Economic Significance of Queensland's Large Gas Using Industry

Combined QLIGC Report

QLIGC

Final Report

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Client Contact:	Andrew Peters
Project Manager:	Kieron Lacey
Email:	kieron.lacey@aecgroupltd.com
Telephone:	07 3831 0577
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Executive Summary

The Issue

The concentration of gas tenure control with LNG proponents with commercial incentives to retain gas for the export markets has led to a gas market failure (DEWS, 2012). Gas supply contract availability for 2013-14 is very tight, and for 2015 and beyond not available. This has placed a number of domestic gas users in a precarious position. These users are unable to commit to capital investment across their businesses to secure future sustainability, not to mention continuation of current operations.

Against a backdrop of declining production volumes of traditional gas supply to the domestic market, the focus of CSG to LNG has significant ramifications for the Queensland processing/ manufacturing industry and the many people employed by these sectors. Large industrial gas users consumed nearly half of Queensland's total gas demand in 2010-11 (approximately 240 PJ). The QLIGC[1] operations account for approximately 40% of total Queensland gas use, and approximately 85% of gas consumed by large industrial gas users.

Approach and Purpose

The objective of this project is to assess the economic contribution of large industrial gas users to the Queensland economy. For the purposes of this project, large industrial gas users are considered to represent businesses that use greater than 1 petajoule (PJ) of gas per annum as an input to industrial uses.

In undertaking the assessment, QLIGC members have provided confidential data on their individual business operations. This data is used to identify the contribution these businesses make to the Queensland economy, both directly through production of goods as well as indirectly through demand for goods and services produced in Queensland as part of the production process. The data has also been used to extrapolate an indicative estimate of the contribution of all large industrial gas users to the Queensland economy.

A Significant Contributor

The study found that QLIGC operations are estimated to contribute over $6.4 billion directly to Queensland GSP, and 10,906 FTE jobs. These operations also indirectly provide support for some 32,778 FTE jobs in Queensland through flow-on activity, producing a further $5.0 billion in GSP. In total, QLIGC operations provided 4.3% of total GSP and supported 2.2% of total Queensland jobs in 2010-11.

The large industrial gas using sector as a whole is estimated to have contributed approximately $13.7 billion to Queensland GSP in 2010-11 (including both direct and flow-on activity), accounting for approximately 5.1% of total Queensland GSP. The large industrial gas using sector is also indicatively estimated to directly and indirectly support approximately 52,240 FTE jobs in Queensland, or approximately 2.7% of all Queensland jobs.

Comparisons to LNG

An assessment of the economic significance of QLIGC operations and the large industrial gas using sector overall indicates these users support, both directly and indirectly, approximately $120 million in GSP per PJ of gas consumed, and approximately 460 FTE jobs per PJ consumed. By comparison, case studies examining LNG projects and the Queensland LNG industry as a whole indicate the economic contribution per PJ of gas used in the production of LNG ranges from $1.7 million to $21.9 million in GSP, and between 0.5 and 20 FTE jobs. That is, large industrial gas users are estimated to contribute:

- Between 5.5 and 70 times more in GSP per PJ of gas consumed than LNG production

[1] Consisting of Incitec Pivot Limited, Queensland Alumina Limited (QAL), Queensland Energy Resources (QER), Rio Tinto Alcan and Xstrata's northern Queensland copper and lead operations.

- Between 23 and 920 times more employment per PJ of gas consumed than LNG production.

Table ES.1. Comparison of Large Industrial Gas Users to LNG [(a)]

Industry	GSP per PJ ($M)	FTE Jobs per PJ
Large Industrial Gas Users (LIGUs)	$120	460
LNG [(b)]	$1.7 to $21.9	0.5 to 20
Difference in Economic Activity of LIGUs per PJ Compared to LNG	5.5 to 70 times higher	23 to 920 times higher

Note: (a) Different modelling techniques are used to examine the economic contribution of the large industrial gas users (Input-Output transaction tables used in an economic significance modelling framework, see Appendix A) compared to the LNG case studies examined (Computable General Equilibrium (CGE) modelling). A significance modelling framework has been applied for the large industrial gas users as this assessment examines an existing industry within the Queensland economy. By comparison, CGE modelling is appropriate to examine LNG projects as these studies are examining the potential economic impacts of new projects/ industry on the Queensland economy, which will involve a shift in use of constrained resources. The use of different modelling approaches does present some issues for directly comparing modelled results, however, the finding that the large industrial gas using sector produces a higher economic contribution to GSP and employment per PJ consumed is considered valid. (b) The ranges provided in the table are based on four studies examining either specific LNG projects or the LNG industry as a whole. Refer to section 4.3 for more detail on the studies included.
Sources: ABS (2012a, 2012b, 2011a, 2011b and 2010), ACIL Tasman (2012), AEC*group* (2011) DEWS (2012), Incitec Pivot (unpublished), KPMG (2010), McLennan Magasanik Associates (2009), QAL (unpublished), QER (unpublished), Rio Tinto Alcan (unpublished), Xstrata (unpublished), AEC*group*.

The LNG case studies incorporate both construction and operation activity in the estimates of economic impacts, and most of the studies also include economic impacts associated with CSG extraction. The majority of employment impacts associated with LNG production outlined in the case studies are driven by construction and CSG extraction activities, not just LNG facility operation.

The large industrial gas using industry is a higher value adding industry than LNG per PJ of gas used. This is unsurprising given the large industrial gas users consume gas as either an energy input or as an intermediate good in value adding processing and production of final outputs. The LNG industry, on the other hand, provides an avenue for gas producers to enter more lucrative gas markets by altering the gas state for transport to export markets. While this provides a considerable increase in the net value of the gas extracted, it provides lower value adding activity per PJ of gas than productive uses of the large gas using sector.

While it is acknowledged different modelling techniques are used for the LNG case studies examined, the quantum of the difference in economic contribution compared to large industrial gas users indicates existing major gas users provide a considerably higher economic value and jobs per PJ of gas consumed.

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1. Introduction

1.1 Background

The concentration of gas tenure control with LNG proponents with commercial incentives to retain gas for the export markets has led to a gas market failure, as identified in the recent Gas Market Review conducted by the Queensland Government (DEWS, 2012). Gas supply contract availability for 2013-14 is very tight, and for 2015 and beyond not available. This has placed a number of domestic gas users in a precarious position. These users are unable to commit to capital investment across their businesses to secure future sustainability, not to mention continuation of current operations.

Against a backdrop of declining production volumes of traditional gas supply to the domestic market, the focus of CSG to LNG has significant ramifications for the Queensland processing/ manufacturing industry and the many people employed by these sectors.

A group of major gas users has formed the 'Queensland Large Industrial Gas Customers group' (QLIGC)[2] to:

1. Inform government of the actual market conditions
2. Ensure government is aware of the domestic industries impacted by the market failure
3. Ensure the government is aware of the contribution these industries/ businesses make to the Queensland and Australian economies
4. Develop policy options to address this market failure.

1.2 Scope and Objective

The objective of this project is to assess the economic contribution of large industrial gas users to the Queensland economy. For the purposes of this project, large industrial gas users are considered to represent businesses that use greater than 1 petajoule (PJ) of gas per annum as an input to industrial uses.

In undertaking the assessment, the QLIGC have provided confidential data on their individual business operations. This data is used to identify the contribution these businesses make to the Queensland economy, both directly through production of goods as well as indirectly through demand for goods and services produced in Queensland as part of the production process. The data has also been used to extrapolate an indicative estimate of the contribution of all large industrial gas users to the Queensland economy.

Direct and indirect (flow-on) impacts are assessed in terms of the contribution to employment, incomes, value added and Gross State Product (GSP).

1.3 Methodology/ Project Approach

The estimates in this report are produced using Input-Output transaction tables and models developed by AEC*group* for the purposes of this assessment, combined with data from a range of sources, including State Accounts data from the ABS. The Input-Output models were used to produce estimates of the direct and flow-on contribution of the QLIGC to the Queensland economy in terms of GSP, gross value added activity, employment and income (i.e., wages and salaries). A detailed description of the methodology employed in this report is provided in **Appendix A**.

The information presented on the significance of QLIGC operations in Queensland is for the 2010-11 financial year unless otherwise stated.

[2] The QLIGC consists of Incitec Pivot Limited, Queensland Alumina Limited (QAL), Queensland Energy Resources (QER), Rio Tinto Alcan and Xstrata's northern Queensland copper and lead operations.

2. Queensland Gas Users & Operating Environment

2.1 Queensland Economy Overview

In the 2010-11 financial year, Queensland's economy was recorded at $266.6 billion dollars in terms of Gross State Product (GSP). The mining industry was the largest contributor, recording 9.7% of the state's total gross value added (GVA) economic activity ($24.0 billion). Other strong performers in terms of GVA include the ownership of dwellings sector ($22.5 billion, 9.1%), as well as the industries of construction ($22.3 billion, 9.0%) and manufacturing ($20.7 billion, 8.3%). This represents a relatively diverse economy.

Employment in the state shows that only three industries employ over 10.0% of the total jobs in Queensland in 2010-11 of 1,954,288. The healthcare and social assistance industry employs the highest amount of people, accounting for 10.9% of all Queensland employees. The construction (10.8%) and retail trade (10.6%) industries also employ over one tenth of the Queensland workforce, while the manufacturing industry is also a high employer, accounting for 9.2% of the state's employed population.

Table 2.1 Queensland GVA/ GSP and Employment by Industry, 2010-11

Industry	Gross Value Add		Employment	
	$B	%	No.	%
Agriculture, forestry and fishing	$8.0	3.2%	71,042	3.6%
Mining	$24.0	9.7%	36,106	1.8%
Manufacturing	$20.7	8.3%	177,885	9.1%
Electricity, gas, water and waste services	$6.0	2.4%	25,607	1.3%
Construction	$22.3	9.0%	210,245	10.8%
Wholesale trade	$12.9	5.2%	86,487	4.4%
Retail trade	$13.5	5.5%	206,724	10.6%
Accommodation and food services	$6.3	2.5%	118,463	6.1%
Transport, postal and warehousing	$16.7	6.7%	121,318	6.2%
Information media and telecommunications	$5.2	2.1%	23,167	1.2%
Financial and insurance services	$17.2	6.9%	49,479	2.5%
Rental, hiring and real estate services	$6.4	2.6%	44,643	2.3%
Professional, scientific and technical services	$14.6	5.9%	129,696	6.6%
Administrative and support services	$5.1	2.0%	50,533	2.6%
Public administration and safety	$14.1	5.7%	156,292	8.0%
Education and training	$10.7	4.3%	134,047	6.9%
Health care and social assistance	$16.2	6.5%	212,540	10.9%
Arts and recreation services	$1.5	0.6%	20,390	1.0%
Other services	$4.5	1.8%	79,625	4.1%
Ownership of dwellings	$22.5	9.1%	0	-
Total Industry (GVA, Employment)	**$248.3**	**100.0%**	**1,954,288**	**-**
Taxes Less Subsidies	*$18.3*	-	-	-
Total Gross State Product	**$266.6**	**-**	**-**	**-**

Source: ABS (2012b, 2011a).

2.2 Queensland Gas Market

2.2.1 Gas Demand by Segment

The Australian gas market can be broadly separated into two markets, the domestic market and the LNG export market. Within the domestic market, Queensland's gas use is part of the Eastern Australian gas market, which includes the states of Queensland, New South Wales, Victoria, South Australia, Tasmania and the Australian Capital Territory. The

annual gas demand for the Eastern Australian gas market is approximately 718 Petajoules (PJ). Of this Queensland's annual demand for gas is approximately 240 PJ (DEWS, 2012).

Queensland's domestic gas demand can be segmented into three categories, determined by the type of user. These segments include:

- Large industrial gas users (i.e., businesses that consume more than 1 PJ/ annum for production of outputs)
- Gas power generation (GPG)
- Utility/ residential (mass market).

The large industrial segment of the gas market was the largest in terms of demand in 2010, accounting for greater than 50% of total gas demand in Queensland (AEMO, 2011). This currently excludes LNG exports, which are yet to commence operation in Queensland. The large industrial gas users segment includes the QLIGC companies, which combined accounted for approximately 40% of the total 240 PJ of gas consumed in Queensland in 2010-11, and are estimated to account for approximately 85% of the total large industrial segment. These major contributors to gas usage in Queensland are largely found in the mining and manufacturing industries. These companies typically use the gas for either power supplies or in a chemical reaction integral to the production line (e.g. fertilizer production).

The GPG market represents approximately 25% to 30% of the total domestic gas demand (AEMO, 2011). In Queensland, this proportion is higher – in 2010 the GPG market accounted for 45% of total gas demand, and this likely increased in 2011 following commissioning of the Darling Downs Power Station in late 2010. This segment includes cogeneration plants that use both gas and coal fire power. There is strong industry interest in the GPG market as there is increasing pressure from government and business to move away from coal and high emissions power generation, to lower emissions and renewable energy sources. GPG is seen as a low emission power source compared to coal and is commonly seen as a transition source between coal fire power and renewable energy. Future demand in this segment is seen to be dependent on external drivers including carbon pricing, other government intervention and economic growth.

Utility and residential gas is supplied through gas distribution networks via pipelines. These are operated, in large, by APA Gas Networks and Origin Energy. The small industry and commercial market demand has been growing slowly (approximately 1% annually) due to higher attention to business energy efficiencies. Gas use for hot-water heating is facing strong competition from solar and heat pump appliances, as well as improved water efficiency. As hot-water heating is the main use for residential gas loads, this is putting downward pressure on Queensland's consumption growth, despite growing population and demand for energy (DEWS, 2012).

2.2.2 Gas Supply

Since 2008, Queensland has experienced unprecedented growth in identified gas reserves, fuelled by interest in the LNG export industry. Current reserve levels of gas in Eastern Australia are approximately 45,000 PJ with Queensland providing the majority of this through CSG reserves (32,000 PJ) (DEEDI, 2011). This figure is estimated using 2P reserve estimates, which include proved and probable reserves. When contingent and prospective gas reserves are taken into consideration, reserves are estimated around 203,000 PJ (123,000 PJ from Queensland). Nearly all of the increase in identified gas reserves in recent years for the prospective and contingent resources comes from CSG sources in Queensland and New South Wales.

Gas supply in Queensland is dominated by several large suppliers including:

- AGL Energy (accounting for 29% of Eastern Australian domestic market)
- Origin Energy
- Australia Pacific LNG (the most significant CSG supplier to domestic consumers)
- Santos
- Arrow Energy
- QGC.

There are a number of smaller entities that also supply gas, although their contribution to Queensland's supply is negligible.

Gas for consumption in Queensland is unlikely to be transported from Victoria due to cost as the geographical distance creates cost issues in the transport of gas between the states for domestic consumption. Supply costs in Victoria would need to fall considerably, or the price of Queensland CSG would need to become significantly higher than that of the southern states for the use of Victoria's gas in Queensland (DEEDI, 2011).

2.2.3 Future Demand

Growth in gas demand in Queensland over the next 10 to 20 years is largely expected to be driven by the LNG export market. Anticipated future demand from the LNG sector has resulted in the domestic market experiencing some difficulties in securing future Gas Supply Agreements (GSAs) for the 2015-2020 period[3]. This rapid development in the export LNG industry has meant Australia is on track to become the equal largest exporter of LNG by 2020 (currently the fifth largest, with Qatar the largest) (AEMO, 2011). At current development rates, LNG exports from Queensland are expected to surpass the total domestic demand from the Eastern and South Eastern Australia by 2016, though development of the LNG industry will be dependent on future market conditions.

Annual demand projections suggest the mass market and large industry markets will exhibit modest growth in the future and are not highly sensitive to the combinations of gas price, carbon price, and economic growth. The Queensland large industrial market is expected to grow at an average 3.3% annually over the following 20 years, with mass market growth slightly lower at 2.3% annual growth (AEMO, 2011).

Gas demand for GPG represents the largest component of anticipated future domestic demand growth, whereas demand in other sectors is relatively modest and uniform. Growth in GPG demand is projected to average 10% annually for the Eastern Australian market (AEMO, 2011). Multiple factors may impact on future demand in this segment, such as gas prices, alternative technology uptake, carbon price projections, and economic growth. Provided gas prices remain relatively low, demand increases from the GPG market are expected to rise significantly due to the displacement of coal fired electricity generation by GPG. Additionally, in the presence of high carbon prices, high electricity demand and taking into account the Clean Energy Future target of closing 2,000 Megawatts of high emission coal fire generators nationally, significant GPG demand growth is projected for the short to medium term before renewable technologies become more competitive. The majority of this growth is most likely to occur in Victoria due to the closure of inefficient and high emission coal-fired plants (AEMO, 2011; DEEDI, 2011).

Overall, projections by DEWS (2012) suggest Queensland domestic gas demand in 2020-21 could be between 250 and 300 PJ, while gas demand for LNG in Queensland could be between 1,500 and 2,000 PJ.

[3] Government has sought guarantees from six major gas producers/LNG proponents (AGL, APLNG, Arrow, Origin, QGC, Santos) on this issue, who have reiterated their commitment to the domestic market.

3. Large Industrial Gas Users Overview

3.1 QLIGC

3.1.1 Operating Characteristics

The QLIGC examined in this report consists of five major companies in the large industrial gas users segment of the natural gas market –Incitec Pivot Limited, QAL, QER, Rio Tinto Alcan and Xstrata's northern Queensland copper and lead operations.

The main operations of the QLIGC companies include operations in the manufacturing and mining industries. Specifically the companies deal in:

- Heavy and precious metal mining (bauxite, copper, lead, silver, etc)
- Smeltering and refineries (alumina production, metal smeltering)
- Phosphate mining and fertiliser production
- Fuel production (naptha, diesel, jet fuel, and high sulphur fuel oil), noting this is a future project expected to commence operation in 2023.

These companies combined consume approximately 95 to 100 PJ of gas and are key contributors to their localities in terms of employment and purchasers of goods and services. Combined, they produce significant economic activity for Queensland and employ a significant amount of people across the state. In total the QLIGC companies employed almost 11,000 people in the state in the mining and manufacturing industries in 2010-11.

3.1.2 Location of Operations

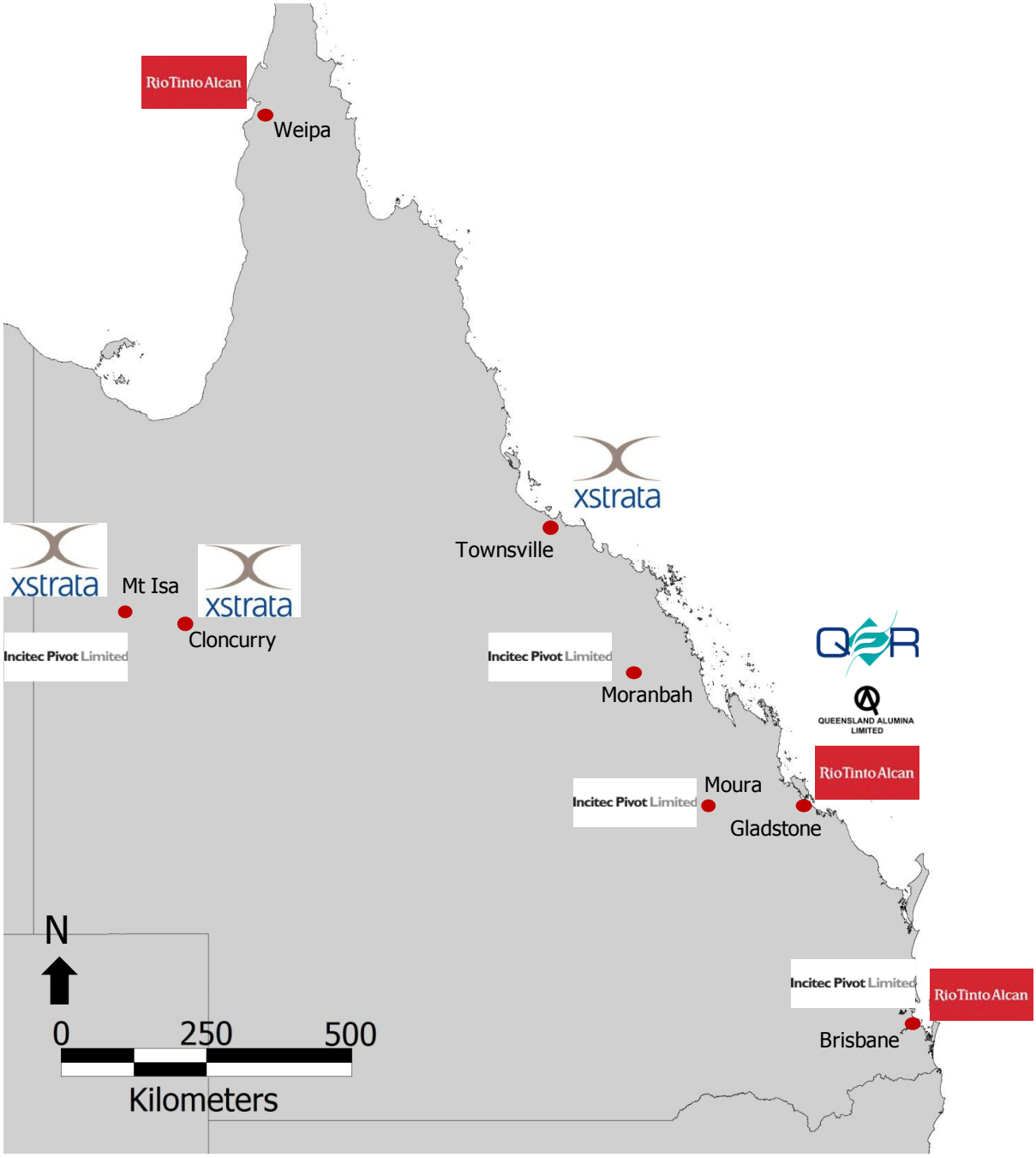
QLIGC operations are widely located across Queensland from Mount Isa to Townsville and Brisbane. Table 3.1 indicates the specific operations and their locations for QLIGC companies, and Figure 3.1 represents these operations on a map.

Table 3.1. QLIGC Operations and Locations

Operation	Company	Location
Mt Isa Mines: • Copper, zinc, lead & silver mining and concentrator operations • Lead smelter	Xstrata	Mt Isa
Ernest Henry Mine: • Copper mining • Copper & gold concentrator operations	Xstrata	Cloncurry
Townsville Refinery: • Copper refinery • Port operations	Xstrata	Townsville
Phosphate Hill: • Phosphate mining and processing	Incitec Pivot	Mt Isa
Gibson Island: • Ammonia, urea and ammonium sulphate production	Incitec Pivot	Brisbane
Ammonium nitrate production plant	Incitec Pivot	Moranbah
Ammonium nitrate production plant	Incitec Pivot	Moura
Bauxite mine	Rio Tinto Alcan	Weipa
Alumina Refinery	Rio Tinto Alcan	Yarwun
Head Office	Rio Tinto Alcan	Brisbane
Alumina Refinery	Queensland Alumina Limited	Gladstone
New Fuels Project (future project, expected to commence operation in 2023): • Produces naptha, diesel, jet fuel and high sulphur fuel oil	QER	Gladstone

Source: Incitec Pivot (unpublished), QAL (unpublished), QER (unpublished), Rio Tinto Alcan (unpublished), Xstrata (unpublished).

Figure 3.1. Map of QLIGC Operations



Source: ABS (2010b), Incitec Pivot (unpublished), QAL (unpublished), QER (unpublished), Rio Tinto Alcan (unpublished), Xstrata (unpublished).

3.2 Other Large Industrial Gas Users

While the QLIGC conglomerate comprises of some of the largest industrial gas users in Queensland, there are several other companies that will also be affected by the impacts on the industry and the outcomes that QLIGC achieve. These include:

- BHP Billiton
- Boyne Smelters Limited
- BP
- Caltex
- Ivanhoe Australia

- Orica
- Queensland Magnesia
- Queensland Nickel
- Queensland Nitrates.

Together the large industrial segment of gas users not only represents a large component of the domestic gas demand in Queensland, but also represents a large portion of the economic activity and employment throughout the state.

4. Economic Significance Assessment

This chapter describes the economic contribution (or significance) of the QLIGC and other large industrial gas users to the Queensland economy in 2010-11. The flow-on contribution of large gas using operations to other industries is also provided.

The economic contribution of the QLIGC and other large industrial gas users to the Queensland economy has been estimated across four key measures:

- **Gross Product**: Refers to the value of all outputs of an industry *including* taxes/ subsidies on its final products after deducting the cost of goods and services inputs in the production process. Gross State Product (GSP) is the measure of a State's total gross production.
- **Gross Value Add**: Refers to the value of all outputs of an industry *excluding* taxes/ subsidies on its final products after deducting the cost of goods and services inputs in the production process.
- **Incomes**: Measures the level of wages and salaries paid to employees of each industry.
- **Employment**: Refers to the part-time and full-time employment positions supported by an industry, both directly and indirectly through flow-on activity, and is expressed in terms of full time equivalent (FTE) positions.

Both type I (production induced) and type II (consumption induced) flow-on activity supported by the QLIGC and other large industrial gas users are presented:

- **Type I impacts** represent the production induced support activity as a result of additional expenditure by gas using industry on goods and services in the production of their outputs, and subsequent round effects of increased purchases by suppliers in response to increased sales.
- **Type II impacts** represent the consumption induced activity from additional household expenditure on goods and services resulting from additional wages and salaries being paid within the Queensland economy.

4.1 QLIGC

An overview of QLIGC operations is provided in section 3.1, and highlights that only four of the five proponents' major gas using operations were active in 2010-11. QER's new fuels project is currently anticipated to commence operation in 2023, and has therefore been excluded from the analysis below for the 2010-11 year. This section provides estimates of the economic contribution per PJ of gas used, and it is reasonable to assume QER's New Fuels Project could deliver a similar benefit per PJ as other QLIGC operations.

4.1.1 Contribution to the Queensland Economy

In 2010-11, QLIGC operations are estimated to have directly generated approximately $6.4 billion in GSP, as well as supporting approximately $5.0 billion in GSP through flow on activity (refer to Table 4.1). This represented a direct contribution of 2.4% to total Queensland GSP (refer to Table 4.2), and flow-on contribution of 1.9%. In total (direct and flow-on), QLIGC operations delivered approximately **$120 million in GSP per PJ of gas used** in 2010-11.

In terms of employment, QLIGC operations are estimated to support 10,906 direct FTE jobs. This is equivalent to 0.6% of employment in Queensland. It is estimated that there are a further 32,778 FTE jobs indirectly supported through QLIGC operations in Queensland. Including both direct and indirect jobs, QLIGC operations are estimated to have supported 2.2% of total Queensland jobs in 2010-11. In total (direct and flow-on), QLIGC operations delivered approximately **460 FTE jobs per PJ of gas used** in 2010-11.

Total incomes associated with this employment are estimated to make up 2.6% of total incomes paid out across the Queensland economy.

Table 4.1. Estimated Direct and Flow-On Contribution of the QLIGC to the Queensland Economy, 2010-11

Contribution Type	Gross Product ($M)	Gross Value Add ($M)	Incomes ($M)	Employment (FTE)
Direct Contribution				
Total Direct Contribution	***$6,414.2***	***$5,973.9***	***$1,223.2***	***10,906***
Flow-On Contribution				
Production Induced (Type I)	$2,494.4	$2,323.1	$970.6	14,913
Consumption Induced (Type II)	$2,494.0	$2,322.8	$1,019.7	17,865
Total Flow-On Contribution	***$4,988.3***	***$4,645.9***	***$1,990.3***	***32,778***
TOTAL CONTRIBUTION	**$11,402.6**	**$10,619.8**	**$3,213.5**	**43,684**

Notes: Totals may not sum due to rounding.
Sources: ABS (2012a, 2012b, 2011a, 2011b and 2010), Incitec Pivot (unpublished), QAL (unpublished), QER (unpublished), Rio Tinto Alcan (unpublished), Xstrata (unpublished), AEC*group*

Table 4.2. Estimated % Contribution of the QLIGC to the Queensland Economy, 2010-11

Contribution Type	Gross Product (%)	Gross Value Add (%)	Incomes (%)	Employment (%)
Direct Contribution				
Total Direct Contribution	***2.4%***	***2.4%***	***1.0%***	***0.6%***
Flow-On Contribution				
Production Induced (Type I)	0.9%	0.9%	0.8%	0.8%
Consumption Induced (Type II)	0.9%	0.9%	0.8%	0.9%
Total Flow-On Contribution	***1.9%***	***1.9%***	***1.6%***	***1.7%***
TOTAL CONTRIBUTION	**4.3%**	**4.3%**	**2.6%**	**2.2%**

Notes: Totals may not sum due to rounding.
Sources: ABS (2012a, 2012b, 2011a, 2011b and 2010), Incitec Pivot (unpublished), QAL (unpublished), QER (unpublished), Rio Tinto Alcan (unpublished), Xstrata (unpublished), AEC*group*

4.1.2 Contribution to the Queensland Economy by Industry

Table 4.3 identifies the direct and flow-on contribution of QLIGC operations to the Queensland economy by industry. In terms of flow-on activity, the following is noted:

- Flow-on contributions to GSP as a result of QLIGC operations are highest for the industries of mining, ownership of dwellings, manufacturing, financial and insurance services, and electricity, gas, water and waste services.
- Flow-on activity supports more than 2,000 FTE jobs in the industries of manufacturing, retail trade, professional, scientific and technical services, transport, postal and warehousing, accommodation and food services, and construction.

Further analysis of Table 4.3 shows that QLIGC operations are a key contributor to demand in the electricity, gas, water and waste services, with QLIGC operations supporting 6.2% of this industry's gross product and value added activity.

Table 4.3. Estimated Contribution of the QLIGC to the Queensland Economy by Industry, 2010-11

Industry	Value of Contribution				% of Total Industry in Queensland			
	Gross Product ($M)	Gross Value Add ($M)	Incomes ($M)	Employ. (FTE)	Gross Product (%)	Gross Value Add (%)	Incomes (%)	Employ. (%)
Direct Contribution								
Total Direct Contribution	***$6,414.2***	***$5,973.9***	***$1,223.2***	***10,906***	***100.0%***	***100.0%***	***100.0%***	***100.0%***
Flow-On (Type I + II) by Industry Contribution								
Agriculture, forestry and fishing	$119.2	$111.0	$26.7	1,145	1.4%	1.4%	1.4%	1.6%
Mining [(a)]	$662.9	$617.4	$83.4	750	2.9%	2.9%	2.9%	2.6%
Manufacturing [(b)]	$507.1	$472.3	$298.6	4,972	2.7%	2.7%	2.6%	2.9%
Electricity, gas, water and waste services	$398.1	$370.7	$122.0	1,465	6.2%	6.2%	6.1%	5.7%
Construction	$220.0	$204.9	$100.7	2,050	0.9%	0.9%	0.9%	1.0%
Wholesale trade	$187.2	$174.4	$105.2	1,197	1.4%	1.4%	1.3%	1.4%
Retail trade	$261.3	$243.4	$152.1	3,973	1.8%	1.8%	1.8%	1.9%
Accommodation and food services	$142.2	$132.4	$83.0	2,366	2.1%	2.1%	2.0%	2.0%
Transport, postal and warehousing	$324.4	$302.1	$141.1	2,421	1.8%	1.8%	1.8%	2.0%
Information media and telecommunications	$127.7	$119.0	$38.3	591	2.3%	2.3%	2.3%	2.5%
Financial and insurance services	$431.4	$401.8	$184.6	1,204	2.3%	2.3%	2.3%	2.4%
Rental, hiring and real estate services	$185.6	$172.9	$80.4	1,151	2.7%	2.7%	2.6%	2.6%
Professional, scientific and technical services	$285.8	$266.2	$169.1	2,567	1.8%	1.8%	1.8%	2.0%
Administrative and support services	$131.9	$122.9	$97.1	1,140	2.4%	2.4%	2.4%	2.3%
Public administration and safety	$36.3	$33.8	$25.0	363	0.2%	0.2%	0.2%	0.2%
Education and training	$127.1	$118.4	$94.9	1,442	1.1%	1.1%	1.1%	1.1%
Health care and social assistance	$140.6	$131.0	$102.1	1,667	0.8%	0.8%	0.8%	0.8%
Arts and recreation services	$42.4	$39.5	$21.0	547	2.6%	2.6%	2.5%	2.7%
Other services	$109.6	$102.1	$65.1	1,766	2.3%	2.3%	2.2%	2.2%
Ownership of dwellings	$547.5	$509.9	$0.0	0	2.3%	2.3%	N/A	N/A
Total Flow-On Contribution	***$4,988.3***	***$4,645.9***	***$1,990.3***	***32,778***	***1.9%***	***1.9%***	***1.7%***	***1.7%***
Total Contribution	**$11,402.6**	**$10,619.8**	**$3,213.5**	**43,684**	**4.3%**	**4.3%**	**2.6%**	**2.2%**

Notes: Totals may not sum due to rounding. (a) Mining refers to the 'rest of mining' as some of the QLIGC's direct activities are considered to occur in the mining sector. (b) Manufacturing refers to the 'rest of manufacturing' as some of the QLIGC's direct activities are considered to occur in the manufacturing sector.
Sources: ABS (2012a, 2012b, 2011a, 2011b and 2010), Incitec Pivot (unpublished), QAL (unpublished), QER (unpublished), Rio Tinto Alcan (unpublished), Xstrata (unpublished), AEC*group*

4.2 Total Large Industrial Gas Users

As outlined in section 3.1, QLIGC operations accounted for approximately 95 – 100 PJ of gas use in Queensland in 2010-11. This equates to approximately 40% of total Queensland gas use, and approximately 85% of total gas used by large industrial gas users in Queensland.

The following section outlines an indicative estimate of the contribution of the large industrial gas using sector as a whole, assuming that other large industrial gas users have a similar production and purchasing pattern as the QLIGC operations per PJ of gas used. This assumption has been used due to limited information available to otherwise identify the economic contribution of other large gas users.

4.2.1 Contribution to the Queensland Economy

Table 4.4 and Table 4.5 show the large industrial gas using sector is indicatively estimated to have contributed approximately $13.7 billion to Queensland GSP in 2010-11 (including both direct and flow-on activity), accounting for approximately 5.1% of total Queensland GSP. The large industrial gas using sector is also indicatively estimated to directly and indirectly support approximately 52,420 FTE jobs in Queensland, or approximately 2.7% of all Queensland jobs.

Table 4.4. Estimated Direct and Flow-On Contribution of the Total Large Industrial Gas Using Sector to the Queensland Economy, 2010-11

Contribution Type	Gross Product ($M)	Gross Value Add ($M)	Incomes ($M)	Employment (FTE)
Direct Contribution				
Total Direct Contribution	***$7,697.1***	***$7,168.7***	***$1,467.8***	***13,087***
Flow-On Contribution				
Production Induced (Type I)	$2,993.3	$2,787.8	$1,164.7	17,896
Consumption Induced (Type II)	$2,992.8	$2,787.3	$1,223.7	21,438
Total Flow-On Contribution	***$5,986.0***	***$5,575.1***	***$2,388.4***	***39,334***
TOTAL CONTRIBUTION	**$13,683.1**	**$12,743.8**	**$3,856.2**	**52,420**

Notes: Totals may not sum due to rounding.
Sources: ABS (2012a, 2012b, 2011a, 2011b and 2010), DEWS (2012), Incitec Pivot (unpublished), QAL (unpublished), QER (unpublished), Rio Tinto Alcan (unpublished), Xstrata (unpublished), AEC*group*

Table 4.5. Estimated % Contribution of the Total Large Industrial Gas Using Sector to the Queensland Economy, 2010-11

Contribution Type	Gross Product (%)	Gross Value Add (%)	Incomes (%)	Employment (%)
Direct Contribution				
Total Direct Contribution	***2.9%***	***2.9%***	***1.2%***	***0.7%***
Flow-On Contribution				
Production Induced (Type I)	1.1%	1.1%	1.0%	0.9%
Consumption Induced (Type II)	1.1%	1.1%	1.0%	1.1%
Total Flow-On Contribution	***2.2%***	***2.2%***	***2.0%***	***2.0%***
TOTAL CONTRIBUTION	**5.1%**	**5.1%**	**3.2%**	**2.7%**

Notes: Totals may not sum due to rounding.
Sources: ABS (2012a, 2012b, 2011a, 2011b and 2010), DEWS (2012), Incitec Pivot (unpublished), QAL (unpublished), QER (unpublished), Rio Tinto Alcan (unpublished), Xstrata (unpublished), AEC*group*

4.2.2 Contribution to the Queensland Economy by Industry

The contribution of the large industrial gas using sector to Queensland by industry is presented in Table 4.6 and shows over 7% of electricity, gas, water and waste services industry activity is supported by large industrial gas users, and more than 3% of activity in the industries of mining, manufacturing, rental, hiring and real estate services, and arts and recreation services.

Table 4.6. Estimated Contribution of the Total Large Industrial Gas Using Sector to the Queensland Economy by Industry, 2010-11

Industry	Value of Contribution				% of Total Industry in Queensland			
	Gross Product ($M)	Gross Value Add ($M)	Incomes ($M)	Employ. (FTE)	Gross Product (%)	Gross Value Add (%)	Incomes (%)	Employ. (%)
Direct Contribution								
Total Direct Contribution	***$7,697.1***	***$7,168.7***	***$1,467.8***	***13,087***	***100.0%***	***100.0%***	***100.0%***	***100.0%***
Flow-On (Type I + II) by Industry Contribution								
Agriculture, forestry and fishing	$143.0	$133.2	$32.0	1,374	1.7%	1.7%	1.6%	1.9%
Mining [(a)]	$795.5	$740.9	$100.0	900	3.5%	3.5%	3.4%	3.1%
Manufacturing [(b)]	$608.5	$566.7	$358.3	5,967	3.2%	3.2%	3.1%	3.4%
Electricity, gas, water and waste services	$477.7	$444.9	$146.4	1,758	7.4%	7.4%	7.3%	6.9%
Construction	$264.0	$245.9	$120.9	2,460	1.1%	1.1%	1.1%	1.2%
Wholesale trade	$224.7	$209.3	$126.2	1,436	1.6%	1.6%	1.6%	1.7%
Retail trade	$313.5	$292.0	$182.5	4,767	2.2%	2.2%	2.1%	2.3%
Accommodation and food services	$170.6	$158.9	$99.6	2,840	2.5%	2.5%	2.5%	2.4%
Transport, postal and warehousing	$389.3	$362.6	$169.3	2,905	2.2%	2.2%	2.1%	2.4%
Information media and telecommunications	$153.3	$142.7	$46.0	709	2.8%	2.8%	2.7%	3.1%
Financial and insurance services	$517.7	$482.1	$221.6	1,445	2.8%	2.8%	2.7%	2.9%
Rental, hiring and real estate services	$222.7	$207.4	$96.5	1,381	3.2%	3.2%	3.2%	3.1%
Professional, scientific and technical services	$343.0	$319.4	$202.9	3,081	2.2%	2.2%	2.1%	2.4%
Administrative and support services	$158.3	$147.4	$116.5	1,368	2.9%	2.9%	2.8%	2.7%
Public administration and safety	$43.5	$40.6	$30.0	435	0.3%	0.3%	0.3%	0.3%
Education and training	$152.5	$142.1	$113.9	1,730	1.3%	1.3%	1.3%	1.3%
Health care and social assistance	$168.7	$157.2	$122.6	2,001	1.0%	1.0%	1.0%	0.9%
Arts and recreation services	$50.9	$47.4	$25.2	657	3.1%	3.1%	3.0%	3.2%
Other services	$131.5	$122.5	$78.1	2,119	2.8%	2.8%	2.7%	2.7%
Ownership of dwellings	$657.0	$611.9	$0.0	0	2.7%	2.7%	N/A	N/A
Total Flow-On Contribution	***$5,986.0***	***$5,575.1***	***$2,388.4***	***39,334***	***2.3%***	***2.3%***	***2.0%***	***2.0%***
Total Contribution	**$13,683.1**	**$12,743.8**	**$3,856.2**	**52,420**	**5.1%**	**5.1%**	**3.2%**	**2.7%**

Notes: Totals may not sum due to rounding. (a) Mining refers to the 'rest of mining' as some of the large industrial gas users' direct activities are considered to occur in the mining sector. (b) Manufacturing refers to the 'rest of manufacturing' as some of the large industrial gas users' direct activities are considered to occur in the manufacturing sector.
Sources: ABS (2012a, 2012b, 2011a, 2011b and 2010), DEWS (2012), Incitec Pivot (unpublished), QAL (unpublished), QER (unpublished), Rio Tinto Alcan (unpublished), Xstrata (unpublished), AEC*group*

4.3 LNG Industry Comparison

The LNG industry will be a significant consumer of gas, as outlined in section 2.2.3. Gas demand can vary depending on the liquefaction process used, but can range between 30 to 60 PJ per million tonnes (Mt) of LNG produced (DEWS, 2012; McLennan Magasanik Associates, 2009). Current planned LNG projects are expected to use approximately 30 – 35 PJ per Mt of LNG (DEWS, 2012).

The following dot points outline the estimated economic impacts of various LNG projects, as outlined by economic studies conducted either on behalf of the Queensland Government or as part of Environmental Impact Statements (EIS) for LNG projects:

- A study undertaken by McLennan Magasanik Associates (2009) for the Queensland Government indicates a 28 million tonnes per annum (Mtpa) LNG industry would require approximately 1,760 PJ of gas, supporting an increase in Queensland GSP of $3 billion and over 18,000 jobs each year. This equates to approximately $1.7 million in GSP per PJ of gas used, and approximately 10 FTE jobs per PJ of gas used.
- ACIL Tasman (2012) examined the future economic impacts of CSG-LNG in Queensland across various development scenarios (a base scenario of 24 Mtpa, and two expansion scenarios of 32 Mtpa and 40 Mtpa). In the base scenario, the study estimated an average annual change in GSP between 2012 and 2035 of $15.8 billion, and an average annual employment impact of 14,242 FTE jobs. Assuming gas use of approximately 30 PJ per Mt of LNG (which is lower gas usage than assumed by ACIL Tasman), this equates to approximately $21.9 million in GSP per PJ of gas used, and approximately 20 FTE jobs per PJ.
- KPMG (2010) examined the economic impacts of the Australian Pacific LNG (APLNG) Project as part of the EIS for this project. They found that once fully operational, the 16 Mtpa APLNG Project will increase GSP by approximately $2.0 billion per annum, and employment by approximately 9,000 FTE jobs per annum. Assuming gas use of approximately 30 PJ per Mt of LNG, this equates to approximately $4.2 million in GSP per PJ of gas used, and approximately 18.75 FTE jobs per PJ.
- AEC*group* (2011) undertook an economic impact assessment as part of the Arrow LNG Plant project Environmental Impact Statement (EIS). This report forms Appendix 21 of the EIS, and outlines the project is estimated to generate (including both direct and flow-on activity) approximately $5.3 billion in Queensland GSP per annum for production of 16 Mtpa of LNG. Assuming gas use of approximately 30 PJ per Mt of LNG, this equates to approximately $11.0 million in GSP per PJ of gas used. Unlike the above studies, the Arrow LNG Plant economic impact assessment only examined the impacts of the LNG facility itself, and did not include impacts associated with CSG extraction. Employment impacts outlined in this study are significantly lower than those outlined in the other studies, in particular during operation. Employment impacts of less than 200 FTE jobs are estimated during operations for this project (or less than 0.5 FTEs per PJ of gas), highlighting the very low employment generated by the LNG facilities per PJ of gas consumed.

While the modelling techniques used for the above case studies are different to that used for the QLIGC operations in this report, it still provides a useful comparator of economic activity per PJ of gas consumed. GSP impacts per PJ ranges from $1.7 million to $21.9 million, while employment impacts range between 0.5 and 20 FTE jobs per PJ of gas used. This is considerably lower than the economic contribution per PJ of gas used by QLIGC operations.

Significantly, the above studies incorporate both construction and operation activity in the estimates of economic impacts, and most of the studies also include economic impacts associated with CSG exploration and extraction. In comparing large industrial gas users with the LNG industry, it is more applicable to examine only the operational component of LNG facilities. The economic impact assessment of the Arrow LNG Plant highlights the majority of employment impacts associated with LNG production (as outlined in the first three dot points above) are driven by construction and CSG extraction activities, not LNG facility operation.

5. Findings

Large industrial gas users consumed nearly half of Queensland's total gas demand of approximately 240 PJ in 2010-11. The QLIGC operations accounted for approximately 40% of total gas consumed in Queensland, and approximately 85% of gas consumed by large industrial gas users.

An assessment of the economic significance of QLIGC operations and the large industrial gas using sector overall indicates these users support, both directly and indirectly, approximately $120 million in GSP per PJ of gas consumed, and approximately 460 FTE jobs per PJ consumed. By comparison, case studies examining LNG projects and the Queensland LNG industry as a whole indicate the economic contribution per PJ of gas used in the production of LNG ranges from $1.7 million to $21.9 million in GSP, and between 0.5 and 20 FTE jobs.

The LNG case studies incorporate both construction and operation activity in the estimates of economic impacts, and most of the studies also include economic impacts associated with CSG extraction. The majority of employment impacts associated with LNG production outlined in the case studies are driven by construction and CSG extraction activities, not just LNG facility operation.

The large industrial gas using industry is a higher value adding industry than LNG per PJ of gas used. This is unsurprising given the large industrial gas users consume gas as either an energy input or as an intermediate good in value adding processing and production of final outputs. The LNG industry, on the other hand, provides an avenue for gas producers to enter more lucrative gas markets by altering the gas state for transport to export markets. While this provides a considerable increase in the net value of the gas extracted, it provides lower value adding activity per PJ of gas than productive uses of the large gas using sector.

While it is acknowledged different modelling techniques are used for the LNG case studies examined, the quantum of the difference in economic contribution compared to large industrial gas users indicates existing major gas users provide a considerably higher economic value and jobs per PJ of gas consumed.

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Appendix A: Significance Assessment Methodology

The economic significance estimates in this report are produced using Input-Output transaction tables and models developed by AEC*group* for the purposes of this assessment, combined with data from a range of sources, including State Accounts data from the ABS. The Input-Output models were used to produce estimates of the direct and flow-on contribution of QLIGC to the Queensland economy in terms of GSP, gross value added activity, employment and income (i.e., wages and salaries).

Overview of IO Modelling

Input-Output (IO) analysis demonstrates inter-industry relationships within an economy, depicting how the output of one industry is purchased by other industries, households, the government and external parties (i.e. exports), as well as expenditure on other factors of production such as labour, capital and imports. IO analysis shows the direct and indirect (flow-on) effects of one industry on other industries and the general economy. As such, IO modelling can be used to demonstrate the economic contribution of an industry on the overall economy and how much the economy relies on this industry or to examine a change in final demand of any one industry and the resultant change in activity of its supporting industries.

The economic contribution can be traced through the economic system via:

- **Direct impacts**, which are the first round of effects from direct operational expenditure on goods and services; and
- **Flow-on impacts**, which comprise the second and subsequent round effects of increased purchases by suppliers in response to increased sales.

These effects can be identified through the examination of five types of impacts:

- **Output**: Refers to the gross value of goods and services transacted, including the costs of goods and services used in the development and provision of the final product. Output typically overstates the economic impacts as it counts all goods and services used in one stage of production as an input to later stages of production, hence counting their contribution more than once.
- **Value added**: Refers to the value of output after deducting the cost of goods and services inputs in the production process. Value added defines the true net contribution and is subsequently the preferred measure for assessing economic impacts.
- **Gross product**: Gross product (or more commonly known as Gross Domestic/ State/ Regional Product) is a similar measure to value added, but also includes taxes less subsidies on the final goods and services produced. Gross product is the most commonly used headline measure of economic activity.
- **Income**: Measures the level of wages and salaries paid to employees of the industry under consideration and to other industries through flow-on activity.
- **Employment**: Refers to the part-time and full-time employment positions generated by the economic shock, both directly and indirectly through flow-on activity, and is expressed in terms of full time equivalent (FTE) positions.

IO Assumptions

The key assumptions and limitations of Input-Output analysis include:

- The inputs purchased by each industry are a function only of the level of output of that industry. The input function is generally assumed linear and homogenous of degree one (which implies constant returns to scale and no substitution between inputs).

- Each commodity (or group of commodities) is supplied by a single industry or sector of production. This implies that there is only one method used to produce each commodity and that each industry or sector has only one primary output.
- The total effect of carrying on several types of production is the sum of the separate effects. This rules out external economies and diseconomies and is known simply as the additivity assumption. This generally does not reflect real world operations.
- The system is in equilibrium at given prices. This is not the case in an economic system subject to external influences.
- In the static input-output model, there are no capacity constraints so that the supply of each good is perfectly elastic. Each industry can supply whatever quantity is demanded of it and there are no capital restrictions. This assumption would come into play depending upon the magnitude of the changes in quantities demanded.

Despite these limitations, IO techniques provide a solid approach for taking account of the inter-relationships between the various sectors of the economy in the short-term and provide useful insight into the quantum of final demand for goods and services, both directly and indirectly, generated by the QLIGC in the Queensland economy.

Significance Assessment Versus Impact Assessment

The framework employed in significance assessment **differs from that employed in economic impact analysis** in that economic significance assessment primarily seeks the contribution of an existing industry as opposed to the impact of a "stimulus" in a particular industry or in several industries (West, 1993). The usual approach of comparing what the economy would be with and without the industries whose contributions are to be assessed does not work because the inter-relationship between industries means whether or not the industries to be assessed exist, there will still be demand for their outputs (e.g., a complete vehicle needs tyres so that whether or not the entire tyre manufacturer is closed down, the car manufacturer's demand for tyres still exists). From a modelling stance, this problem is solved by assuming that demand for outputs of the industries to be assessed would instead be met by imports.

Model Development

The models used in this assessment are derived from sub-regional transaction tables developed specifically for this project. The process of developing a sub-regional transaction table involves developing regional estimates of gross production and purchasing patterns based on a parent table, in this case the 2008-09 Australian transaction table (ABS, 2012a).

Estimates of gross production (by industry) in Queensland were developed based on the percent contribution to employment (by place of work) of Queensland to the Australian economy (ABS, 2010a), and applied to Australian gross output identified in the 2008-09 Australian table.

Industry purchasing patterns within Queensland were estimated using a process of cross industry location quotients and demand-supply pool production functions as described in West (1993).

In addition to the general limitations of Input-Output analysis, there are two other factors that need to be considered when assessing the outputs of sub-regional transaction table developed using this approach, namely:

- It is assumed the sub-region has similar technology and demand/ consumption patterns as the parent (Australia) table (e.g. the ratio of employee compensation to employees for each industry is held constant); and
- Intra-regional cross-industry purchasing patterns for a given industry vary from the national tables depending on the prominence of the industry in the regional economy compared to its input industries. Typically, industries that are more prominent in the region (compared to the national economy) will be assessed as purchasing a higher proportion of imports from input industries than at the national level, and vice versa.

Input-Output tables utilise an aggregated system of industry classifications based on the ANZSIC system. In total, the 2008-09 Input-Output tables produced by the ABS (2012a) define 111 distinct industries.

Significance Assessment Approach

The significance assessment is initially undertaken for the 2008-09 financial year to be consistent with the Input-Output transaction tables utilised. These estimates are then "rebased" to 2010-11 values using:

- Data from the Queensland State Accounts (ABS, 2011a) to identify growth between 2008-09 and 2010-11 in gross product and gross value add for each industry of the economy.
- Data on labour productivity increases (ABS, 2011b) to identify changes in productivity per employee for each industry between 2008-09 and 2010-11. These estimates were then applied to 2010-11 production (estimated above) to identify 2010-11 employment for each industry. Modelled total employment and employment by industry is rebased to estimates of total employment from the ABS for 2010-11 (ABS, 2012b).
- Estimates of incomes in 2010-11 were obtained assuming that the relationship between income and output in 2008-09 remains constant, which is consistent with the stylised fact of cost shares of output being close to constant over the long-term.

Estimates of the **flow-on** effects of the QLIGC in 2010-11 are obtained assuming constant proportion between **individual** industries' flow-on effects and the direct **(total)** effects (output, GVA, income and employment) in 2008-09. Since the relationship between industries is likely to have changed over this period, the estimates produced are indicative only. In the absence of a more recent Input-Output transaction table, which forms the basis to quantify the inter-relationships between industries, the estimates produced represent the flow-on effects of QLIGC operations assuming no significant structural changes in the relationship between industries.

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E aec@aecgroupltd.com W www.aecgroupltd.com ABN 84 087 828 902