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SUBMISSION ON

DRAFT DECISION BY OFFGAR FOR ACCESS ARRANGEMENT, PARMELIA PIPELINE

Client:

Project Title: Draft Decision by OffGAR for Access Arrangement, Parmelia Pipeline

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APPENDICES

1. BACKGROUND

Egis Consulting Australia Pty Limited (ECA) have reviewed the Draft Decision on Parmelia Pipeline Access Arrangement by Office of Gas Access Regulation (OffGAR) and find significant cause for concern in the Draft Decision.

As the basis of tariff calculation for the Parmelia Pipeline is directly affected by this decision ECA consider it appropriate to address certain issues central to the Draft Decision.

In November 1998 ECA were requested by CMS Energy to provide an indicative set of rates for the design, construction and commissioning of a 14" gas pipeline; based on the as-built cost data collected by ECA during the construction of the Goldfields Gas Pipeline. The cost data was therefore not an estimate, but was to be based on real time completed cost data, arising from the construction of the 14" section of the GGT pipeline.

CMS Energy then took this "as built" cost data and applied the current operating configuration of the Parmelia Pipeline to those rates. The results of this exercise produced the base cost data for the Optimised Replacement Cost for a 14" pipeline for the CMS Energy submitted Access Arrangement Information (PPAAI) dated 7 May 1999 to OffGAR.

Given what we see as the significant implications of the Draft Decision, it is appropriate that ECA address certain anomalies between the Optimised Replacement Cost (ORC) valuation provided to OffGAR by CMS in its PPAAI and the OffGAR valuation of ORC, developed on its behalf by Connell Wagner.

Prior to commenting on the OffGAR Draft Decision, it is appropriate to point out the level of experience ECA has in determining the reasonable cost of developing gas pipeline assets.

ECA have played a central role in the conceptualisation, design, procurement, construction and project management of a high proportion of all of the significant gas pipelines in Australia.

The register of all gas pipelines with which ECA has direct association includes:

- PNG to Brisbane Gas Pipeline
- Eastern Gas Pipeline
- Conoco Coal Seam Gas Pipeline
- Goldfields Gas Pipeline
- Karratha to Port Hedland Pipeline
- McArthur River Pipeline
- Kubutu Oil Pipeline
- Wallumbilla to Gladstone Pipeline
- Amadeus Basin to Darwin Gas Pipeline

- Jackson to Moonie Oil Pipeline
- Karratha to Cape Lambert Gas Pipeline
- Sydney to Newcastle Gas and Oil Pipelines
- Moomba to Sydney Gas Pipeline

It is from this experience base that ECA wishes to provide comment to the Draft Decision on the Parmelia Pipeline Access Arrangement.

The comparison between the CMS derived ORC values and the values proposed by Connell Wagner are summarised in Table 1.0. This table is referenced in the OffGAR Draft Decision in Part B, Section 7.3.4, Page 6.

Table 1.0: Summary of ORC Estimates

Asset Group	Valuation ($million)CMS Typical Value*	Connell Wagner Preliminary Estimate
Pipeline mainline	115	80
Laterals	7	8
Compression	14	17
Metering	16	4
Other pipeline facilities SCADA and Utilities	16	7
Property	0	3
EPCM** land management; compensation and contingency	42	12
Plant, machinery and equipment	1	2
Interest during construction	0	13
Total ORC	210	146
DORC (remaining asset life of 32 years)	112	78

* Calculated by a proportional reduction of CMS's stated maximum asset values by the ratio of the maximum Capital Base estimate to the typical Capital Base estimate (210/253)
** Engineering, procurement, construction and management

This review by ECA will demonstrate the Connell Wagner preliminary estimate is unsubstantiated in terms of realising the true asset value of the Parmelia Pipeline. In addition there are certain anomolies within the Connell Wagner estimate which need to be addressed by OffGAR.

The approach taken by ECA will outline the following:

- Issues raised from the OFFGAR/Connell Wagner evaluation;
- ECA comments on these issues;
- References and documentations to validate the comments raised by ECA; and
- Conclusions formed by ECA.

2. ISSUES RAISED

The following issues were identified from the OffGAR evaluation. These were:

1 The sizing of the 10 inch and 6 inch pipeline using X70 steel for the current load requirements.

2 Information is available to suggest Western Australia's future gas consumption will increase over the remaining asset life of 32 years for the Parmelia Pipeline. This includes statistical data, and future projections from energy corporations and prominent public identities.

3 The codes and standards requirements raised by the Connell Wagner evaluation.

4 The metering station costs from Connell Wagner preliminary estimate.

5 Pipeline compressor sizing of 5000 kW by Connell Wagner.

6 Pipeline inlet compression at a MAOP of 15 Mpa.

7 The allowance in the Connell Wagner estimate for EPCM.

8 The recognition of the value of the Parmelia Pipeline easement in determining the ORC.

3. REVIEW PROCESS

3.1 DESIGN BASIS FOR THE SIZING OF 10" AND 6" PIPELINE

This section will identify what limitations apply to Connell Wagner in sizing of the Parmelia Pipeline as an optimised replacement in a 10" and 6" configured pipeline. In doing this it is imperative to identify the following:

1 What is the maximum continuous load from all customers on the Parmelia Pipeline;

2 What restrictions the construction of a 10" and 6" pipeline place on future forecasts for gas consumption and the operability of the pipeline;

3 What is the capability in terms of the current throughput capacity of the Parmelia Pipeline.

In regard to Point (1), the following background information was gathered and used for the calculations. This information was based on the OFFGAR Draft Decision Part B page 68.

Connell Wagner used the following pipeline design parameters to size the 10" and 6" pipeline:

- Maximum throughput of 60 TJ/day;
- Pipeline length of 416km;
- Perth metropolitan load of 40 TJ/day;
- Pinjarra load of 20 TJ/day;
- Pipe construction material of X70 material, externally and internally coated;
- Compression designed to boost from 7.4 Mpa to MAOP of 15 Mpa;
- 15°C inlet pipeline temperature;
- Compressor size adjusted to the nearest commercially available unit; and
- Two compressor units (100% redundancy) at each compressor station.

Inputs to the pipeline are currently made at:

- Dongara, from the Dongara field;
- Mondarra, from the Dampier to Bunbury Natural Gas Pipeline (DBNGP);
- Mondarra, from the Mondarra field;
- Main Line Valve 1, from the Beharra Springs field;
- Compressor Station 1, from the Woodada field.

The Parmelia Pipeline current end users are:

- Rocla sand in Gnangara (Perth Metropolitan);
- Midland brick company (Perth Metropolitan);
- Whiteman bricks work (Perth Metropolitan);
- Feroblast galvanising plant (Perth Metropolitan);

- Tip Top bakery (Perth Metropolitan);
- Jandakot wool washers (Perth Metropolitan);
- Kwinana power station (Perth Metropolitan); and
- Alcoa refinery at Pinjarra.

The pipeline lengths have been assumed as Dongara to Kwinana (335 km), and Kwinana to Pinjarra (80 km) totalling to 415km from Dongara to Pinjarra. The gas compositions were assumed to be the DBNGP downstream of the Wesfarmers LPG (WLPG). For the purpose of sizing a physical pipeline, the gas composition will have negligible affect on the sizing.

The equation used was taken from AS 2885.1, 1997.

$$W.T. = \frac{DesignPressure\_x\_Nominal\_outside\_diameter}{2\_x\_Design\_factor\_x\_Yield\_stress}$$

3.2 SIZING OF 10" AND 6" PIPELINE COMMENTS

The actual dimensions used for the sizing are summarised below in Table 3.2.0. Note the difference in dimensions used by Connell Wagner and the values arrived at by calculation by ECA. Examining the material specification API 5L, there are NO standard pipe wall thicknesses available at the wall thicknesses specified by Connell Wagner. The only conclusions for this are;

(a) The wall thicknesses specified by CW are the raw numbers calculated which have not been upgraded to the next commercially available wall thickness; or

(b) The wall thicknesses specified by CW are specially ordered steel. The X70 steel will have to be ordered from international suppliers. It is important to consider the additional costs and delivery schedule as they may affect the steel selection and wall thicknesses; or

(c) The numbers calculated by CW are incorrect.

Assuming a design factor of 0.6 for the worse case scenario of Class T1 (suburban areas, using an MAOP of 15 MPa as specified by Connell Wagner) the wall thicknesses set out in Table 3.2.0 were determined. There was no corrosion allowance added for the purpose of this calculation.

Table 3.2.0: Summary of Actual Pipe Dimensions Used.

Reviewed Internal Diameter (mm)	CW Pipe Internal Diameter (mm)	ECA Reviewed Wall Thicknesses (mm)	CW Wall Thicknesses (mm)
159.56	157.7	4.37	5.29
258.9	255.9	7.09	8.58

Based on these calculations, taking into account a suitable corrosion factor and allowing to adjust the wall thicknesses to the nearest commercially available wall thickness, ECA will accept the wall thicknesses proposed by Connell Wagner for the pipeline configuration stated as the baseline parameter.

In response to Point (2) of Section 3.1, the 10" and 6" will meet the current specified load of 40 TJ/day for the Perth metropolitan area and 20 TJ/day for Alcoa at the outlet. However the 60 TJ/day at the feed inlet is questionable for a conservative design configuration. Simulation results indicated the 10" would be operating at its maximum capacity with NO available buffer for future increases.

In response to Point (3) an important factor Connell Wagner neglected to consider when sizing the 10" and 6" line, is the maximum potential delivery using the pipeline in its existing configuration. Referring to the CMS submission to OFFGAR PPAAI, Section 6.2.1.4, page AAI 34 of 34 the maximum capacity from the Parmelia is typically 86 TJ/day with ALL the compressors active.

Table 3.2.1: Summary of Compressor Stations on the Parmelia Pipeline

Compressor Stations	Number of compressor units	Status
CS1	2	Active
CS2	2	Active
CS3	1	Decommissioned/ mothballed
CS4	1	Decommissioned/ mothballed
CS5	1	Active

The fundamental flaws in the sizing proposed by Connell Wagner is the lack of consideration for the current maximum capability of the pipeline, and the future increase in the gas consumption by end users.

In addition the 10" and 6" valuation makes no provision for the value of the Parmelia Pipeline to be used in conjunction with another parallel pipeline to service the needs of industry grade gas users.

ECA is not aware of any pipeline it has designed where no allowance has been made in sizing for market growth, where such growth potentially exists.

3.3 FUTURE FORECAST FOR GAS CONSUMPTION IN WESTERN AUSTRALIA.

Information available suggests Western Australia's future gas consumption will increase over the remaining asset life of 32 years for the Parmelia Pipeline. This includes statistical data, and future projections from energy corporations and prominent public identities.

The numerous sources referenced in this review suggests Western Australia's gas energy consumption will increase overtime. Referring to The Australian Gas Association publication "Gas Statistics Australia 1999", page 44 and 45, Figures 2B, 2C, 2D, and 2E shows a continuous increase in the Western Australia's natural gas share and consumption over the period of 1969 to 1998. The period covered in the plots would be representative of Australia's economic cycle. Therefore there would be no reason to suggest the trend would not continue over the next 32 years of the Parmelia Pipeline asset life.

Also referring to the Australian Gas Association publication, page 76, Table 6.6 Fuel Types Used in Thermal Electricity Generation by State 1997-98. This shows Western Australia to be the largest natural gas user for electricity generation. Table 2.10 Natural Gas Production and Sales by State 1997-98, page 48 shows Western Australia as the largest natural gas producer in Australia at 655.5 PJ/a.

Jim Limerick, the CEO from the Department of Resources Development in Western Australia, indicated strongly in his presentation titled "Natural Gas in Western Australia – An Energy Driven Future" that Western Australia will be entering into a new phase of natural gas industry development in the near future. His presentation outlined the following:

- WA has more than ¾ of Australia's identified gas reserves;
- There has been a dramatic growth in the amount of natural gas produced over 31 years;
- There are still many more proven by undeveloped gas and condensate fields;

- Current gas markets are LNG, LPG gas exports, domestic fuel and domestic process feedstock.
- There are new value adding gas processing industries requiring gas as feedstock. These industries are expected to come on steam in the next 10 years. Refer to Figure on Gas Processing and Adding Value.
- From all the potential gas fields in WA there is potential for WA to build power stations providing competitive low cost and low greenhouse gas omitting energy to industry.

See Appendix A for support documentation.

3.4 CODE & STANDARD REQUIREMENTS ON THE PARMELIA PIPELINE

1 The MAOP pipe rating of 15 Mpa brings all flanges, valves, fittings, etc to Class 900. This will result in higher costs for ALL the associated components and compression requirements. We are unable to determine if the Connell Wagner Preliminary Estimate for the main pipeline and the laterals considered the costs associated for Class 900 compared with Class 600. From our experience it would appear that no allowance was made.

2 The compression requirement will increase, as the pressure drop across the 10"/6" piping increases down the pipeline. If the required pipeline capacity needs to be increased due to increase load requirements we would further question this pipeline configuration.

3 ECA also questions whether the size selected by CW will meet the line pack requirements from the end users in an emergency or shutdown situation . This should be considered when sizing the pipeline to Pinjarra, as both 10"and 6" are small diameters. Sufficient line pack allowance is necessary to allow for down time for maintenance, taking into account the amount of gas required by the end users.

AS 2885.1 – 1997, page 31 Table 4.26.6 Guide for the Spacing of Mainline Valves specifies a recommended minimum distance between isolation valves. Assuming 80km is classified as T1, 335 km as R1, this will result in 15 MLVs. The Connell Wagner calculation equates to 12 MLVs. According to the code this is under specified.

Connell Wagner did not include isolation valves on the laterals. AS 2885.1 – 1997, page 31, Clause 4.2.6.6 Isolation Valves requires isolation valves to be provided to isolate pipeline segments. There are a number of laterals ranging from 100mm to 200mm in diameter. These valves cannot be ignored and should be included as essential items and costed.

3.5 COMPRESSOR SIZING

The compressors sized by Connell Wagner at 5000kW are too large for the required service. Typically for centrifugal compressors, the compression ratio is between 1.4 to 1.8. Therefore using the MAOP of 15 Mpa, three cases were examined.

TJ/day	Suction Pressure (kPa)	Compression Ratio	Compressor Shaft Power (KW)
60	8333	1.8	1400
60	10715	1.4	780
40	8333	1.8	930
40	10715	1.4	520
20	8333	1.8	465
20	10715	1.4	260

Connell Wagner specified the MAOP at 15 Mpa. This pressure will just deliver the required current load of 60 TJ/day. This is based on the required delivery of 60 TJ/day from Dongara to the Perth Metropolitan area 335km down the pipeline. However if the demand increases it would not be possible at the specified diameters and MAOP to increase the capacity without taking the following engineering actions;

1 Increasing the MAOP greater than 15 Mpa by increasing the compression on the line.

2 Line looping around the required the pipeline section;

3 Installing a new pipeline with a greater diameter size;

Regarding Option (1). It is possible to increase the compression on the pipeline if the current working pressure is below the MAOP. However there is a limitation on the level of increase. This is dependent on the existing class ratings of flanges, valves, fittings, and fabricated assemblies, etc.

The operating philosophy is also another important factor. This is dependable on the end user requirements and maintenance levels of the pipeline operator. For example operating at maximum compression when not required will cause unnecessary additional opex costs. However it is not possible to go beyond the MAOP for the existing pipeline material without changing the material.

Regarding Options (1), (2) and (3) above, a cost benefit analysis would be required on the merits of each engineering action. ECA's experience would suggest line looping would be the most economic alternative.

All these possible engineering solutions have one common thread. They all require extensive modifications and additional costs. These costs would not be expended unnecessarily if the pipeline was sized with a reasonable allowance for growth.

3.6 SIZING CONCLUSIONS

In conclusion on the matter of the CW proposed 10"/6" pipeline configuration, driven by a 5000kW compressor at the inlet and taking into account an MAOP of 15 Mpa ECA advises that ECA consider that:

- The pipeline has been undersized for its current load
- The pipeline configuration proposed does not address growth in the gas market
- The pipeline configuration proposed does not address inlet gas supply coming from southern reservoirs
- The compression proposed is questionable

Because of these concerns we suggest that OffGAR need to revisit the basis of their position with respect to the ORC for the Parmelia Pipeline.

3.7 METERING STATION COST COMPARISON

The Midwest Eradu Rd metering station was classified in the R1 boundaries. This is situated about 100km east of Geraldton. The capacity through this is about 30/40 TJ/day. The cost for building this metering station was about $375,000. This only included;

- Flow meter and SCADA interface;
- Odorant injection;
- Shutdown valve;
- 2 x Floretine valves; and
- EPCM manhours.

MLV 117 is located in the R1 boundary, 10km North of Ellenbrook. The capacity of this is 30/40 TJ/day. This was about $500,000 which included;

- Odorant unit;
- Pressure reduction skid.

The Parmelia Pipeline inlet metering stations and the city gate metering stations includes a gas chromatograph analyser.

Therefore a metering station with the complete package including;

- Flow meter and SCADA interface;
- Odorant injection;
- Shutdown valves;
- 2 x Floretine valves;
- Odorant unit;
- Pressure reduction skid;
- Gas Chromatograph; and
- Engineering / management

Will cost about $650,000. This does not include the following:

- Owners cost;
- Customers cost; and
- Land management costs.

Therefore for the 15 metering stations which are currently in use on the Parmelia line a capital cost in excess of $10 million is not unrealistic. The value calculated on the Moomba to Sydney line by EAPL in their submission of an ORC for third party access to the regulatory authority for a 14" metering station was $1,575,000.

We contend that the value quoted by CW of $4 million for provision of metering facilities is significantly underestimated.

3.8 EPCM COST COMPARISON

The value proposed by CMS for EPCM costs takes into account:

- Cost of engineering and project management to oversee the design construction and commissioning of the pipeline

- Cost of lands management and survey to successfully acquire an easement for the pipeline

- Cost of all statutory approvals

- Cost of finance

- Allowance for contingency

- Owners cost for overseeing the development

CMS allocated $42 million to cover these costs on a pipeline with a capital value then estimated at $168 million.

CW estimate an EPCM value of $12 million and $13 million for finance.

Refer to Appendix B which suggests that for all lands management and statutory approvals alone a cost of $5.3 million would apply.

Excluding these factors the accepted norm in the industry for EPCM services of an engineer is 8-10% of Capex, being an amount of $13.4 to 16.8 million.

The owner can expect to spend in the region of 25% of that figure in managing the engineer, finances, lands management issues, insurances, statutory requirements and industrial relations issues, as well as review the design from an operability perspective. An amount of $3.4 million is not unreasonable.

Finally there is the matter of contingency. We are not aware of any prudent pipeline operator who does not make an allowance for contingency. It is arguable what this figure might be, but percentages of 5 to 10% of capex have been applied in the past.

Taking into account the CW valuation of financing cost, a reasonable EPCM valuation would be in the following range:

Engineer	$13.4 million
Owners cost	$3.4 million
Financing	$13 million
Lands Management	$5.3 million
Contingency	$8.4 million (5%)
Total	$43.5 million

It would seem that based on this analysis and the experience of ECA the figure proposed by CMS is a more accurate reflection of the real value of the asset were it to be replaced than that proposed by CW.

On the basis of the above we consider the Draft Decision produced by OffGAR to be deficient in its base calculations and recommend that these issues be revisited.

APPENDIX A

FUTURE FORECAST SUPPORT DOCUMENTATION

Primary Energy Consumption in Australia by Fuel Type 1993-94 to 1997-98p

Year ended 30 June	Crude Oil[a]		Natural Gas[b]		Black Coal		Brown Coal		Renewables[c]		Total Energy Consumption	
	PJ	%	PJ	%	PJ	%	PJ	%	PJ	%	PJ	%
1994	1502.3	35.9	736.8	17.6	1213.3	29.0	474.3	11.3	255.4	6.1	4182.1	100.0
1995	1575.2	36.1	793.1	18.2	1242.8	28.5	492.0	11.3	262.2	6.0	4365.3	100.0
1996	1638.9	36.4	797.1	17.7	1283.2	28.5	514.4	11.4	271.9	6.0	4505.5	100.0
1997	1639.7	35.6	818.5	17.8	1309.0	28.4	559.1	12.1	284.9	6.2	4611.2	100.0
1998_p	1638.6	34.1	860.0	17.9	1396.2	29.0	631.6	13.1	283.7	5.9	4810.1	100.0

Average Growth Rate (% pa)

1975-80	1.3	13.9	3.4	3.5	0.0	3.0
1980-85	-1.5	7.6	2.7	2.8	2.0	1.5
1985-90	2.1	5.6	3.2	4.1	1.8	3.2
1990-95	2.1	2.9	1.9	1.8	2.1	2.0
1995-98	1.3	2.7	4.0	8.7	2.7	3.3

a Includes crude oil, condensates and natural occurring LPG
b Natural gas and ethane used as fuel and petrochemical feedstock
c Includes wood, bagasse, solar and hydro-electricity
Source: ABARE – unpublished data

Final Energy Consumption in Australia 1993-94 to 1997-98p

Year ended 30 June	Oil and Petroleum[a]		Gas[b]		Electricity		Coal		Renewables[d]		Total Energy Consumption	
	PJ	%	PJ	%	PJ	%	PJ	%	PJ	%	PJ	%
Agriculture												
1994	53.1	84.6	0.0	0.0	9.7	15.4	0.0	0.0	0.0	0.0	62.8	100
1995	54.8	84.6	0.0	0.0	10.0	15.4	0.0	0.0	0.0	0.0	64.8	100
1996	55.1	85.3	0.0	0.0	9.5	14.7	0.0	0.0	0.0	0.0	64.6	100
1997	57.3	85.5	0.0	0.0	9.7	14.5	0.0	0.0	0.0	0.0	67.0	100
1998	58.9	85.6	0.0	0.0	9.9	14.4	0.0	0.0	0.0	0.0	68.8	100
Mining												
1994	44.4	22.6	105.4	53.6	38.7	19.7	8.1	4.1	0.0	0.0	196.6	100
1995	47.2	21.9	117.3	54.4	41.2	19.1	10.1	4.7	0.0	0.0	215.8	100
1996	54.0	22.6	130.3	54.6	43.7	18.3	10.7	4.5	0.0	0.0	238.6	100
1997	60.9	24.5	133.1	53.5	44.3	17.8	10.5	4.2	0.0	0.0	248.8	100
1998	61.3	23.2	146.3	55.3	47.8	18.1	9.2	3.5	0.0	0.0	264.6	100
Industry[e]												
1994	153.7	15.9	316.7	32.8	209.7	21.7	175.9	18.2	110.1	11.4	966.1	100
1995	155.3	15.7	328.8	33.3	209.8	21.3	174.9	17.7	117.9	11.9	986.7	100
1996	168.4	16.9	324.5	32.6	209.8	21.1	165.1	16.6	127.9	12.8	995.7	100
1997	146.7	14.5	342.3	33.9	216.0	21.4	168.0	16.7	136.0	13.5	1009.0	100
1998	151.7	14.6	344.7	33.3	233.9	22.6	166.8	16.1	139.2	13.4	1036.3	100
Transport												
1994	1062.0	98.9	1.3	0.1	7.0	0.7	3.9	0.4	0.0	0.0	1074.2	100
1995	1118.2	98.9	1.5	0.1	7.2	0.6	4.0	0.4	0.0	0.0	1130.9	100
1996	1160.9	98.9	1.6	0.1	7.4	0.6	4.0	0.3	0.0	0.0	1173.9	100
1997	1180.8	98.8	1.9	0.2	7.6	0.6	4.3	0.4	0.0	0.0	1194.6	100
1998	1187.4	98.8	2.5	0.2	8.2	0.7	4.2	0.3	0.0	0.0	1202.3	100
Commercial												
1994	12.5	7.4	40.2	23.9	110.9	66.0	3.8	2.3	0.7	0.4	168.1	100
1995	12.7	7.1	43.4	24.2	119.1	66.4	3.6	2.0	0.7	0.4	179.5	100
1996	12.8	6.7	45.7	24.1	127.3	67.1	3.3	1.7	0.7	0.4	189.8	100
1997	12.8	6.5	46.3	23.6	133.1	68.0	3.0	1.5	0.6	0.3	195.8	100
1998	13.2	6.4	48.5	23.6	140.2	68.2	3.1	1.5	0.5	0.2	205.5	100
Residential												
1994	16.5	4.8	97.6	28.3	146.0	42.4	0.3	0.1	84.0	24.4	344.4	100
1995	16.2	4.5	106.1	29.6	151.8	42.3	0.3	0.1	84.1	23.5	358.5	100
1996	15.9	4.3	112.3	30.4	155.5	42.1	0.2	0.1	85.5	23.1	369.4	100
1997	16.1	4.3	113.7	30.1	161.2	42.7	0.2	0.1	86.4	22.9	377.6	100
1998	15.6	4.1	115.7	30.1	167.4	43.5	0.2	0.1	85.6	22.3	384.5	100
Total[f]												
1994	1398.2	48.7	561.2	19.6	521.9	18.2	192.1	6.7	195.5	6.8	2868.9	100
1995	1463.2	48.8	597.0	19.9	539.1	18.0	193.0	6.4	203.7	6.8	2996.0	100
1996	1526.2	49.4	614.3	19.9	553.2	17.9	183.1	5.9	214.1	6.9	3090.9	100
1997	1537.0	48.7	637.2	20.2	571.9	18.1	186.2	5.9	223.0	7.1	3155.3	100
1998	1548.5	48.1	657.7	20.4	607.4	18.8	183.3	5.7	225.4	7.0	3222.3	100

a Includes all petroleum products and LPG
b Natural gas and town gas
c All black and brown coal products
d Includes wood, bagasse and imputed energy equivalent for solar hot water appliances
e Includes iron and steel, chemical, construction and ‘other’ industries
f Includes oil products for lubricants, greases, bitumen and solvents

Primary Energy Shares by State 1997-98p

	Crude Oil[a]	Natural Gas[b]	Black Coal	Brown Coal	Renewables[c]
	%	%	%	%	%
NSW/ACT	33.6	9.4	53.3	0.0	3.7
VIC	28.9	18.9	0.0	49.3	2.9
QLD	36.7	5.2	46.0	0.0	12.1
SA	39.9	33.8	22.2	0.0	4.1
WA	33.7	46.9	17.0	0.0	2.4
TAS	40.3	0.0	10.8	0.0	48.9
NT	73.1	26.8	0.0	0.0	0.1
Australia	**34.1**	**17.9**	**29.0**	**13.1**	**5.9**

a Includes crude oil, condensate and naturally occurring LPG.
b Natural gas and ethane used as fuel and petrochemical feedstock.
c Includes wood, bagasse, solar and hydro-electricity
Source: ABARE – unpublished data.

Natural Gas Consumption by State[a]
1969-70 to 1997-98p

Year ended 30 June	NSW[b]	VIC	QLD	WA	SA	NT	Total
1970		13.1	7.1	0.3	9.5		29.5
1971		33.4	8.8	0.6	32.1		74.4
1972		42.5	9.4	11.4	38.9		102.2
1973		57.1	10.7	32.5	43.9		144.1
1974		80.6	12.0	31.2	48.7		172.5
1975		97.3	10.2	31.5	50.2		189.2
1976		112.6	9.4	31.9	57.3		211.2
1977	10.3	130.9	9.4	32.8	72.9		256.3
1978	22.9	139.6	11.0	31.3	78.4		283.2
1979	32.8	157.5	11.1	32.2	81.3		314.9
1980	50.4	178.5	12.6	33.1	88.0		362.6
1981	62.7	213.3	13.4	33.6	92.9		415.9
1982	73.0	238.9	14.3	31.9	104.0		462.1
1983	77.5	228.5	16.8	38.3	105.1		466.2
1984	83.8	243.7	17.6	38.6	106.2	0.1	490.0
1985	85.5	224.2	19.0	73.9	119.6	1.0	523.2
1986	93.1	230.4	19.7	115.3	111.1	1.3	570.7
1987	101.4	221.1	19.9	132.9	107.9	5.1	588.4
1988	94.5	218.8	23.5	153.0	109.5	11.3	610.5
1989	95.5	230.0	21.4	158.5	111.3	11.0	627.8
1990	101.2	259.2	22.0	183.3	109.9	12.5	688.0
1991	96.4	230.8	37.0	181.3	96.7	13.2	655.4
1992	96.0	239.0	39.1	189.0	101.8	13.6	678.7
1993	97.4	245.7	39.4	207.4	103.4	13.8	707.0
1994	98.6	234.9	44.3	233.1	112.2	13.7	736.8
1995	102.0	260.2	44.7	261.1	110.2	15.0	793.1
1996	107.8	262.2	47.3	263.3	99.4	17.2	797.1
1997	130.3	238.4	47.1	284.1	99.5	18.4	818.5
1998p	134.5	241.9	50.6	309.4	104.8	18.8	860.0

Fuel Types Used in Thermal Electricity Generation by State 1997-98[a]

	Oil & Petroleum		Natural Gas		Black Coal		Brown Coal[b]		Total	
	PJ	**%**	**PJ**	**%**	**PJ**	**%**	**PJ**	**%**	**PJ**	**%**
New South Wales	0.8	0.1	0.0	0.0	560.0	99.9	0.0	0.0	560.8	100.0
Victoria	0.3	0.1	0.8	0.2	0.0	0.0	514.5	99.8	515.6	100.0
Queensland	1.5	0.4	1.6	0.4	380.7	99.2	0.0	0.0	383.9	100.0
Western Australia	3.0	2.3	43.7	33.1	85.6	64.7	0.0	0.0	132.3	100.0
South Australia	0.4	0.6	35.5	46.6	0.0	0.0	40.2	52.8	76.2	100.0
Tasmania	0.2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	100.0
Northern Territory	0.9	5.2	17.0	94.8	0.0	0.0	0.0	0.0	18.0	100.0
Total	**7.2**	**0.4**	**98.8**	**5.9**	**1026.3**	**60.8**	**554.7**	**32.9**	**1687.0**	**100**

a Does not include hydroelectricity or fuel consumed in private power stations
b Includes brown coal briquettees

Note: Natural gas used in thermal electricity differs from public electricity generation directed sales as shown in Table 2.10 because of different sources and different coverage.

Source: ESAA, Electricity Australia 1999

Composition of Pipeline Gas 1997-98[a]

Component	Longford-Melbourne	Moomba-Sydney & Adelaide	Roma-Brisbane	Denison Trough-Gladstone	Dampier-Perth	Dongara-Perth	Amadeus-Darwin
Methane	91.6	89.9	88.5	90.0	85.8	91.8	78.2
Ethane	5.0	7.2	6.1	3.7	6.0	2.3	10.2
Propane	0.4	0.1	1.4	1.1	2.7	0.5	2.8
Butane	0.1	0.0	0.5	0.2	0.8	0.2	0.9
Higher Hydrocarbons	0.0	0.0	0.1	0.1	0.0	0.1	0.2
Nitrogen	0.8[b]	1.1	2.1	2.7	2.4	1.4	7.3
Carbon Dioxide	2.1	1.6	1.2	1.7	2.1	3.5	0.0
Other	0.0	0.0	0.0	0.1	0.0	0.0	0.2[c]
Heating value (MJ/m^3)	38.5	38.9	39.7	38.6	49.9	37.4	40.6

a The chemical composition of natural gas in a number of other pipelines is available on request from the AGA.
b Nitrogen and oxygen
c Helium
Source: The Australian Gas Association, Annual Survey of Distributions, Pipeliner and Producers.

Natural Gas Production and Sales by State 1997-98

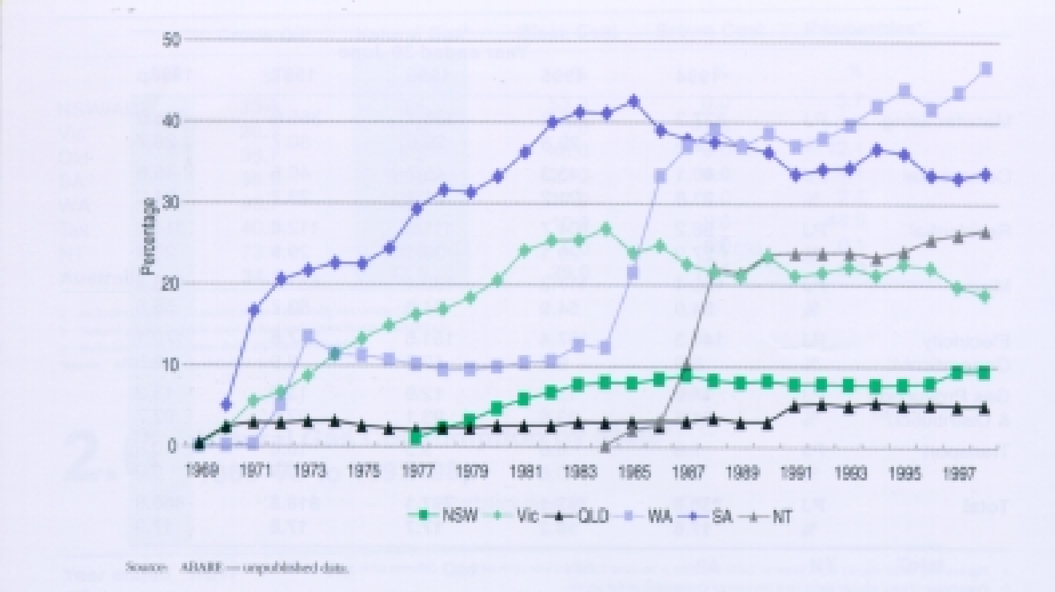
	NSW[a]	VIC[a]	QLD	WA	SA	NT	ACT	Total
Wellhead Production	0.0	293.8	89.9	963.8	159.7	18.4	0.0	1525.6
Use in Production[b]	0.0	35.8	3.1	77.1	4.2	0.1	0.0	120.2
Reinjected or Stored	0.0	60.7	3.5	231.2	-5.5	0.0	0.0	289.9
Net Production	0.0	197.3	83.3	655.5	161.0	18.3	0.0	1115.4
LNG exports	0.0	0.0	0.0	419.2	0.0	0.0	0.0	419.2
Net Interstate Transfer	106.5	0.0[a]	-31.0	0.0	-80.7	0.0	5.3	0.0
Transmission & reticulation uses, unaccounted for gas and statistical discrepancy[c]	-0.1	6.8	0.6	1.0	2.5	-3.3	0.1	7.7
Available to End Users	**106.6**	**190.5**	**51.7**	**235.3**	**77.8**	**21.6**	**5.1**	**688.5**
Utility Sales								
Residential	16.6	np	1.5	np[d]	7.7	0.0	2.9	28.7[f,g]
Commercial & Industrial	90.0	np	9.9	np[d]	33.6	0.1	2.2	135.8[f,g]
Total	**106.6**	**176.3**	**11.4**	**np[d]**	**41.3**	**0.1**	**5.1**	**340.8[g]**
Direct Sales								
Public Electricity Generation	0.0	3.1	1.6	43.8	36.5	17.0	0.0	102.0
Other Industrial	0.0	11.1	38.7	191.5	0.0	4.5	0.0	243.8
Total	**0.0**	**14.2**	**40.3**	**235.3**	**36.5**	**21.5**	**0.0**	**347.8**
Total Sales	**106.6**	**190.5**	**51.7**	**235.3**	**77.8**	**21.6**	**5.1**	**688.5**

a Figures for Albury, NSW were included with Victoria.
b Estimated as a residual after deducting from production gas sold, includes gas used in oil and condensate processing.
c This component is estimated and may include gas used as fuel for pipeline compressors, utilities own use, reforming losses and unaccounted for gas. It also may include statistical discrepancies between reported producer and end-user sales. For estimates of unaccounted for gas see Section 7 'Gas Distribution Industry Performance Indicators'.
d All utility sales volumes for Western Australia were included with direct sales to 'Other Industrial'. Of total utility sales in Western Australia, 14% were to residential customers and 86% to commercial and industrial customers.
e Less than 50TJ. See table 3.2 for details.
f Excludes Victoria.
g Excludes Western Australia

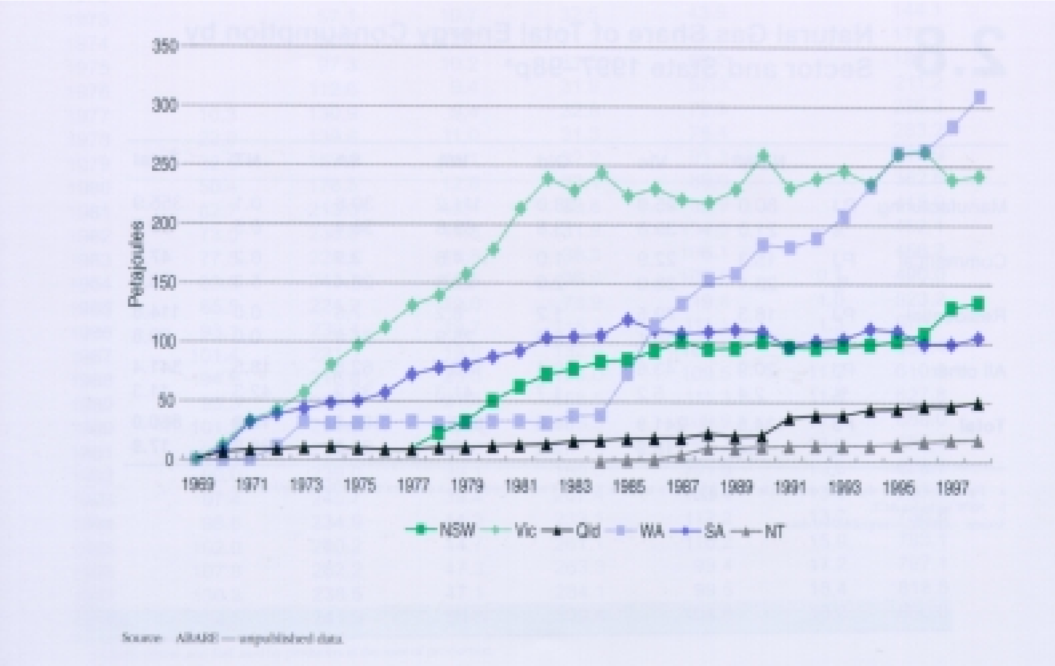
Note: Public electricity generation direct sales differ slightly from natural gas used in thermal electricity generation as shown in Table 6.6 because of different sources and different coverage.

Sources: The Australian Gas Association, Annual Survey of Distributors, Pipeliners and Producers.

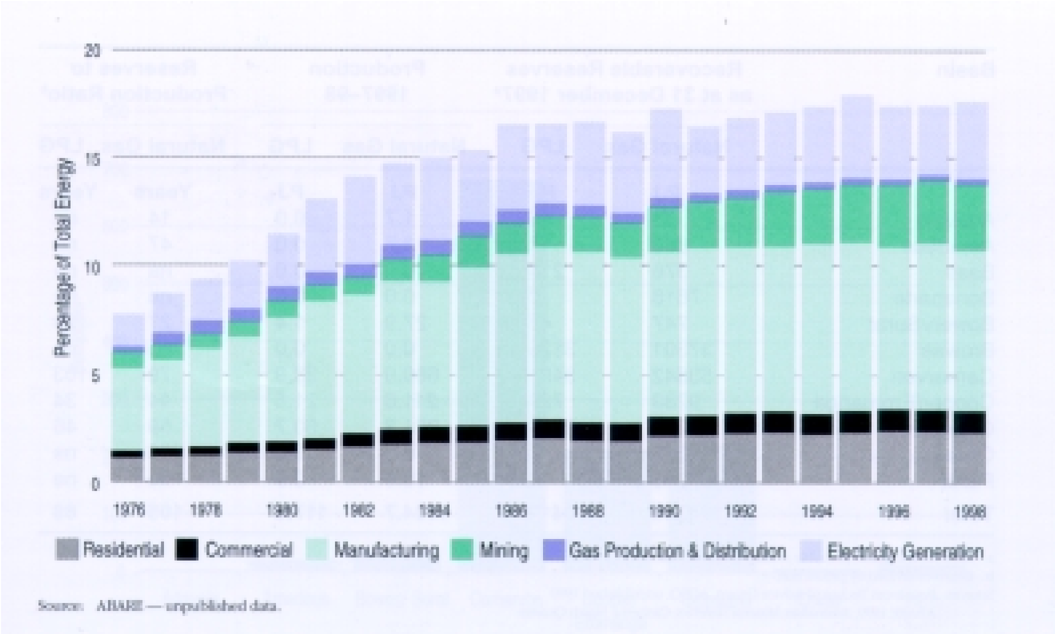
Natural Gas Share of Total Energy Consumption by State 1969-70 to 1997-98p



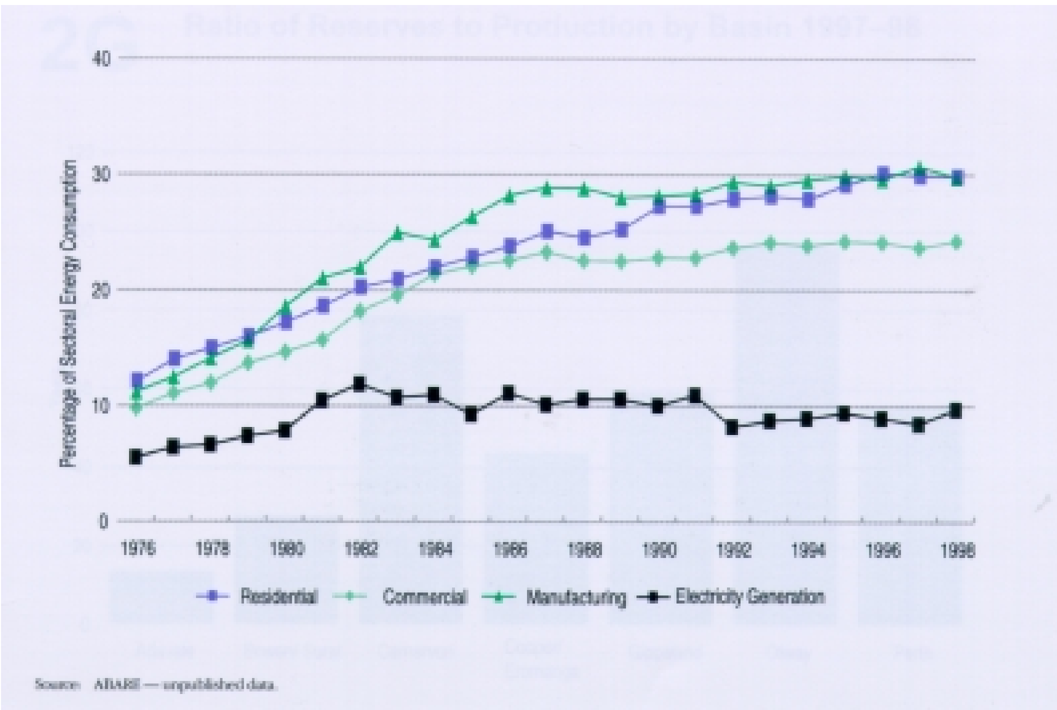
Natural Gas Consumption by State 1969-70 to 1997-98p



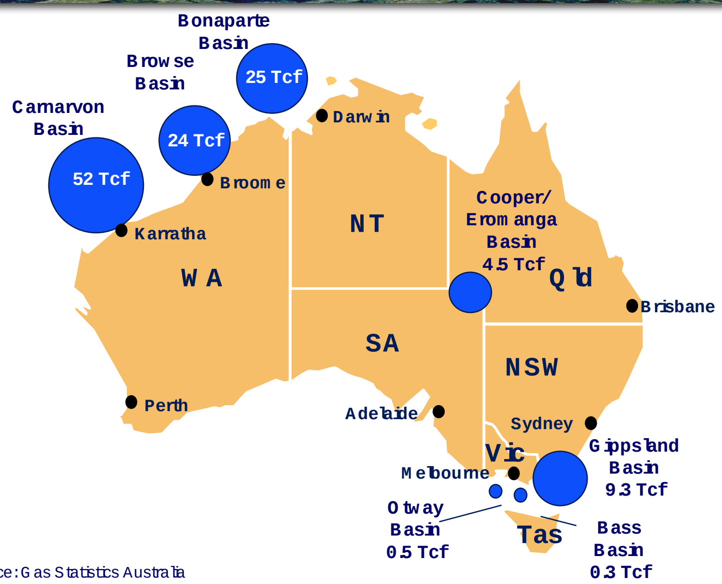
Natural Gas Share of Total Energy Consumption by Sector 1975-76 to 1997-98p



Natural Gas Share of Sectoral Energy Consumption 1975-76 to 1997-98p

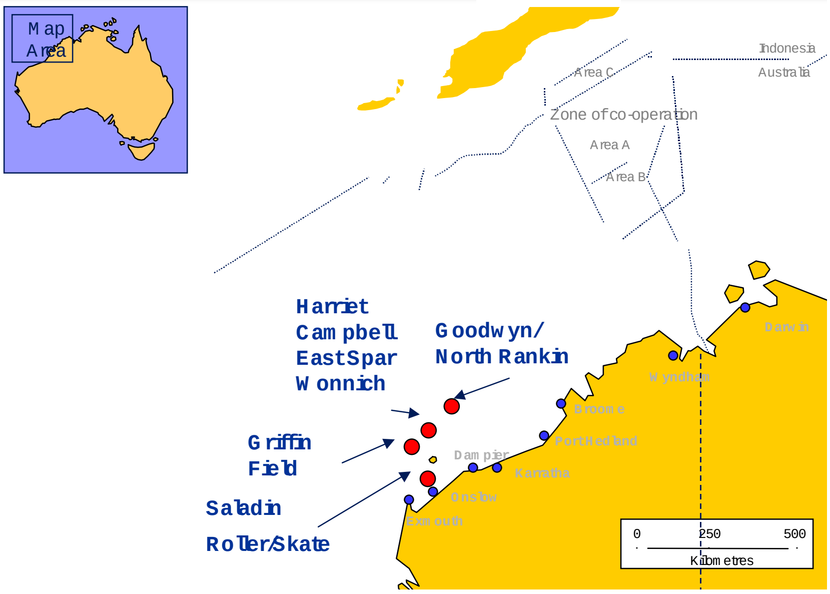


Estimated recoverable gas reserves

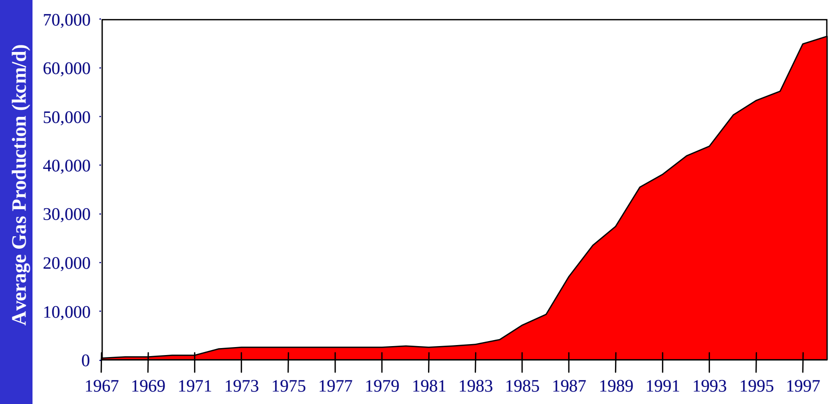


Source: Gas Statistics Australia

Major developed gas resources



WA Gas production 1967 - 1998



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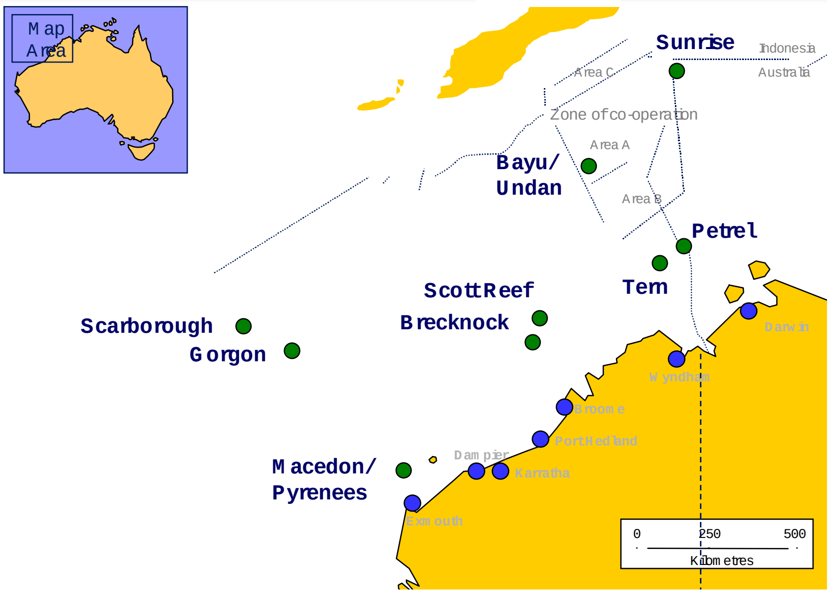
Major undeveloped gas resources



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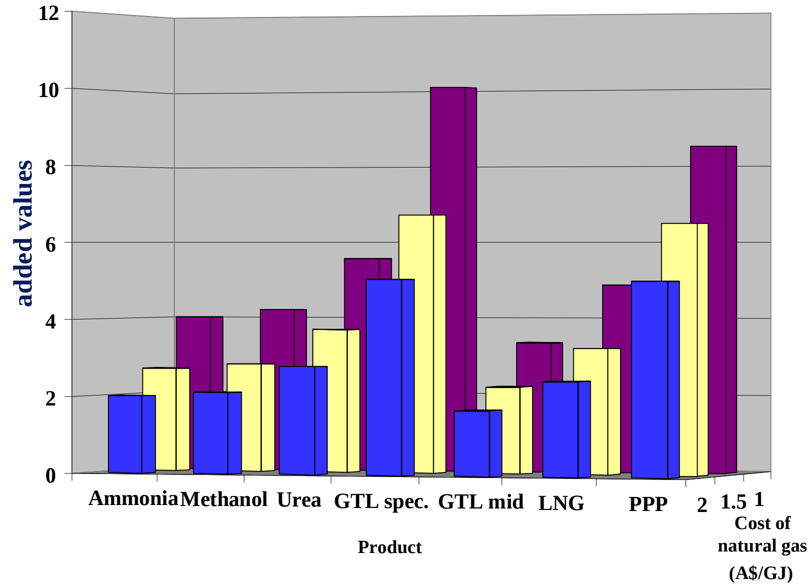
Gas processing & adding value



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DEPARTMENT OF RESOURCES DEVELOPMENT

APPENDIX B

LAND MANAGEMENT

LAND MANAGEMENT

DONGARA – PINJARRA PIPELINE

(INCLUDING LATERALS)

The estimate below is based on current day costs associated with the licensing environmental/statutory approval, easement acquisition, native title and cultural heritage issues associated with constructing the Dongarra to Pinjarra Pipeline.

The costings are based on the Land Management costs indicative of recent pipelines in Australia, eg. Goldfields Gas Pipeline, Eastern Gas Pipeline, Moomba -Sydney Ethane Pipeline, Cape York-Rockhampton Section of the PNG to Queensland Pipeline. Particular consideration has been given to the developed rural areas and outer metropolitan areas traversed by the pipeline.

The Dongarra-Pinjarra pipeline traverses environmentally sensitive and developed areas. The Swan Valley area and the outer metropolitan areas of Perth have high land values. Selecting the route, consulting/negotiating with landowners, Councils and special interest groups for acquisition of the easement would we believe be difficult, protracted and costly.

Cultural/heritage, environmental and planning issues would involve lengthy consultation and negotiation to resolve.

Statutory/Environmental Approval

EIS/EMP Cultural/Heritage Issues etc	$850,000
Landowner Easement Compensation..	$1,500,000
Labour involved in Easement Acquisition, Licensing, Native Title, etc; Vehicles, Accommodation, consumables, etc...	$2,582,400
Legal fees..	$150,000
Landowner Construction Damages	$165,000
TOTAL	**$5,247,400**