



GORGON GAS DEVELOPMENT: EPA REPORT 1323

Appeal to the Minister for the Environment
14 May 2009

KEY POINTS

- The expanded Gorgon project will result in a significant increase in greenhouse emissions over the 60 year life of the project.
- The EPA report considers that given the magnitude of the emissions, these should be mitigated or offset via appropriate mechanisms consistent with government policy.
- The EPA recommends that the decision to permit processing on Barrow Island be reconsidered should the proposed carbon sequestration not be achieved.
- The increase in greenhouse emissions associated with the expanded project can however be offset by requiring that a percentage of production be directed to domestic supply.
- A **15 per cent domestic supply commitment** is consistent with recent State policy and could significantly minimise and mitigate greenhouse emissions, and maximise energy efficiency.
- Such a commitment could potentially deliver emission reductions of around 66 million tonnes over the life of the project. This is equivalent to the annual emissions of 15 million cars, or to removing 1 million cars off the road for 15 years.
- This would substantially offset the 87 million tonne increase in emissions associated with the proposed expansion.
- Chevron's stated intention to delay domestic supply until start-up of the third LNG train diminishes the potential greenhouse mitigation benefits of domestic supply.
- In emission terms, for every year that domestic supply is delayed, an additional 1 million tonnes of greenhouse emissions is produced than would otherwise have been the case.

- A domestic supply commitment is consistent with the State's existing 15% domestic reservation policy which underpins Western Australia's long term energy security and economic development.
- While much of the economic benefit of the Gorgon project is in the construction phase, domestic supply will have long term economic and environmental benefits to the State.
- These potential long term benefits should be considered as a means of offsetting the environmental risks associated with the increased emissions from the expanded Gorgon project.
- The Alliance requests the Minister apply additional conditions in approving the expanded Gorgon project with respect to domestic supply:
 - a minimum 15% of gas production should be supplied to the domestic market; and
 - first delivery of the domestic supply commitment should be made no later than start-up of the first LNG train.

1. The DomGas Alliance

The DomGas Alliance represents natural gas users, infrastructure investors and producers in Western Australia. The Alliance aims to promote security, affordability and diversity of gas supply for industry and households.

The Alliance was formed in 2006 in response to a serious shortage of gas supply for new developments in WA. Alliance members represent around 80 percent of Western Australia's domestic gas consumption and gas transmission capacity, including smaller industrial and household users of gas. The Alliance also represents gas exploration and development companies working to develop domestic gas fields.

Members include: Alcoa of Australia, Alinta, Burrup Fertilisers, Dampier Bunbury Pipeline, ERM Power / NewGen Power, Fortescue Metals Group, Horizon Power, Newmont Australia, Synergy, Verve Energy and Murphy Oil.

The Alliance works closely with State and Federal Governments and other industry stakeholders to promote initiatives and debate on domestic gas supply issues.



2. Background

Chevron Australia and its joint venture partners Shell Development Australia and Mobil Resources have proposed the development of gas reserves of the Greater Gorgon Area.

In September 2007, State environmental approval was granted by the WA Minister for the Environment for Chevron to construct facilities on Barrow Island for the processing of gas from the Greater Gorgon Area, and to extract gas from the Gorgon gas field.

The original approval related to the construction of two LNG processing trains for the production of up to 10 million tonnes of LNG per year. In September 2008, Chevron proposed a significant expansion of the Gorgon Project as detailed in a Public Environmental Review (PER). These changes include:

- a significant expansion in LNG production from 10 million tonnes per annum to 15 million tonnes per annum with the addition of a third LNG processing train;
- an increase in the rate of carbon dioxide injection into the ground at Barrow Island.

The expanded project represents a 50% increase in the production rate of LNG and a 24% increase in the injection rate of carbon dioxide at Barrow Island over the original approved project.¹

3. EPA report recommendations on greenhouse emissions

The expanded Gorgon project will result in a significant increase in greenhouse emissions over the 60 year life of the project. The EPA report concludes:

The addition of an extra LNG processing train as proposed would result in a 36% increase in carbon dioxide equivalent emissions of 1.45 MTPA over the 60+ year life of the project. *An increase in emissions of this magnitude is substantial and should be mitigated or offset via appropriate mechanisms consistent with government policy at the time.*²

The EPA considers that the expanded project would increase annual greenhouse emissions, with emissions rate per tonne of product remaining the same. The EPA goes on to note that sequestration of carbon dioxide is required by conditions applied to the approved project.³

¹ EPA, *Gorgon Gas Development Revised and Expanded Proposal: Barrow Island Nature Reserve: Report and recommendations of the Environmental Protection Authority*, Report 1323, April 2009, p.2.

² EPA, *supra*, p.32.

³ EPA, *supra*, p.33.

In its recommendations to the Minister for Environment, the EPA advises that:

*Gas from the Gorgon field is high in carbon dioxide. A fundamental justification by the proponent for using Barrow Island was the need for access to a suitable aquifer beneath the island for long term carbon dioxide storage. The EPA also notes that sequestration of carbon dioxide was a Government requirement for access to Barrow Island for the Gorgon project and that this requirement is contained in binding conditions applied to the approved Gorgon project. If injection and long term storage of carbon dioxide produced with gas that is processed at the Gorgon plant is not achieved (for whatever reason, including the introduction of carbon markets) then the decision to permit gas processing on Barrow Island nature reserve should be reconsidered.*⁴

4. The proposed greenhouse mitigation conditions

In its report, the EPA refers to the *Guidance Statement for Minimising Greenhouse Gas Emissions* as articulating the EPA's objectives:

- *Minimise greenhouse gas emissions* in absolute terms and reduce emissions per unit of product to as low as reasonably practicable; and
- *Mitigate greenhouse gas emissions*, mindful of Commonwealth and State greenhouse gas strategies and programmes.⁵

To achieve these objectives, the EPA:

expects that potential greenhouse gas emissions from proposed projects are adequately addressed in the planning, design and operation of projects, and that: *best practicable measures are applied to maximise energy efficiency and minimise emissions ...*⁶

The EPA considers that given the magnitude of the emissions associated with the expanded Gorgon project, these should be mitigated or offset via appropriate mechanisms consistent with government policy.

A key measure advanced by Chevron is the injection of reservoir carbon dioxide into the subsurface of Barrow Island (carbon sequestration).

The EPA considers that a fundamental justification by Chevron for using Barrow Island was the need for access to a suitable aquifer beneath the island for long term carbon dioxide storage. Accordingly, the EPA considers it essential that injection or equivalent greenhouse gas mitigation action occurs.⁷

⁴ EPA, *supra*, p.iv.

⁵ EPA, *supra*, p.31.

⁶ EPA, *supra*, p.32.

⁷ EPA, *supra*, p.32.

Accordingly, the EPA recommends that the decision to permit processing on Barrow Island be reconsidered should the proposed carbon sequestration not be achieved.

5. Greenhouse mitigation benefits of domestic gas supply

The DomGas Alliance urges the Minister to apply conditions requiring that a percentage of production be directed to domestic supply.

A 15 per cent domestic supply commitment is consistent with recent State policy and could:

- significantly minimise and mitigate greenhouse emissions; and
- maximise energy efficiency.

Such a commitment could potentially deliver emission reductions of around 66 million tonnes over the project's life, equivalent to removing 15 million cars of the road.

This would substantially offset the 87 million tonne increase in emissions associated with the proposed expansion.

5.1 Significant greenhouse benefits of domestic supply

Domestic gas supply remains by far the most greenhouse and energy-efficient use of natural gas resources.

Unlike LNG, domestic gas does not need to be liquefied, shipped long distances in tankers and then regasified before it can be used as a fuel – an energy-intensive process.

Analysis conducted by the DomGas Alliance found that domestic gas supply is over 92% energy efficient on a lifecycle basis, with less than 8% of energy lost in the supply chain.⁸

Transport through the Dampier to Bunbury Natural Gas Pipeline, the longest gas transmission system in Australia, only uses less than 3% of the energy transported.

In contrast, LNG is only 74% energy efficient, with 26% of the energy consumed by the LNG supply chain.

In terms of lifecycle greenhouse emissions, LNG produces 20% more greenhouse emissions on a per gigajoule basis compared to domestic pipeline gas.

⁸ 2009 DomGas Alliance study.

Table: DomGas Alliance lifecycle study (2009)

For every 100 GJ of energy in the supply chain:				
	Energy Delivered	Energy Consumed	Total	Energy efficiency
Dom Gas	92.3 GJ	7.4 GJ	100 GJ	92.3 %
LNG	73.7 GJ	26.3 GJ	100 GJ	73.7 %

Lifecycle greenhouse emissions for:

1 GJ LNG: 67 kg CO_{2-eq}

1 GJ domestic gas: 56 kg CO_{2-eq}

1 GJ of LNG generates almost 20% more greenhouse emissions over its lifecycle than domestic pipeline gas.

The above analysis is consistent with other international studies. A study by respected Carnegie Mellon University concluded that LNG generated almost 25% more greenhouse emissions over its lifecycle compared to domestic natural gas. The study also found that the upper band of lifecycle emissions associated with LNG approached that of coal.⁹

Table: Carnegie Mellon lifecycle study (2007)

Lifecycle emissions (lb CO_{2-e} per megawatt hour)			
	Dom Gas	LNG	Coal
Midpoint	1250	1600	2100
Upper Band	1600	2400	2550

A study by US-based Climate Mitigation Services also found liquefying and transporting natural gas in LNG tankers accounted for around 21% of the total lifecycle emissions of LNG.¹⁰

Claims by major LNG exporters that Australia is helping solve the world's greenhouse problems by exporting its clean reserves of natural gas are

⁹ Jaramillo, Griffin and Matthews, 'Comparative Life-Cycle Air Emissions of Coal, Domestic Natural Gas, LNG and SNG for Electricity Generation', *Environ. Sci. Technol.* 2007, 41, 6290-6296.

¹⁰ Heede, R., 'LNG Supply Chain Greenhouse Gas Emissions for the Cabrillo Deepwater Port: Natural Gas from Australia to California', Climate Mitigation Services Study, May 2006.

therefore incorrect. Such claims ignore the lifecycle footprint of LNG production and seek only to compare end-use emissions of gas versus coal.

Given Western Australian industry and electricity generators are in the main extremely energy efficient compared to their international counterparts, this reinforces the greenhouse benefits of domestic gas supply.

A domestic supply commitment would therefore significantly minimise and mitigate greenhouse emissions associated with the expanded Gorgon project, and maximise energy efficiency.

5.2 A domestic supply commitment is consistent with State policy

In its report, the EPA considers that the substantial increase in emissions associated with the expanded Gorgon project should be mitigated or offset “via appropriate mechanisms *consistent with government policy at the time*”.

A domestic supply commitment is consistent with the State’s 15% domestic reservation policy. That policy was established by the previous State government in October 2006 and has been reinforced by the current government.

The *WA Government Policy on Securing Domestic Gas Supplies* states in relevant part:

In order to provide continued certainty that Western Australian consumers will have ongoing access to supplies of natural gas, the WA Government will negotiate with proponents of export gas (LNG) projects to include a domestic gas supply commitment as a condition of access to Western Australian land for the location of processing facilities.

The State's objective is to secure domestic gas commitments up to the equivalent of 15 percent of LNG production from each export gas project. This target reflects current estimates of future domestic gas needs, estimated gas reserves and forecast LNG production. As these estimates could change over time the target will be subject to periodic review.¹¹

6. Domestic supply conditions are required

Given the effectiveness of domestic supply commitments to mitigate project emissions, conditions should be applied with respect to the volume and timing of domestic gas. In particular:

- a minimum 15% of gas production should be supplied to the domestic market; and

¹¹ Department of the Premier and Cabinet, *WA Government Policy on Securing Domestic Gas Supplies*, p.2.

- first delivery of the domestic supply commitment should be made no later than start-up of the first LNG train.

6.1 A 15% domestic supply commitment should be applied

The 2003 Gorgon State Agreement provides for a domestic reservation of 2000 petajoules (PJ) or 2 trillion cubic feet (Tcf).¹² The State Agreement also requires the delivery of at least 300 TJ per day of natural gas.

With around 40 Tcf of identified gas resources in the Greater Gorgon area, setting aside 2 Tcf for domestic use only equates to a 5% domestic supply commitment. Such a commitment would be inadequate as a means to offset the expected increase in greenhouse emissions associated with the expanded project.

Nor does it align with the State's gas reservation policy which is to secure domestic gas supply commitments to 15% of LNG production from export gas projects. The Gorgon State Agreement was concluded in 2003 and predates the 15% reservation policy.

Environmental approval of the expanded Gorgon project should therefore include a 15% domestic reservation condition, consistent with existing State policy. Such a commitment would deliver 6000 PJ of gas or 6 Tcf to the domestic market over the life of the project.

6.2 A 15% commitment could reduce emissions by 66 million tonnes

A 15% domestic supply condition would result in significant greenhouse emission reduction and mitigation.

It was earlier assessed that for every 1 GJ of natural gas supplied to the domestic market, 11 kg of carbon dioxide equivalent emissions is avoided than if the gas was exported as LNG.

A 15% commitment would equate to 6000 PJ of domestic supply or 6 billion gigajoules. This could deliver emission reductions of around **66 million tonnes** over the life of the project. This is equivalent to the annual emissions of 15 million cars, or to removing 1 million cars off the road for 15 years.

This would substantially offset the 87 million tonne increase in emissions associated with the proposed expansion.

¹² Clause 17(1) of the Gorgon State Agreement, as annexed in Schedule 1 of the *Barrow Island Act 2003 (WA)*.

6.3 Domestic gas delivery should be with first LNG start-up

Clause 17 of the Gorgon State Agreement requires the joint venturers to:

submit to the Minister by 31 December 2010 proposals *for the establishment of a DomGas Project by 31 December 2012*, including design features to enable the progressive expansion of the connection(s) to deliver at least 300 terajoules (“TJ”) per day of natural gas

Clause 17 further requires the joint venturers to, until at least 300 TJ per day of natural gas is first delivered to the domestic market:

actively and diligently undertake ongoing marketing of natural gas in Western Australia ... and design, engineering and other relevant activities in relation to establishment of a DomGas Project

In public statements, however, Chevron has indicated that first domestic gas delivery would not be until start-up of the *third LNG train*. The project’s October 2008 “Gorgon Project Update” states:

Greater Gorgon Area General Manager Colin Beckett said a proposal on domestic gas supply will now be submitted at the same time as the Project’s overall development proposals.

The solution proposed by the Gorgon Joint Venture participants will provide the progressive supply of up to 300 terajoules per day of domestic gas with *delivery starting at or around ready-for-start up of the Project’s third LNG train*.

Delaying domestic supply until start-up of the third LNG train diminishes the potential greenhouse mitigation benefits of domestic supply.

In emission terms, for every year that domestic supply is delayed, an additional **1 million tonnes** of greenhouse emissions is produced than would otherwise have been the case.

It is therefore vital that environmental approval of the expanded Gorgon project include a condition that first delivery of the domestic gas commitment be no later than start-up of the **first LNG train**.

7. The long term environmental and economic benefits of domestic supply

While much of the economic benefit of the Gorgon project is in the construction phase, domestic supply will have long term economic and environmental benefits to the State.

These potential benefits should be considered as a means of offsetting the environmental risks associated with the expanded Gorgon project.

7.1 Vital role of domestic gas supply in reducing the State's greenhouse emissions

Domestic gas supply has a vital role in meeting Western Australia's greenhouse challenge. Natural gas is the only conventional energy source that can underpin the State's transition to a low carbon economy during the next 20 years.

Natural gas produces less than half the greenhouse emissions compared to coal and uses proven, readily available technology. Combined cycle gas-fired plants and gas-fired cogeneration plants constitute by far the most greenhouse efficient forms of non-renewable power generation.

Over its life, a new 350 megawatt per hour natural gas combined cycle plant will produce 30 million tonnes of carbon dioxide emissions, compared to 70 million tonnes for an equivalent coal power plant.¹³ In terms of annual greenhouse gas emissions avoided, the difference is equivalent to removing 325,000 cars off the road.

Natural gas underpins the development of greenhouse-friendly gas fired cogeneration plants. Cogeneration plants at alumina refineries in Western Australia for example generate steam which is used in the alumina refining process, as well as electricity for supply into the grid. Cogeneration plants can achieve at least 75% energy efficiency, compared with 30-50% for comparable coal fired generation.

Natural gas supply is also critical to underpin future expansion of renewable energy. Only natural gas plants can provide the peaking power capacity necessary to support renewable power such as wind and solar, and which makes renewable energy a feasible source of energy for the local market.

7.2 The domestic gas shortage is undermining the State's climate change response

Western Australia's current gas shortage and escalating prices are however undermining the State's response on climate change. The domestic gas shortage could be the single greatest factor contributing to emissions growth in Western Australia over the next decade.

At current prices in Western Australia, gas is no longer competitive with coal for baseload power generation and most resource processing.

¹³ Simshauser, P. and Wild, P. (2007) 'The WA Power Dilemma', p.23; www.bbpower.com/media/299790/25907%20wa%20energy%20summit.pdf.

As a result of the escalating prices and supply shortages, a number of resource and energy development projects have had to resort to coal-fired energy. The last tender process run by the State Government for new baseload generation capacity attracted only coal fired proposals owing to the lack of gas availability. This resulted in new coal fired plant being contracted.

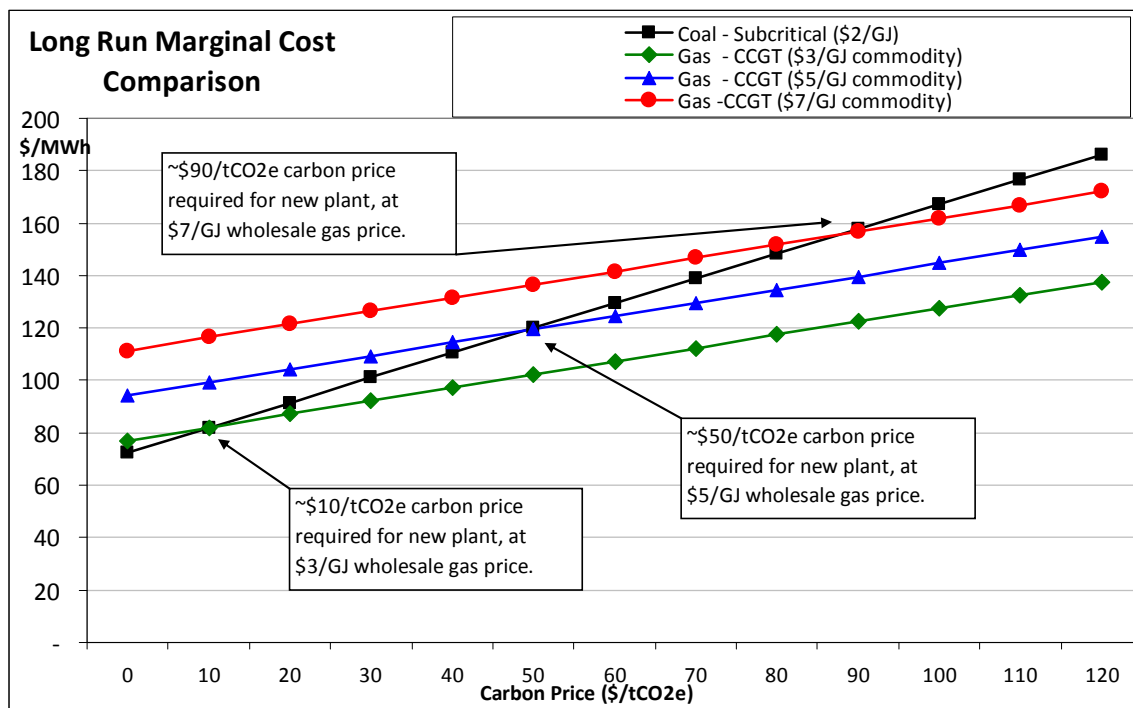
The shift from gas to coal is unlikely to change under an emissions trading scheme.

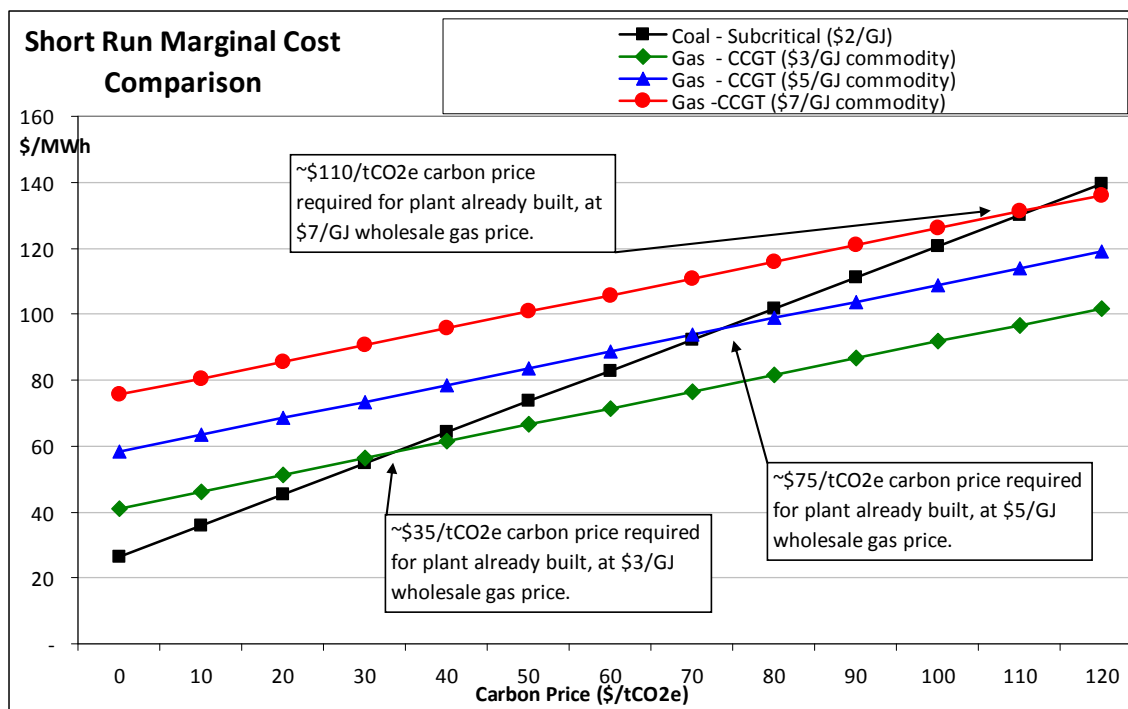
At a wholesale gas price as low as \$7 per gigajoule, natural gas would only be competitive with \$2 per gigajoule coal at the following carbon costs:

- \$90 per tonne carbon cost - on a long run marginal cost (LRMC) basis, that is, for new baseload power plant construction;
- \$110 per tonne – on a short run marginal cost (SRMC) basis, that is, for plant already built.

Recent wholesale domestic gas prices have been as high as \$14-16 per gigajoule before transport costs.

Figure: Competitiveness of \$7/GJ Gas vs. \$2/GJ Coal





Abbreviations:
 CCGT – combined cycle gas turbine
 tCO₂e – tonne of CO₂ equivalent
 MWh – megawatt hours
 kW – kilowatt
 WACC – weighted average cost of capital
 O&M – operations and maintenance

Key Assumptions									
	Plant Size MW	Capital Cost \$/kW	Useful Life Years	WACC %	Capacity Factor %	Heat Rate GJ/MWh	Fixed O&M \$/MWh	Variable O&M \$/MWh	Carbon Intensity t/MWh
Coal (Sub Critical)	300	2,500	35	12.0%	90.0%	11.0	18.0	3.0	0.9
Gas (CCGT)	300	1,750	25	12.0%	80.0%	8.5	8.5	2.5	0.5

Additional Comments: Gas transport cost is assumed to be \$1.50/GJ. "Grandfathering" and similar concepts are not considered. Numbers are indicative only.

There are long term environmental benefits in domestic gas supply. These benefits should be considered as a means of offsetting the environmental risks associated with the expanded Gorgon project.

9. Domestic supply provides long term economic benefits

Domestic supply also provides long term economic benefits. Access to secure and affordable energy, particularly natural gas, underpins the State's mining and resource processing industries, fuels power generation, and supplies small businesses and households.

Western Australia is the most energy and gas-dependent economy in Australia. Natural gas supplies half of the State's primary energy requirements and fuels 60% of the State's electricity generation. In contrast, natural gas supplies 19% of the primary energy needs of Australia as a whole.

Given the dependence on gas-fired electricity, the availability and affordability of natural gas also has a major direct impact on households and small businesses through electricity prices, as well as gas prices.

The State's demand for gas will continue to grow. Western Australia will require around 1100 TJ/day of gas by 2014-15 to meet new and replacement demand. This demand is equivalent to the total size of the existing market for gas.

Importantly, around 274 TJ/day of replacement gas will be needed to replace existing gas contracts as they expire. These include large contracts for gas used to underpin existing electricity generation, industrial processing and manufacturing.

The potential long term benefits of domestic supply should therefore be considered as a means of offsetting the environmental risks associated with the expanded Gorgon project.

10. Conclusion

The Alliance requests the Minister apply additional conditions in approving the expanded Gorgon project with respect to domestic supply:

- a minimum 15% of gas production should be supplied to the domestic market; and
- first delivery of the domestic supply commitment should be made no later than start-up of the first LNG train.