REPORT FOR THE DOMGAS ALLIANCE

NATURAL GAS DEMAND FORECAST FOR WESTERN AUSTRALIA AND ECONOMIC IMPACT OF POTENTIAL SUPPLY SHORTAGES

August 2007

COMMERCIAL AND ECONOMIC REPORT FOR THE DOMGAS ALLIANCE

This Publication

This report has been prepared for the DomGas Alliance to assist in review of the impact of natural gas supply issues in Western Australia.

This report aims to provide an assessment of the economic impact of potential shortages in natural gas availability.

This report is based on information verified by Economics Consulting Services where possible. Only broad details are included in this report and no investment decisions should be made based on the information included.

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Key Points

This report has been prepared by Economics Consulting Services for the DomGas Alliance. The Alliance is a group of Western Australian based companies that transport natural gas, or are users or potential users of natural gas.

Natural gas first flowed into markets in Western Australia with the completion of a pipeline from the Dongara gas fields to Perth in 1971. This supply was supplemented with a second pipeline from the giant North West Shelf project in 1984.

Western Australian natural gas consumption in 2006 averaged 816 TJ/day – seven times the volume used in 1983 prior to deliveries from the North West Shelf. The average rate of increase over the 23 years from 1984 has been 8.5% per annum.

Were this rate of increase to continue, the level of consumption would reach 1,365 TJ/day in 2012. A forecast by the Department of Industry and Resources puts the volume in 2012 at 1,044 TJ/day. These estimates are 228 TJ/day and 549 TJ/day above the 2006 consumption level.

An alternative project based approach suggests that there is a demand from new projects for at least 528 TJ/day associated with resource projects. Gas for increased electricity generation potentially adds 120 TJ/day for a total of 648 TJ/day. This estimate is well above the range suggested by the trend line forecasts perhaps reflecting the boom in resource processing underway.

A number of current gas purchase contracts expire in the next six years and estimates based on past published contracts suggest that there is a replacement demand of 245 TJ/day. The total forecast estimate of new gas requirements by 2013 is thus 893 TJ/day.

The projects with new gas demand involve the following economic parameters:

- Construction capital investment - $23.6 billion;
- Construction workforce – 15,850 people; and
- Operating workforce – 5,250 jobs; and
- Economic output - $9.2 billion per annum.

This estimate based on new projects does not take into account the potential costs to the economy should replacement gas not be available. That cost will depend on the cost of alternative energy sources should they be acceptable and the costs associated with conversion to them.

Chapter 1

1. Background

1.1 Introduction

This report has been prepared by Economics Consulting Services for the DomGas Alliance. The Alliance is a group of Western Australian based companies that transport natural gas, or are users or potential users of natural gas. The group was formed to work with State and Federal governments, regulators and gas producers to ensure a long-term supply of competitive gas for Western Australia.

This report has been prepared with assistance from Alliance members, gas producers and consumers. A lot of the information provided has been commercially sensitive, and Economics Consulting Services appreciates the willingness of the companies to discuss the issues as part of the important task of natural gas policy development.

The information included in this report has been carefully constructed to avoid commercially sensitive detail. This means that there is less detail than many people would like to see to confirm the conclusions reached. The authors hope that a balance has been achieved in the difficult current market structure.

The report begins with a brief snapshot of past production and the structure of gas consumption in the State. This provides a framework for the forecast and explains why a project analysis provides a valid forecasting approach.

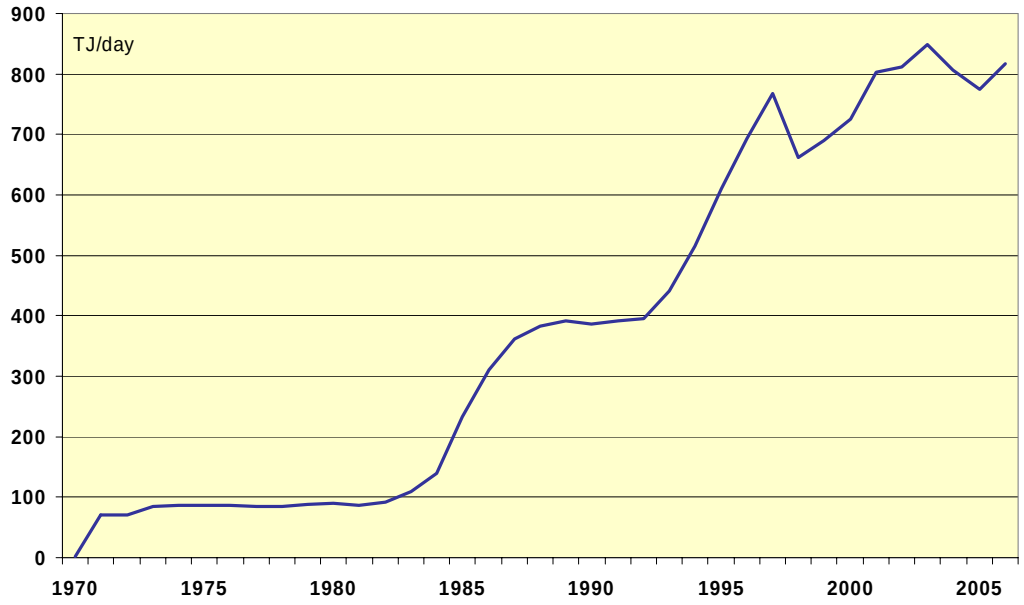
1.2 Natural Gas Production History

Natural gas first flowed into markets in Western Australia with the completion of a pipeline from the Dongara gas fields to Perth in 1971. This Western Australian Natural Gas Pipeline (WANG) supplied the only gas to industry and residential consumers until completion of the Dampier to Bunbury Natural Gas pipeline from the North West Shelf project in 1984. The enormous gas resources of the North West Shelf project have allowed gas sales in Western Australia to rise rapidly (Figure 10).

Western Australian natural gas consumption in 2006 averaged 816 TJ/day – seven times the volume used in 1983 prior to deliveries from the North West Shelf. The average rate of increase over the 23 years from 1984 has been 8.5% per annum.

Were this rate of increase to continue, the level of consumption would reach 1,365 TJ/day in 2012 (five years of growth from 2007).

Figure 1: Domestic Gas Production, 1970 to 2006 (TJ/day)



Source: Department of Industry and Resources

1.2 Natural Gas Use

Gas usage in Western Australia is dominated by a small number of industrial sectors and individual organisations.

Mineral processing is the largest sector consuming about 40% of the gas with most used to produce alumina from bauxite with nickel and mineral sand processing also important. Alumina is produced in four refineries owned by two companies and is by far the largest single use of natural gas in Western Australia.

Electricity generation is the second dominant sector accounting for around 30% of the total. Base load power generation has historically been dominated by coal-fired plants with gas used in mid-level and peak electricity power stations. In the last ten years, gas use has grown rapidly both in combined cycle plants and in cogeneration plants, providing heating and electricity. A number of large cogeneration plants are associated with the alumina refineries. Use of gas for electricity generation has grown rapidly over the last decades and gas fired plants now provide around 60% of the electricity generating capacity in the State, compared to approximately 35% of generation from coal-fired plants.[1] They increasingly compete with coal for base load electricity, and with diesel in mine sites. Power stations remote from the large integrated electricity networks rely heavily upon gas for fuel.

[1] Office of Energy (WA), 'Electricity Generation from Renewable Energy' available from http://www.energy.wa.gov.au/cproot/799/5305/RenewableEnergyFactSheetAug2006FINAL.pdf .

The mining sector is a large consumer of natural gas for electricity generation with some mineral extraction processing. Annual consumption has risen by an average of 3.2 % each year over the past decade with this sector now accounting for about 25% of the total.

In summary, mineral processing, mining and electricity generation account for over 90% of natural gas use in Western Australia. Use in the commercial and residential sectors is a small proportion of the total. While most households in the State access a reticulated gas supply, the milder climate means a relatively low heating requirement with most gas used to provide hot water.

Chapter 2

2. Project Forecast

2.1 Introduction

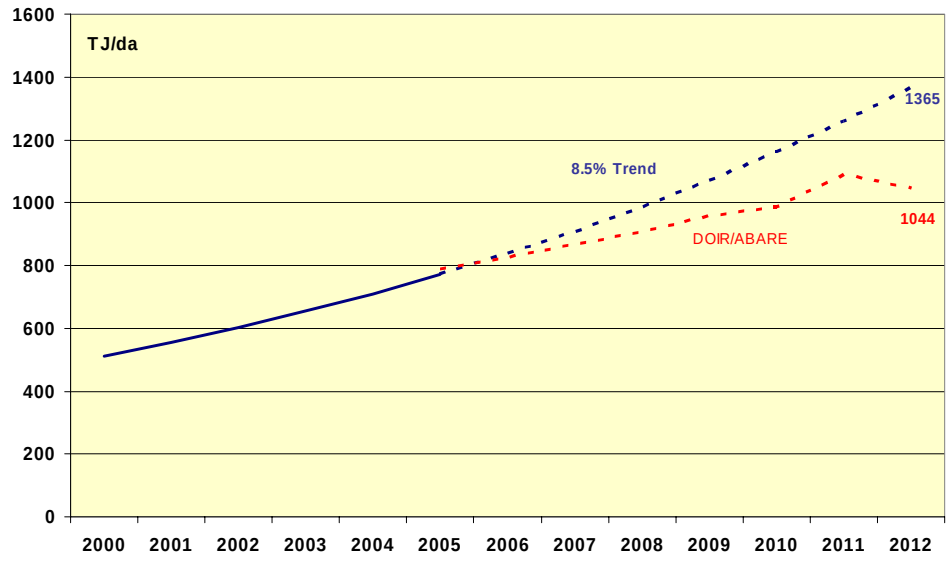
This report looks at potential gas demand from a project perspective and compares this with forecasts based on past consumption patterns.

2.2 Trend Analysis

Gas consumption in Western Australian markets has grown on average by 8.5% per annum since 1984 when the North West Shelf gas reached the south west of the State through the Dampier to Bunbury Natural Gas Pipeline. A continuation of this trend would see consumption reach 1,365 TJ/day in 2012. The Department of Industry and Resources and Australian Bureau of Agriculture and Resource Economics have made a more conservative forecast with the consumption reaching 1,044 TJ/ day in the same period (Figure 2). The latter estimate varies slightly from the published numbers as it has been averaged to a calendar year basis from a financial year projection.

The increase in gas consumption over the estimated use in 2006 is 67% for the trend line projection and 28% for the DOIR/ABARE forecast. Both estimates represent a substantial increase over a six year duration.

Figure 2: Natural Gas Consumption Forecast (TJ/day)



Nearly all gas sold by in Western Australia is by way of contract between a small number of gas producers and a small number of buyers. These "bilateral" contracts typically last for ten or more years and contain detailed specifications on gas quality, the certainty (or reliability) of delivery, gas volumes and prices.

Future gas requirements are thus made up from gas that is needed to replace existing contract volumes when the current contracts expire; gas for expansion in electricity generation; and new projects that require gas for processing or electricity production.

2.3 Project Analysis

2.3.1 Total Demand

Forecast gas demand includes gas to replace existing contract volumes; gas for expansion in electricity generation; and new projects that require gas for processing or electricity production. The total forecast estimate is 893 TJ/day made up of:

- Replacement gas: 245 TJ/day;
- Grid electricity generation: 120 TJ/day; and
- New mineral and petroleum processing projects: 528 TJ/day.

The following sections provide more detail on each of these demand sectors.

2.3.2 Replacement Gas

Public information on gas contracts was last published by the Office of Energy in 2003 and it is likely that some of the contracts that were expected to expire in the next five years have already been renegotiated. Industry sources suggest that there are still large contracts that require replacement between 2010 and 2013.

The estimate of replacement gas by 2013 is 245 TJ/day. The companies involved have limited options for alternative energy sources.

2.3.3 Electricity Generation

Energy sources for electricity generation primarily depend on the location of the power station. In the largest interconnected grid servicing the south west of the State, coal and natural gas have been the dominant fuel sources. In the Pilbara grid, natural gas and prior to that, fuel oil, were the only sources. Regional towns not connected to either grid are nearly all diesel fired with some renewable sources and gas starting to emerge as alternative sources. Mine sites were traditionally diesel fired with gas emerging as major fuel source following the construction of the Goldfields Gas Transmission pipeline in 1996.

Coal and fuel oil were the dominant sources of energy in the south west interconnected grid until gas arrived in large volumes with the Dampier to Bunbury Natural Gas Pipeline. Coal tended to remain the preferred option for base load generation with gas use in peak electricity generation plants. Peaking plant which is only used during periods of higher electricity prices is able to profitably operate with higher fuel costs. As peaking plant requires rapid start ability such as that provided by gas turbines, gas is generally the fuel of choice. However, gas fired generation was successful in the WA 2005 base load generation tender resulting in around 300 MW of gas fired base load generation being constructed.

The main energy retail organization, Synergy, is currently seeking an additional 400 MW of electricity capacity and it appears highly likely that this can only be met by a new coal fired power station.

In the last decade, cogeneration plants associated with industrial processes have emerged as an electricity source for the interconnected grid. Two of these are located at Alcoa's Pinjarra alumina refinery; one at BHP Billiton's Worsley alumina refinery; and one at the BP oil refinery. Three new gas fired cogeneration plants associated with alumina production have received environmental approval. Two units are coming on line in an open cycle configuration and were planned to convert to cogeneration with electricity available to sale in the south west of the State around 2009-2010. Two other cogeneration plants were under consideration but one company has moved to coal as the preferred energy source given the lack of gas supplies.

The total estimated demand for gas by the three new cogeneration plants is 120 TJ/day. The new Kwinana gas turbine power station will almost certainly seek to expand within the next five years but this will depend on gas availability. The potential use has not been included given the uncertainty at this stage. The forecast also assumes that the existing gas fired power stations operated by Verve have gas contracts for the forecast period.

2.3.4 New Mineral and Petroleum Processing Projects

Seventeen large projects have indicated that they are seeking natural gas for expansion or new developments totalling 518 Tj/day.

Record international commodity prices driven by demand from China and other Asian economies are generating strong demand for development of new mineral projects. This report has focused on those with a significant gas demand. Many others would use gas for power generation if it was available. The list of projects considered includes eight iron ore developments and nine other gas customers.

Many other projects have not been included for a range of reasons. For example, potentially three iron ore developments in the Mid West may turn to coal due to lack of a gas supply. Other projects that will use gas if available but are hard to forecast at this stage include titanium dioxide processing expansion at Kemerton and Kwinana, copper at Whim Creek, gold at Wallaby, silicon at Kemerton, nickel at Goongarrie and Cawse and Flying Fox and rare earths at Mt Weld.

Table 1: Potential Projects with significant gas demand

Iron Ore	Other
BHP Billiton iron ore expansion	LionOre Bulong nickel
Rio Tinto iron ore expansion	Newmont Super Pit
FMG Chichester Ranges	Newmont Jundee
Murchison Metals Jack Hills	Moly Mines molybdenum
Asia Iron Extension Hill	Aurox Balla Balla vanadium
Citic Pacific Cape Preston	CBH Sulphur Springs
Australasian Resources Balmoral South	Central Norsemen gold
Ferrowest Yalgoo pig iron	Burrup Fertilisers ammonia
	DBNGP pipeline gas

Chapter 3

3. Economic Impacts

3.1 Introduction

Natural gas provides the energy source to drive electricity generation, mining and mineral processing. Consumers have moved to this energy source in response to a range of factors including convenience of use, technical advantages, price, and environmental advantages. Each industry has options for alternative energy sources except those that are based on gas conversion or chemical processing using the gas. The suitability of the alternatives will vary with industry and project location. For example, electricity generation can be based on coal in the south west of the State or diesel in areas remote from an electricity grid.

For some industries, the conversion to other energy sources will be relatively inexpensive while for others, the alternatives may prevent the project proceeding. For example, iron ore projects based on magnetite with pellet production require substantial energy inputs and may not be viable in the Pilbara where the only alternative to natural gas appears to be imported coal or imported fuel oil. Magnetite production may be profitable in the Mid West region where there are coal resources.

A comprehensive analysis of the potential impact of a lack of natural gas on the Western Australian economy would examine each industry sector and potential project; review the alternative energy sources and the potential for that project to operate profitably under a range of commodity price scenarios. Such a comprehensive approach would be difficult to undertake and would rely on many assumptions about future relative prices and industry technical options. It is beyond the scope of this study.

An alternative approach is to assume that a lack of gas prevents the projects from proceeding at this time. The best case would be simply a deferral until gas became available while the worst outcome would be the loss of that development completely. Implicit in the first assumption is that commodity prices will continue at levels that enable profitable development when gas becomes available. The second outcome implies that the supply to international markets is met by a competitor outside Western Australia and is not recovered or that the current “price bubble” is not repeated for the foreseeable future. There are commodity forecasters that hold both views.

This study adopts a middle course and assumes that the projects seeking gas in the next six years will be “deferred or lost”.

3.2 Lost or Deferred Economic Impact

The projects with new gas demand involve the following economic parameters:

- Construction capital investment - $23.6 billion;
- Construction workforce – 15,850 people; and
- Operating workforce – 5,250 jobs; and
- Economic output - $9.2 billion per annum.

Economic output has been conservatively estimated using long term prices rather than the current record high levels. No value has been ascribed to the increased gas use in the DBNGP or the replacement gas that continues current economic activity.

In addition to the deferral or loss of these new projects, lack of new gas supplies will impact on existing consumers if replacement gas is not available for current contracts. The economic impact will vary with the cost of conversion and operating cost consequences associated with each user. Some users will be able to convert to electricity or other fossil fuels at relatively low cost while others will face significant conversion and operational disadvantages. While relatively small overall gas consumers, residential dwellings illustrate the options. Houses have water and home heating options that include wood, liquid fossil fuels (heating oil), town gas (from coal) and electricity from a range of energy sources. Houses have, and continue to use, most of these sources and while natural gas has become a preferred option in most urban houses; it would be possible to convert to other sources of heat albeit with inconvenience, cost and environmental consequences.

The replacement gas included in this study (due for replacement in the next six years) includes large resource companies and the full range of small to medium sized consumers. It is not possible to determine the value of the economic output without disclosing the identity of these companies.