were listed. In 1994, British Gas plc was restructured into 5 units – Transco (for transportation and storage), Public Gas Supply, Business Gas, Service and Retail, E&P and Global, and in 1997, the transportation and storage unit merged with National Grid and became National Grid Transco.

National Grid Transco is a regulated by the Office of Gas and Electricity Markets (Ofgem) the British government energy regulator.

Again, it is clear that the British gas industry – for natural gas – owes its genesis to direct involvement by government, which underwrote all the development from exploration to production, transport, distribution and retail sales. British Gas Corporation was, in the end a very profitable firm, and provided a good revenue stream to government. It also provided the British Government with a large windfall when it was listed and its shares sold.

#### **7.4 France**

The natural gas industry began in France in the 1960s, firstly with the development of gas fields in southern France, near the town of Lacq, and subsequently with gas imports from the Netherlands and Algeria. In the latter case, gas was imported in the form of liquefied natural gas (LNG) that was shipped via ports at Le Havre and Marseilles.

The whole industry was underwritten by the French government through a vertically integrated state-owned firm, Gaz de France. In general, that situation continues to exist today.

## **8 OPTIONS THAT MAY BE AVAILABLE FOR THE DEVELOPMENT OF PIPELINES FOR CARBON DIOXIDE.**

### **8.1 Summary of government involvement**

The development of the natural gas industry in Australia and in many other first world economies was initiated and sustained by mostly direct, and sometimes indirect, government involvement. This involvement was necessary to mitigate what private firms would regard as unacceptable risks. Governments also decided that the ready availability of a very flexible and valuable energy source was essential for the development of their economies, the improvement of the standards of living for their populations, and the provision of services and infrastructure for the long term benefit of their constituents.

Governments' involvement was seldom criticised by their constituents, even when inefficiencies were pointed out by market economists. In most cases the state-owned corporations were profitable and provided a strong revenue stream to assist consolidated revenue. The governments usually secured windfall gains when the state-owned corporations were privatised – the Victorian government was particularly successful on this score.

In most cases, the initial financing of the state-owned corporations was not a charge against the government's budget – financing was done via the issue of government guaranteed bonds or debt underwritten by government. Once the state-owned corporation began to get significant cash flow in excess of its costs, this cash was re-invested in new infrastructure works to extend its network and improve its market share against alternative fuels.

Further, government involvement allowed the development and implementation of long term strategies in the form of:

- Writing long term (25 – 30 year) take-or-pay contracts for gas supply that encouraged the exploration and production firms to define much larger reserves than they might have otherwise defined in a finance or market constrained environment;
- Building infrastructure facilities – pipelines, storages and networks – that were sized for long term gas demands. Hence there were few bottlenecks in the delivery systems as markets grew;
- Establishing moderate to low prices for both the gas and delivery services because of “first mover advantage” and low cost of debt;
- Technological advances – because of the need to be seen to be running their businesses well, and in the public eye, the state-owned firms were very conscious of good practice, safety and the application of appropriate technology. Research and development was very important. For example, the monopoly cash flows that resulted from pipelines and telecommunications in USA provided considerable advances in technology – Pipeline Research Committee, Battelle Memorial Laboratories, Bell Telephone Laboratories. Likewise in Europe, British Gas and Gaz de France were (and still are) world leaders in energy research;
- Developing “hard” assets that serve the country well over many electoral cycles;
- Providing a training ground for professionals and tradesmen through a commitment to training and skills development. In Australia, those who worked with the various state-owned corporations in the 1970s, 1980s and 1990s, are still providing commercial, management, engineering and trades skills to industry.

There were some downsides, and these usually related to perceived inefficiencies in the application of capital and labour, but the gradual corporatisation of the state-owned firms, the recruitment of private industry people to boards and oversight by external auditors improved the situation. There were, and still are, pockets of strong unionism in some sectors that may stifle progress and resist removal of inefficiencies, but this has been able to be managed in most circumstances.

M.J. Kimber Consultants Pty. Ltd. is of the view that government involvement in the development of the gas industry provides a paradigm for the development of the infrastructure for the capture, transport and storage of CO<sub>2</sub>.

## 8.2 Paradigm for CCS

If Australia is to implement a carbon capture, transport and storage process, a very large amount of new infrastructure will be required:

- Capture plants at sources of CO<sub>2</sub> – mainly power stations – with the capability to process and capture more than 30 million tonnes of CO<sub>2</sub> per year for one group of sources, such as the power stations in Queensland;
- Compressors at the capture plants to compress the gas from nominally atmospheric pressure to pipeline pressure – a pressure ratio of 1:150. This will require compressor drive motors having an output power of 40 to 50 MW;
- Large diameter, very high pressure pipelines from source to sequestration sites – mostly in excess of 1000 km long and having a diameter of approximately 900 mm;

- Compressor/pumps at intervals of about 200-300 km along the pipeline to overcome friction loss in transport, plus a source of energy to power the pumps – possibly an adjacent natural gas pipeline or a major electricity transmission line;
- A group of deep injection wells at the sequestration site;
- A network of injection pipelines and pumps linking the cross-county CO<sub>2</sub> pipeline to the wells; and
- Overall control systems to optimise the entire operation, thus minimising costs and ensuring that the sequestration rate matches the generation rate without deleterious effects on any of the component segments of the system.

Excluding the capture plant, the cost of a single such a chain of infrastructure components could exceed \$5 billion.

The financing and implementation of this investment in infrastructure will be a challenge because:

- The risks of failure to achieve all the goals is high because of geological, environmental and other technical uncertainties, thus adding to overall project financial risks;
- There is uncertainty about the scaling up of the capture process technology;
- The major parts of the infrastructure chain must be designed to accommodate growth in capacity as more sources of CO<sub>2</sub> are brought on stream;
- There is uncertainty about revenue stream – will emitters (or customers of those emitters if pass-through is permitted) be prepared to pay what it costs to build and operate the capture, transport and storage infrastructure?
- What rate of return will be permitted and how long will the owner and operator of the infrastructure have to wait to make a profit?

However, when one addresses these costs and risks, they appear to be very similar to those costs and risks that governments faced in the development of Australia's (and other countries') domestic natural gas industries. For example, the 1300 km Moomba to Sydney pipeline would cost around \$2 billion today, simply based on the change of CPI. In fact, recent estimates suggest that its replacement would be closer to \$3 billion. In addition, a gas processing plant, production wells and gathering systems could cost a further \$2 billion.

In the case of the natural gas industry, the pipeline cost was often paid directly by government and the take-or-pay contracts with the producers underwrote their ability to raise debt and equity. In short, the government back-stopped all costs of setting up the infrastructure.

Thus, it would seem logical that if government wants to mandate CO<sub>2</sub> capture, transport and storage for all CO<sub>2</sub> emitters in a clearly risky economic environment, then government should underwrite the infrastructure necessary to implement that mandate.

M.J. Kimber Consultants Pty. Ltd. suggests that only government, and most appropriately, the Commonwealth, can initiate this process, using an approach similar to that adopted by the Commonwealth's Pipeline Authority in 1973, or South Australia's Pipelines Authority of South Australia in 1967. The elements in the chain from source to sequestration site could be set up as follows:

1. Carbon capture processing plants must be integrated with the source of CO<sub>2</sub> for operational reasons, so it is apparent that these plants should be owned and operated by, or on behalf of the source owner – a power station or equivalent.
2. The CO<sub>2</sub> source owner would enter into a contract with a government owned “waste disposal” firm to take away the CO<sub>2</sub> for a price that should, in the long term, compensate the government firm for the cost of building and operating the inlet compressors, the pipeline system and associated facilities. The dividing line between capture and pipeline can be defined either at the low pressure outlet side of a capture plant, or at the outlet of a compressor that will deliver the CO<sub>2</sub> at the required pipeline pressure into a government owned pipeline.
3. The government firm would then enter into take-or-pay contracts with the sequestration field owner and operator for disposal of the CO<sub>2</sub>. This will represent a pass-through cost to the emitter for actual quantities of CO<sub>2</sub> put into storage. The government would take the volume risk on both the pipeline and the storage.

The essential pre-condition to this value chain would be an ability for the emitter to pass through to its customers the cost of capture by means of its own CO<sub>2</sub> capture/processing plant and the cost for “waste disposal”. Governments would be responsible for all costs, with an ability to recover all of them in the long term, but not initially, by means of a back-loaded tariff arrangement.

### 8.3 Suggested financing proposal

In its initial years of operation the Commonwealth’s Pipeline Authority was financed by means of loans from consolidated revenue, which, of course, resulted in criticism that this increased the Commonwealth’s deficit. Subsequently, the Pipeline Authority raised its own funds through government guaranteed commercial paper, which was sold to both retail and wholesale investors. The bonds had a life of 5 to 10 years at some margin above the purchase date cash rate. In effect, these were government backed bonds that, while they increased government debt, provided small investors the opportunity to invest in energy development through government backed instruments.

Similarly, the government-owned statutory authority that was charged with the responsibility of building and operating the CO<sub>2</sub> transport and storage system could raise funds through a similar issuance of bonds – perhaps called “Green Bonds” or “Carbon Bonds”. The latter name is perhaps a better marketing option since it could be related to the strength of a carbon bond in a diamond, or a manifestation of the stability of putting the CO<sub>2</sub> away for ever.

Treasury might be persuaded to revisit the Infrastructure Bonds that were issued in the 1990s for large investments in pipelines, roads and water projects. These offered significant taxation advantages for investors.

The government might see that the issue of bonds provides some political advantages in that they do not appear in the deficit.

The finance industry complained some years ago when the sale of Treasury Bonds ceased, and perhaps these Carbon Bonds could fill that gap, provide some security for investors who are spooked by the stock market; and, since the Carbon Bonds will be outside government’s budget appropriations, they might draw less political heat than if the CCS were to be funded directly from the budget.

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In the long term, and when the financial climate is right, the assets that comprise the CCS value chain could be privatised and the bonds redeemed.

#### **8.4 Is economic regulation necessary?**

The short answer is “no” provided the tariff setting process is negotiated, transparent and its application is non-discriminatory and if the Board of the CCS authority is comprised of representatives of its stakeholders.

The CCS Authority’s transport and storage system has to provide open access at a published non-discriminatory tariff. However, there may be a need for tariff surcharges where the CO<sub>2</sub> stream offered by capture plants contains contaminants<sup>25</sup>.

Economic modelling of the tariff must also be subject to a public external audit process conducted by commercial auditors, not the Australian Energy Regulator or the Australian Competition and Consumer Commission.

I am not of the view that either the PPP model or the highly leveraged infrastructure model is appropriate in the first tranche of this activity – it often leads to financial engineering with little value adding for Australians.

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<sup>25</sup> Contaminants reduce the transport efficiency of CO<sub>2</sub> and may cause severe operational problems for both pipeline and storage facilities. Tariffs must also be based on total mass of product carried, rather than the mass of just the CO<sub>2</sub> portion.

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