2 PROJECT OVERVIEW

Liquefied natural gas, commonly referred to as LNG, is a safe, proven and efficient technology used to deliver supplies of natural gas, the cleanest of all fossil fuels, to markets around the world. Drawing on BG Group's track record of successful LNG development, the QCLNG Project will unlock Queensland's supplies of coal seam gas (CSG) and establish the LNG industry on the east coast of Australia.

Domestically, the QCLNG Project will help expand the gas market, providing opportunities for gas suppliers and increased choice for consumers. It will rank as one of Australia's largest capital investments and generate significant economic benefits for Australia and in particular for Queensland, including more than 4,000 jobs at the peak of construction, about 1,000 permanent positions and increased demand for goods and services.

2.1 THE QCLNG PROJECT

The QCLNG Project will consist of project infrastructure to be developed by QGC comprising the following major components (Project Components):

- a significant CSG field development and supporting infrastructure in the Surat Basin of southern Queensland (Gas Field Component) including management of associated water produced
- a network of underground pipelines, including gas and water collection pipelines in the Gas Field Component and a 380 km underground gas transmission pipeline (Export Pipeline) from the Gas Field to a LNG Facility (Pipeline Component)
- a gas liquefaction facility on Curtis Island, adjacent to Gladstone, initially comprising two processing units, or "trains", to be followed by a third train. This component also includes an export jetty and other supporting infrastructure (LNG Component)
- LNG shipping operations to load the LNG and ship cargos to global export markets (Shipping Operations).

An additional component, a new shipping channel from the existing channels in the Port of Gladstone and a swing basin at the export jetty, will need to be developed to provide access for the shipping operations. The dredging works required for this Component may be part of a larger shipping channel development program being proposed by Gladstone Ports Corporation (GPC). This development is discussed further below.

This EIS covers the development of the QCLNG Project Infrastructure, specifically the Components listed above.

The operation of the QCLNG Project may also involve the development of several components of other infrastructure which could be constructed and operated by parties other than QGC (Ancillary Infrastructure).

Environmental approvals processes separate to this EIS are either underway for some of these components or will be undertaken should additional components be developed. This Ancillary Infrastructure may include:

- a bridge and roads to provide direct vehicular access from Gladstone to Curtis Island
- a major new development of the Western Basin of the Port of Gladstone, involving dredging of a series of additional shipping channels and land reclamation using the dredged material proposed by GPC
- other off-tenement infrastructure associated with or the transportation and beneficial use of approved or treated associated water from the gas fields
- acquisition or addition of new gas tenements, resources and any new infrastructure required to provide additional reserves to underpin the future expansion of the QCLNG Project.

Further information on this Ancillary Infrastructure is provided in *Section 2.2.2* below. However, as these components do not form part of the QCLNG Project they have not been assessed as part of this EIS. References to where other separate environmental assessments are being undertaken or are proposed for these components are provided in the relevant sections of this document.

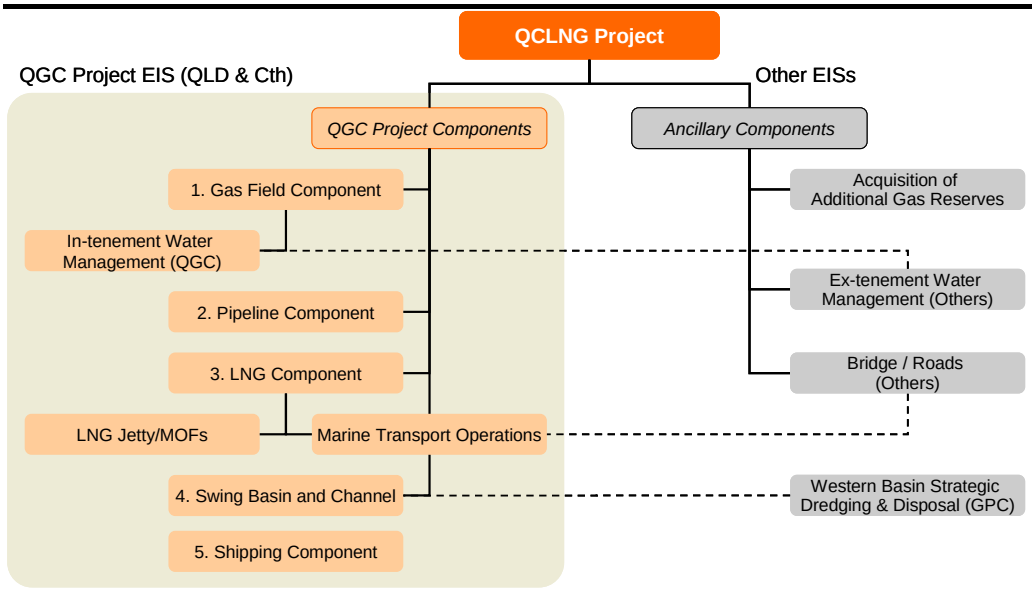
2.2 SCOPE OF THIS EIS

This Draft EIS has been prepared to describe the major infrastructure components to be developed by QGC and explain the environmental impacts of their construction, operation and decommissioning.

Figure 1.2.1 provides a description of the Project Components which are the subject of this EIS as defined in the ToR against which this EIS is to be assessed. In addition, the figure details the Ancillary Infrastructure which fall outside the ToR and any interrelationships between the Ancillary Infrastructure and the Project Components.

A full description of the constituent parts within each of the major Project Components is provided in *Section 2.2.1*.

Figure 1.2.1 Scope of QCLNG EIS and Relationships to Other EISs



2.2.1 QGC Project Components

The five principal Project Components to be developed by QGC are:

- **Gas Field Component:** the expansion of QGC's CSG operations in the Surat Basin. The Gas Field Component comprises:
  - approximately 6,000 gas production wells over the life of the project with initially 1,000 to 1,500 wells across the Gas Field by mid 2014. The remaining wells will be phased in over the life of the project (20 to 30 years) to replace declining wells
  - associated surface equipment, such as wellhead separators, telemetry devices and metering stations
  - field infrastructure such as access tracks, warehouses, camps (both construction and operations), office and telecommunications
  - gas and water-gathering systems and gas-processing and compression infrastructure.

  The Gas Field Component will also include the management of water produced in the CSG extraction process on the production tenements including any use of the water by QGC on its tenements (Associated Water).

- **Pipeline Component:** Development, construction, operation and decommissioning of a gas pipeline network of approximately 730 km to link the Gas Field Component and other nearby CSG resources to the LNG Facility. The pipeline network includes:
  - a 380 km gas transmission Export Pipeline from the Gas Field Component to the LNG Facility in Gladstone

- potentially a 150 km Lateral Pipeline which will enable the connection of additional gas fields to the Export Pipeline
- a 200 km Collection Header – a central pipeline located in an Upstream Infrastructure Corridor (UIC) to collect gas from centralised compressor facilities for delivery to the Export Pipeline
- a submarine pipeline crossing at The Narrows and connecting the mainland with the LNG Facility.

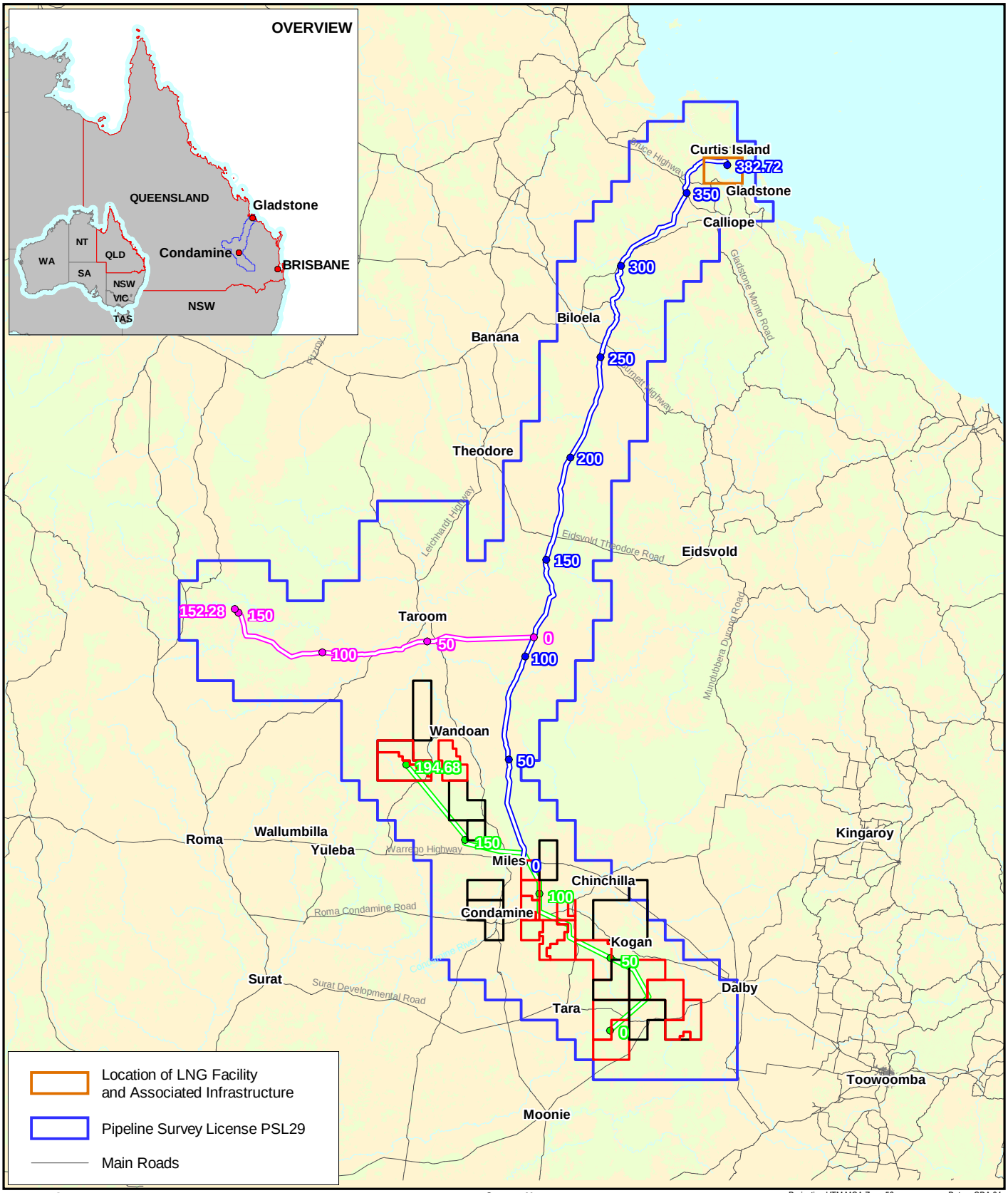
- **LNG Component:** Development, construction and operation within the Curtis Island Industry Precinct of the Gladstone State Development Area (GSDA) of:
  - a LNG processing plant (LNG Facility) with production capacity up to 12 million tonnes per annum (mtpa), nominally comprising three LNG processing units or "trains" with 3.8 million tonnes per annum (mtpa) production capacity each
  - Associated Onshore Facilities
  - Jetty and Marine Operations Facilities (MOF)
  - Marine Transportation Operations, involving the transit of construction and operations materials, and personnel via barges and ferries between Gladstone and Curtis Island. The Marine Transportation Operations require:
    - new or upgraded existing facilities within the Port of Gladstone
    - a MOF attached to the LNG Facility on Curtis Island.

    Marine Transportation Operations are QGC's preferred option for long-term access between Gladstone and the LNG Facility on Curtis Island. An alternative of bridge and road access to Curtis Island has also been outlined in *Volume 2* and comparative environmental assessments of the two options are detailed in *Volume 5*.

- **Swing Basin and Channel:** The development of a new shipping channel and swing basin connecting the existing Targinie channel to the LNG Facility site to enable ships to access the Jetty and MOF. This development will require the dredging of a new channel and swing basin and potentially some widening and deepening of other parts of the Port of Gladstone. It will also involve initial dredging of a small channel from the Swing Basin to the MOF at the LNG Facility (MOF Channel).

- **Shipping Operations:** Regular transit of LNG tankers and, potentially, infrequent transit of ships carrying propane to the LNG Facility for the "spiking" of LNG. Shipping operations will involve three stages: loading of LNG/unloading propane at the marine jetty; transit of ships through Gladstone Harbour; and transit of ships through the Great Barrier Reef Marine Park to open ocean.

A full description of the Project Components is provided in *Volume 2*.



Legend:

- Export Pipeline & Kilometre Point
- Lateral Pipeline & Kilometre Point
- Upstream Infrastructure Corridor & Kilometre Point
- CSG Fields - ATP
- CSG Fields - PL & PLA

Source Note:
1:250,000 Topographic vector copyright Geoscience Australia

Projection UTM MGA Zone 56 Datum GDA 94

0 50 75 100

Kilometres

N

QUEENSLAND CURTIS LNG
A BG Group business

Project	Queensland Curtis LNG Project
Client	QGC - A BG Group business
Title	QCLNG Project Study Area

ERM
Environmental Resources Management Australia Pty Ltd

Drawn	DB	Volume	1	Figure	1.2.2
Approved	CDiP	File No	EO5-P-MA-96146		
Date	30.04.09	Revision	A		

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ERM does not warrant the accuracy of any such Maps and Figures.

The five principal Project Components developed by QGC span a linear area of some 500 km and cover five Local Government Areas. *Figure 1.2.2* provides an overview of the geographic area covered by the Project.

2.2.2 Ancillary Infrastructure

The operation of the QCLNG Project may involve the development of Ancillary Infrastructure by other parties solely or possibly with the involvement of QGC. The relationships and interdependencies of the Ancillary Infrastructure to the QCLNG Project Components are discussed further in *Section 2.6.2* of this chapter.

As discussed in *Section 2.1*, the environmental assessment and planning permit processes for these components are separate to this EIS. However, to provide a full understanding and context of the QCLNG Project, where relevant, the Ancillary Infrastructure, the environment in which it is to be developed and the associated environmental impacts are detailed.

The development of the Ancillary Infrastructure is also addressed where relevant in the context of assessment of cumulative impacts throughout this EIS.

The principal Ancillary Infrastructure that may be developed by others includes:

- Transport of and use of Associated Water ex-tenement: covering water produced from the development of the Gas Field Component off QGC tenements and its beneficial use. This is discussed further in *Volume 3, Chapter 11*. QGC is undertaking further investigations into a range of possible beneficial uses for Associated Water and commercial discussions with a number of parties seeking to purchase water for use in other industrial and commercial processes. Should QGC propose other ex-tenement associated water beneficial use development, or enter into agreements with a party for the sale and purchase of water, any environmental assessment and permitting required for the infrastructure would be undertaken by that party.
- The Western Basin Strategic Dredging and Disposal (WBSDD) Project: The WBSDD Project to be undertaken by GPC involves the staged dredging of five new shipping channel areas and the reclamation of land in the Western Basin of the Port of Gladstone using the dredged material. The Swing Basin and Channel required for the QCLNG Project may constitute part of one of the stages identified in the WBSDD Project.
- Bridge/road access to Curtis Island: Access to Curtis Island via road and a bridge is discussed in the GLNG Project EIS prepared by Santos Limited.[1] QGC may subject to commercial arrangements utilise the bridge/road access during the operational phase of the LNG Component should it be developed by other parties. Therefore, it is discussed only as an option to marine transport in this EIS. QGC had originally referred the development

1 See GLNG website at: < http://www.glng.com.au/ >. Accessed 12 July 2009.

of a bridge and associated roads associated with the QCLNG Project under the EPBC Act which were subsequently designated as controlled actions. However, these components are no longer proposed by QGC as part of the Project and the EPBC referrals have subsequently been withdrawn.[2]

- New gas tenements, resources or infrastructure: QGC continues to explore, identify new acreage, joint-venture and acquisition opportunities to develop further CSG resources in Queensland. Additional reserves provide both the opportunity for further domestic gas business as well as underpinning the resources required for additional sales from the LNG Facility. Should QGC identify additional resources which are proposed to be added to the reserves for the QCLNG Project, any additional or new environmental assessment, planning processes and applications for CSG activities and infrastructure will be undertaken as required.

Ancillary Infrastructure is further described in detail in *Volume 2.*

2.3 TIMESCALE FOR IMPLEMENTATION

Pending the relevant approvals, QGC expects to make a final investment decision on the QCLNG Project in the first quarter of 2010. Construction is anticipated to begin soon after with commercial operations anticipated to start in early 2014.

The Project is anticipated to have a design life of at least 20 years for each LNG train.

2.4 PROPONENT

The Proponent of the Project Components is QGC Limited (QGC).

QGC's corporate history is represented below in *Figure 1.2.3*. QGC is a wholly-owned subsidiary of BG Group plc (BG Group) and is charged with carrying out BG Group's activities in Australia.

2 EPBC Referrals: Bridge (EPBC 2008/4400); Curtis Island Road (EPBC 2008/4404); and Mainland Road (EPBC 2008/4403).

Figure 1.2.3 QGC Development Timeline

Founded as Queensland Gas Company Limited, the Brisbane-headquartered CSG explorer listed on the ASX in August 2000 with a market capitalisation of $16 million. Over the next seven years, the company developed a strong reserves base in the Surat Basin of southern Queensland, culminating in its first gas sales in the domestic market in 2007.

In February 2008, QGC entered an alliance with BG Group via its subsidiary BG International Limited to develop the QCLNG Project. Later that year, QGC acquired control of Sunshine Gas Limited and Roma Petroleum Limited. These transactions gave QGC exploration and production leases covering 37,500 km², mostly in the Surat and Bowen Basins, and Proved, Probable and Possible (3P) gas reserves of more than 8,200 petajoules (PJ).

In January 2009, QGC completed a successful integration with BG Group. The integration consolidates QGC's extensive CSG expertise and BG Group's international experience in LNG within a single-company structure.

In April 2009 QGC was delisted from the ASX and changed its name from Queensland Gas Company Limited to QGC Limited.

In May 2009 BG Group completed a successful takeover of Pure Energy Resources Limited. This acquisition added a further 2,472 PJ to QGC's 3P gas reserves, including a further 1,241 PJ in the Surat Basin.

QGC now has more than 370 staff located in Queensland.

In addition to LNG, the new QGC is focused on continued expansion of its CSG resource base in southern Queensland and supply of both domestic and export markets. QGC has already committed a significant proportion of its fast-growing reserves to meeting Australia's energy needs. These reserves are projected to supply about 20 per cent of Queensland's domestic gas market in 2009. QGC will continue to identify and evaluate opportunities for domestic gas sales and expects to continue to supply at least current domestic contracts post-2014 when the QCLNG Project begins production.

Business details, nominated persons for Project correspondence and business and mailing addresses for these entities are set out in *Table 1.2.1* below.

Table 1.2.1 Proponent Details

Detail	QGC Limited (QGC)
ABN/Company No:	ACN 089 642 553
Nominated Contact:	Catherine Tanna Executive Vice President (BG Group plc) & Managing Director, Australia
Mailing Address:	GPO Box 3107, Brisbane, QLD 4001

An overview of relevant experience and environmental policies of BG Group and QGC is provided below.

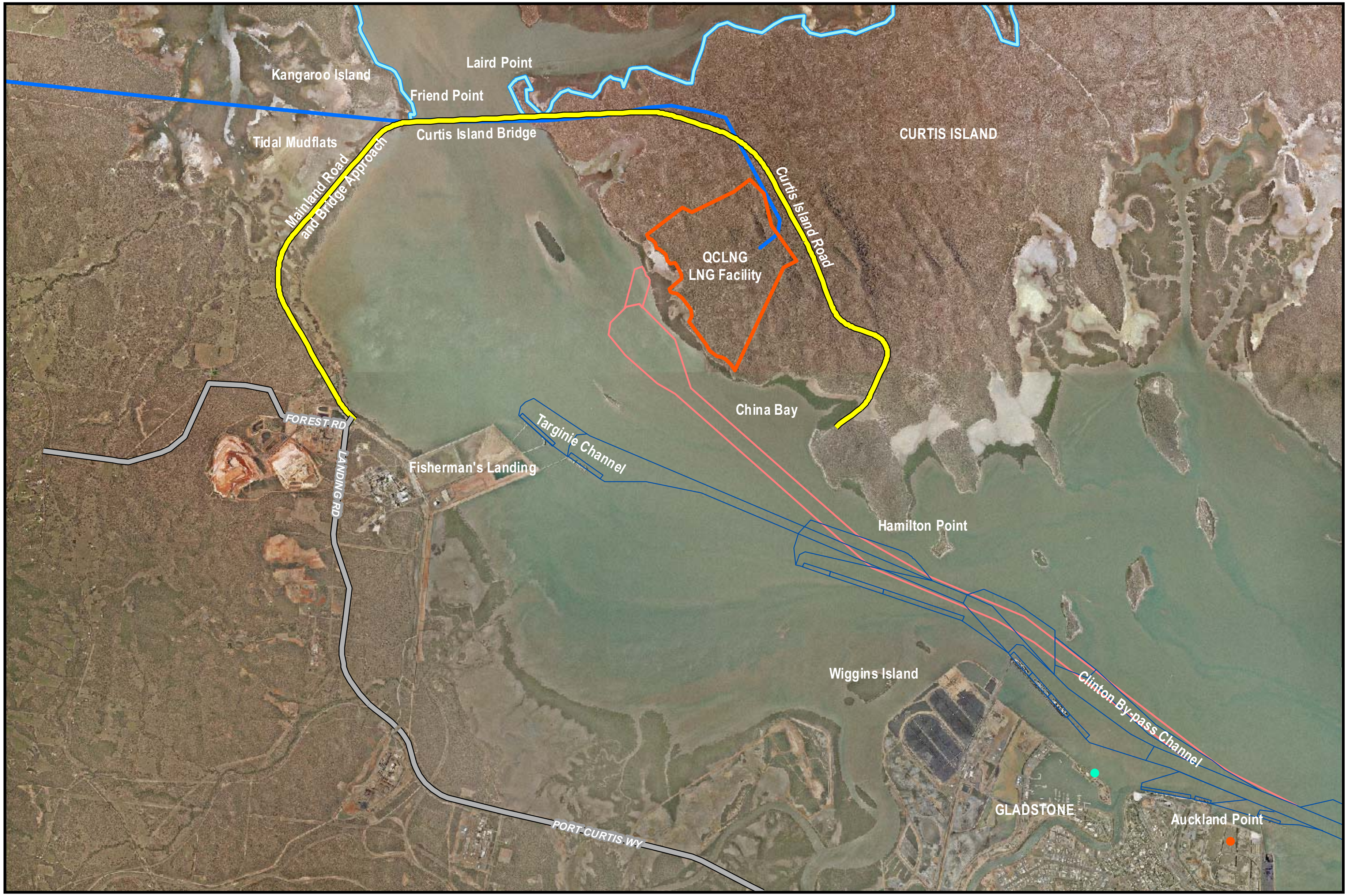
2.4.1 BG Group plc

BG Group plc is a UK-listed energy business with activities on five continents and interests in 27 countries. Although headquartered in Reading, more than 60 per cent of the company's 5,300 employees are located outside the United Kingdom.

BG Group has operations across the energy sector, particularly in natural gas where it has experience throughout the gas chain from exploration to distribution to the customer. BG Group ranks among the largest companies on the London Stock Exchange with a market capitalisation of approximately A$72 billion (as of July 2009). In 2008 BG Group's operating profit was £5.4 billion.

BG Group's LNG business encompasses liquefaction, shipping, regasification and marketing. In particular, BG Group has relevant industry experience, acquired in conjunction with its operating partners, in the development and operation of:

- numerous gas production fields and delivery pipelines around the world
- a four-train LNG export facility on the south-western coast of Trinidad which commenced operation in 1999 and has a production capacity of more than 15 mtpa
- a two-train, 7.2 mtpa capacity LNG export facility in Egypt, which commenced operation in 2005 and uses ConocoPhillips Optimized Cascade Process^{SM} liquefaction technology
- an initial two-train LNG export facility of around 12 mtpa in Nigeria, with potential for expansion (currently under development with joint venture partners)
- existing processing capacity in LNG import terminals and regasification facilities in the United States, Chile and Wales, with new capacity currently under development in Italy.



Legend

- Proposed QCLNG Site Boundary
- Proposed Export Pipeline
- Possible Curtis Island Road/ Bridge Corridor
- Proposed Swing Basin & Shipping Channel
- Existing Shipping Channel
- GBRCMP Boundary
- Indicative Location of the Proposed Operations Phase Ferry Terminal
- Construction Phase Logistics Site

Source Note:

Aerial Photo - Department of Infrastructure and Planning for QCLNG Project.
Curtis Island Road/Bridge Corridor - Connell Wagner.
Shipping Channels - HR Wallingford, Drawing EBR4320\012\D003-E

Projection: UTM MGA Zone 56 Datum: GDA 94

0 0.5 1 2 km

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QUEENSLAND CURTIS LNG
A BG Group business

ERM

Environmental Resources Management Australia Pty Ltd

Project	Queensland Curtis LNG Project
Client	QGC - A BG Group business
Drawn	JB
Approved	FM
Date	25.05.09
Volume 1	Figure 1.2.4
File No:	0086165b_EIS_PO_GIS003_F1.2.4
Revision	2

Title: **Location of the LNG Facility and Ancillary Infrastructure**

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BG Group also has a long history in LNG shipping and was involved in development of both the prototype and the first working LNG carriers in the industry. BG Group's current core LNG fleet consists of nine vessels (seven owned and two on long-termed charters), 138,000 m^3 to 145,000 m^3 in capacity, all with steam turbine propulsion systems. In addition, BG Group currently controls 18 LNG vessels of 138,000 m^3 to 165,000 m^3 under short and medium-term charters. BG Group has exercised options to acquire four 170,000 m^3 ships with Dual Fuel Diesel Electric (DFDE) propulsion systems from Samsung Heavy Industries which will all be delivered in 2010. The company will also take two new 155,000m^3 DFDE ships on charter in 2010.

In 2008, BG Group managed total LNG volumes of about 13 million tonnes and supplied around 8.4 million tonnes of LNG to customers in the Pacific Basin.

The company believes there is significant potential to further expand its LNG supply activities in the Pacific Basin to meet increasing global demand for natural gas, a cleaner, more efficient energy. Regionally, BG Group was recently selected by the Energy Market Authority (EMA) of Singapore to supply up to 3 million tonnes per annum of LNG to the Singapore market for up to 20 years.

In May 2009 BG Group signed a LNG Project Development Agreement with China National Offshore Oil Corporation and its affiliates (CNOOC), focused on the QCLNG Project. BG Group and CNOOC will jointly participate in a consortium formed to construct two LNG ships in China that will be owned by the consortium.

2.4.2 Environmental Background and History

Between 2000 and 2009, prior to its acquisition by BG Group, QGC's gas production and exploration activities were conducted subject to a Health, Safety, Environment and Quality (HSEQ) policy which committed the company to complying with or exceeding all applicable legislation and standards. Also, all employees and contractors were involved in the ongoing improvement of environmental performance. Staff training initiatives were regularly undertaken to increase environmental awareness among staff in all groups. Brisbane and field-based environmental personnel assisted with environmental performance and carried out various training initiatives. Environmental Management Plans were developed to assist QGC in the conduct of its activities.

QGC gas field development is carried out in accordance with Level 1 Environmental Authorities for the petroleum activities on its tenements.

Prior to BG Group's acquisition of QGC, environmental management was standardised across all QGC-operated tenements under Environmental Management Plans which detail potential impacts, environmental protection objectives and environmental mitigation measures/controls for petroleum activities. These have been prepared in consultation with the Environmental

Protection Agency, now the Department of Environment and Resource Management, to meet all regulatory requirements.

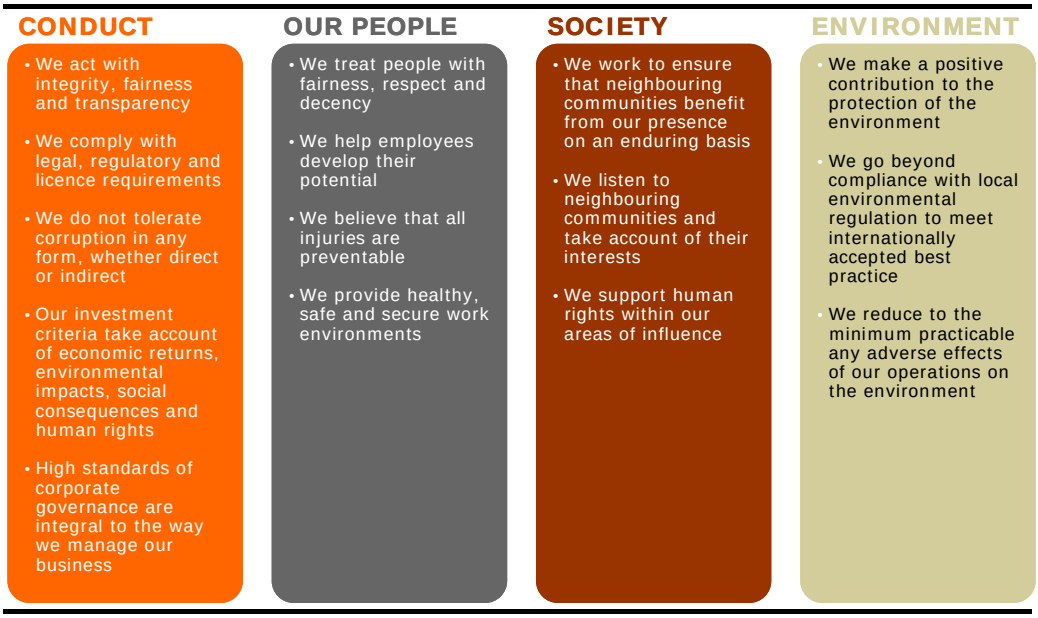
Gas exploration and production activities were undertaken with the aim of balancing company growth with landholder, Traditional Owner and broader community environmental expectations. QGC's objectives for environmental performance are encompassed in the QGC Code of Environmental Practice, requiring that QGC:

- comply with or exceed all applicable laws, regulations, advisory and industry standards and, where adequate laws do not exist, adopt and apply standards that reflect the company's commitment to HSEQ and make adequate provision of resources to meet these requirements
- provide a suitable working environment and conditions in which employees can work without danger to themselves, the community and the environment
- involve all of its employees in the continuous improvement of HSEQ performance
- train and hold individual employees accountable for their area of responsibility through continuous education and defined role descriptions
- manage risk by implementing systems to identify, report, assess, monitor and control risks and by reviewing performance
- ensure that all employees and visitors such as contractors, suppliers and guests are informed of and understand their obligations with respect to this policy.

2.4.2.1 BG Group Business Principles

BG Group aims to be an industry leader in health, safety, security, social and environmental performance and this is reflected in its Business Principles, reproduced in *Figure 1.2.5*. As a member of the BG Group, QGC is committed to these Business Principles.

Figure 1.2.5 BG Group Business Principles



BG Group considers social and environmental performance integral to the manner in which it conducts business and indicators are reported regularly. Indicators include social investment and reported emissions, environmental discharges and waste and energy usage.

2.4.2.2 BG Group's Health, Safety and Environment (HSE) Policy

Statement of Principle

Outstanding business performance requires outstanding performance in the areas of Health, Safety and Environment (HSE). This means ensuring the health and safety of our people and of those affected by our business and protecting our physical assets, reputation and the environment.

BG Group's HSE policy cascades from our Business Principles:

- We believe all injuries are preventable.
- We provide healthy, safe and secure work environments.
- We make a positive contribution to the protection of the environment.
- We reduce to the minimum practicable any adverse effects of our operations on the environment.

In this:

- We go beyond compliance with local regulation to meet or exceed internationally accepted good practice in HSE management.
- We recognise that HSE is everyone's responsibility and that we each have a duty to intervene to prevent unsafe actions and to reinforce good behaviours. Our goal is zero injuries. The safe delivery of projects and operation of facilities is a critical success factor. It is not just the end result

that matters; we care about how we get there.

- We aim to be an industry leader in HSE performance.

Implementation

We will:

- ensure all management decisions reflect our HSE intentions
- ensure all employees understand their HSE accountabilities and demonstrate visible HSE leadership
- ensure that our HSE management systems reflect best industry practice and are properly resourced. We will continually improve by ensuring that lessons are always learnt
- provide direction, education, training and supervision to ensure that all employees understand the required behaviours and the consequences of non-compliance. Good HSE performance is essential for career advancement
- ensure that our contractors understand their HSE accountabilities and required behaviours, share our aspirations and are aware of the consequences of non-compliance. We will learn continually from each other's experiences
- work with our partners to achieve internationally accepted good practice in HSE and learn continually from each other's experiences
- adopt a risk-based approach to the design, construction and operation of facilities across their full life cycle
- take account of stakeholder HSE concerns by involving and consulting with employees and their representatives, communities where we operate, government authorities, customers and shareholders
- continually improve our HSE performance so that work-related ill health and incidents are reduced and so that environmental emissions, waste and the use of energy are reduced relative to activity
- comply with this policy and drive HSE improvements by setting expectations and objectives and reviewing, monitoring and auditing performance
- publicly report on key HSE objectives and performance, fully cooperate with relevant government agencies and work with the industry to improve HSE practices
- regularly review this policy.

BG Group's Environmental Strategy

BG Group's Environmental Strategy enables BG Group to establish and sustain operations in compliance with the company's Business Principles, and to respond to progressively changing external requirements. Full detail on BG's Environmental Strategy, positions on key environmental issues and performance metrics can be found on the BG Group website at: www.bg-group.com.

BG Group's Social Performance Policy

BG Group's social performance aim is to meet and exceed our business objectives by managing our operational risks and aligning objectives with those of host communities and governments. These social performance objectives are met through:

- establishing and maintaining effective relationships with interested and affected stakeholders
- avoiding and minimising negative impacts from our activities
- creating and delivering opportunities to benefit communities.

These key elements of BG Group's social performance are set within a governance framework that includes a Social Performance Standard with associated guidelines, an assurance process, active monitoring, reporting and metrics.

2.5 PROJECT RATIONALE AND SIGNIFICANCE

The QCLNG Project is a priority development for QGC and its parent, BG Group. The Project will draw on QGC's extensive local CSG expertise and BG Group's international experience in LNG to help unlock Queensland's vast reserves of CSG at a time of rising demand for cleaner, more efficient energy.

Pending the relevant approvals, the Project will begin commercial operations in 2014. Domestically, it will provide new gas extraction and transportation infrastructure, offering greater opportunities for gas producers and in so doing increasing choice for consumers.

2.5.1 Properties – Coal Seam Gas

CSG occurs naturally, produced over millions of years as coal is formed deep underground through heating and compressing plant matter.

The gas, which is mostly methane, is trapped in coal seams typically at depths of 300 to 600 m. The coal seams are usually saturated with water and the pressure of this water holds the gas in place. CSG is extracted by drilling wells into the coal seams. The water flows to the surface unaided or is pumped out if the pressure within the seam is low, releasing the CSG from the coal.

The CSG and water are separated at the wellhead and the gas is piped to a compression plant, where it is dried and compressed before it is transported through a transmission pipeline to the LNG Facility or domestic customers.

CSG in the Surat Basin is typically more than 97 per cent methane with only small amounts of nitrogen and carbon dioxide. As such, it requires relatively little treatment before it is turned into LNG.

2.5.2 Properties – LNG

LNG is natural gas that has been cooled until it becomes a liquid so it can be easily transported and stored. LNG is odourless, colourless, non-corrosive and non-toxic. Liquefying natural gas is a convenient way of transporting it over large distances not feasible by pipeline or to provide it to locations which do not have naturally occurring reserves.

The QCLNG Project will source CSG from the Surat Basin and transport it via a gas transmission Export Pipeline to the proposed LNG Facility. There, impurities in the gas, such as carbon dioxide, will be removed and the gas cooled to about -162ºC, using the same principles that work in household refrigerators or air-conditioning units.

At this temperature, the natural gas liquefies and takes up 1/600th of its original volume. As a liquid, the gas, now LNG, is transported safely and economically at near atmospheric pressure in large vessels. Further details about the LNG process can be found in *Volume 2, Chapter 9*.

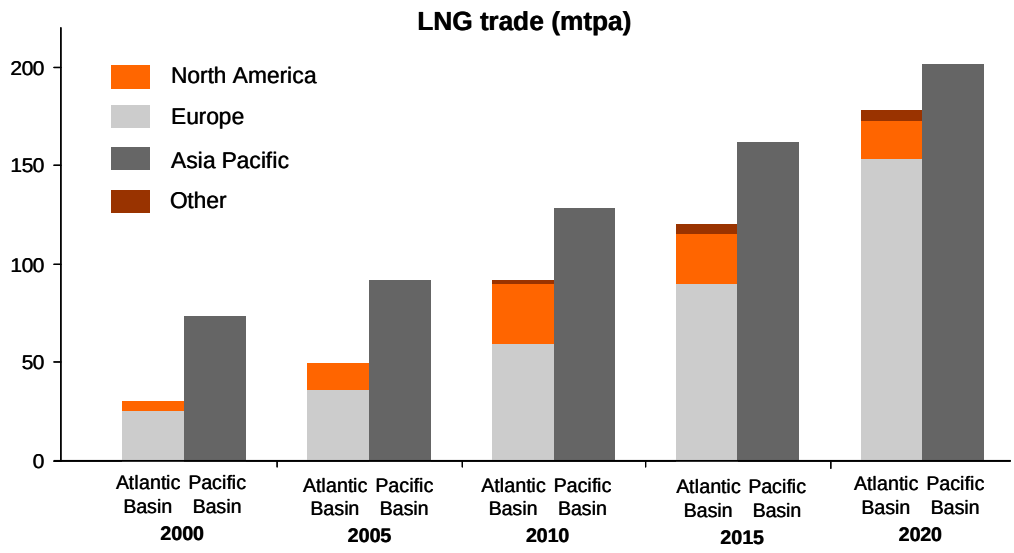
When LNG is returned to ambient temperature, it becomes the same natural gas used to cook meals, warm homes, and provide fuel for cars, buses and power stations.

The first natural gas liquefaction plant was constructed in the United States in 1912 and LNG has been shipped commercially around the world since 1959. Australia began exporting LNG from the North West Shelf Project in 1989.

2.5.3 Strategic Rationale Driving the Project

The increasing importance of LNG is highlighted by the projected growth of the LNG trade worldwide (*Figure 1.2.6*) from 142 mtpa in 2005 to a projected 380 mtpa by 2020. The Pacific Basin LNG trade, historically the largest market for LNG, is forecast to increase by 109 mtpa to 201 mtpa over the same period. (The Pacific Basin is defined as the geographic trade area to the east of the Suez Canal while the Atlantic Basin is that to the west of Suez Canal.)

Figure 1.2.6 Global LNG Trade



In this context, the QCLNG Project provides a new source of LNG to supply rapidly growing markets near Australia.

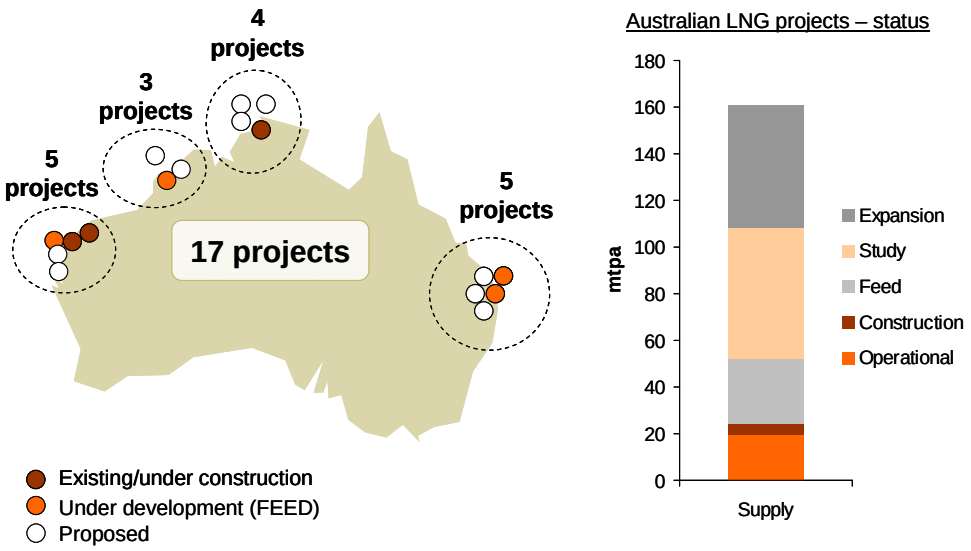
Intense competition to supply these markets is expected from international and Australian LNG projects (existing and potential new projects). Australia has two existing projects (North West Shelf and Darwin) currently exporting a combined 19.6 mtpa. This will increase to 24.4 mtpa when the Pluto project, under construction in Western Australia, is completed in 2011.

A total of 17 LNG projects are in various stages of planning and development in Australia *(Figure 1.2.7)*. These proposed projects are planned to produce 132 mtpa of potential additional LNG supply. This planned supply plus the additional supply from existing projects totals 156.4 mtpa. This volume is almost equivalent to the entire projected Pacific Basin LNG market in 2015. Given that there are also projects outside of Australia competing for this Pacific Basin market, it is unlikely that all but a few will proceed as the market cannot absorb the total projected volume of new Australian LNG supply.

BG Group has analysed potential supply scenarios to meet Pacific Basin[3] LNG demand in the period up to 2020. This analysis indicates there is approximately 80 mtpa of demand currently uncontracted, or available to new suppliers, in this period. As indicated above, the forecast existing and planned supply from Australia is nearly twice this demand.

3 Pacific Basin comprises countries in North Asia (which includes China, Japan and Korea), South Asia (which includes Australia and the Pacific Islands), North America (which includes the USA) and those of the Western side of South America (principally Chile) that ring the Pacific Ocean. The Pacific Basin includes the worlds largest economies China, USA and Japan.

Figure 1.2.7 Australian LNG Projects



Source: BG Group data: public reports, Wood Mackenzie

In addition, the total potential supply from Australia combined with other LNG exporting countries is even greater and significantly exceeds the available demand. This means that the competition from outside of Australia to supply this limited demand is significant and as a result many currently planned projects are unlikely to proceed.

To some degree, end-markets will influence which projects are developed as customers tend to contract with those regarded as the most likely to proceed and the most competitive. A key factor in this competition will be the ability to meet market demand in the key demand window of 2014 – 2015. As the majority of the currently planned LNG production projects are scheduled to begin production after 2014, it will be those that are able to commence supply in 2014 that will capture the key longer term Pacific Basin market share.

Therefore, the timeliness of regulatory approvals will be a key success factor in Queensland's ability to capture this opportunity, establish a market position and the long term associated employment and royalty benefits.

Pending the relevant approvals, QGC is on track to commence commercial operation of the QCLNG Project in early 2014.

2.5.3.1 Increased Demand for LNG and Natural Gas

Natural gas is well established in the fuel mix of the industrialised nations of northern Asia. Japan, South Korea and Taiwan use natural gas as a fuel for power generation and for commercial, industrial and residential applications via city gas networks. In each of these countries, natural gas (imported in the form of LNG) was first introduced for its clean-burning properties and associated improvements in air quality.

In addition, natural gas helped protect countries from oil price shocks by reducing dependence upon Middle Eastern crude oil. For these reasons it is

expected to continue to play a role in the future energy growth of these nations as they seek to reduce greenhouse gas emissions and maintain a diverse mix of fuels from a spread of geographic sources.

More recently, India and China have started to import LNG to meet expected high levels of energy demand growth, as well as for environmental reasons. Both have some indigenous gas production, but not enough to meet their expected levels of demand growth. In both cases pipeline supply options are limited.

In India gas competes with naphtha[4] as a feedstock for fertiliser, as well as a fuel for power generation. In China, LNG is displacing LPG in the domestic and commercial sectors in coastal regions and is underpinning new power plant development. Natural gas presently has a very small market share in China when compared to industrialised countries, which typically have 15 to 22 per cent natural gas as the primary fuel. Given the size of the overall China energy market, even a small change in market share will represent a significant increase in regional gas demand.

In addition, a number of existing gas users are planning to import LNG as either their domestic reserves decline (e.g. Thailand, Pakistan, Vietnam) or their access to additional pipeline supplies is limited, forcing them to look to more distant sources of gas (e.g. Singapore, Chile).

In the near-term the relative price of competing fuels and contractual volume obligations will determine the amount of LNG imported by the various consumers in the region. Over the longer term, the rate of economic growth in the region, price considerations, government policy on fuel mix and environmental issues and public sentiment towards nuclear energy are key influences on LNG demand. Given the environmental benefits of natural gas over other hydrocarbons, as long as natural gas remains competitively priced against alternatives, particularly in power generation, it is expected to continue to show robust demand growth in the region.

2.5.3.2 Domestic Supply

The CSG industry in Australia is relatively small with current production around 138 PJ in NSW and Queensland (for the 12 months ending March 2009[5]). Reserves are abundant with Australia's total CSG resources estimated at in excess of 250,000 PJ. Putting that in perspective, only 20 per cent of these total resources need to be recovered to meet Queensland's and New South Wales' gas needs for a minimum of 40 years.

Queensland's Bowen and Surat Basins are considered to hold Australia's largest onshore reserves of CSG.[6] Given the size of these resources and the

4 Naptha is a liquid intermediate between the light gases and the heavier liquid kerosene products produced from the distillation of crude oil.

5 EnergyQuest. Energy Quarterly Report May 2009.

6 ABARE (2002) Australian Gas Supply and Demand Balance to 2019-20 Accessed 1 October 2008

projected growth in demand for LNG, there is significant opportunity for the development of a CSG-to-LNG facility on the coast of Queensland in proximity to the CSG reserves.

Energy security and fuel diversification policies have also played an important role in increasing demand for gas as governments seek to reduce dependence on oil and encourage the use of more environmentally-friendly fuels. The Queensland Government is encouraging the development of the natural gas industry through the Queensland Gas Scheme. Under the current scheme electricity retailers are required to source at least 13 per cent of their electricity sales from gas-fired generation. The Government intends to increase this target to 15 per cent in 2010 and allow for further increases up to 18 per cent.

The Commonwealth Department of Resources, Energy and Tourism has recognised the potential of LNG and supports research into the use of LNG in major markets.[7]

QGC has already committed a significant proportion of its fast-growing reserves to meeting Australia's energy needs. These reserves are projected to supply about 20 per cent of Queensland's domestic gas market in 2009.

QGC will continue to identify and evaluate opportunities for domestic gas sales and expects to continue to supply current domestic supply opportunities post-2014 when the QCLNG Project begins production. New gas extraction and transportation infrastructure developed as part of the Project will help expand the domestic market by offering more opportunities to gas producers, in turn increasing choice for consumers.

2.5.4 Project Socio-economic Costs and Benefits

QGC has undertaken comprehensive social and economic impact assessments, providing a detailed analysis of the impact of the Project on existing and future social and economic factors. These assessments are presented in *Volume 8*. A summary of the key impacts appears below.

2.5.4.1 Economic benefits

Direct economic benefits include increased employment and purchasing of goods and services from local businesses. Indirect benefits include the flow-on effects of increased spending and employment.

During the construction phase the Project will create direct economic benefits through significant capital expenditure; the number of employees required (more than 4,000 people at peak); and the demand for supplies and services from local businesses.

7 See Australian Government, Department of Resources, Energy and Tourism at http://www.ret.gov.au/resources/upstream_petroleum/australian_liquefied_natural_gas/Pages/Home.aspx . Accessed 13 May 2009.

The Project's operating phase will also provide a number of direct regional and state-level benefits from the annual revenue generated; the creation of approximately 1,000 jobs; and significant royalties and tax revenues over the life of the Project (at least 20 years).

Details on the potential economic impacts of the Project can be found in *Volume 8: Part C*.

2.5.4.2 Economic Impact

Some stakeholders have raised the Project's potential economic impact on:

- domestic gas prices. QGC believes Queensland CSG resources are larger than the domestic market can absorb. Therefore any increase in domestic gas prices due to the export of LNG is expected to be minimal. In addition, increases in domestic demand are part of QGC's overall business plan: there will be no conflict between domestic and export demands
- cost of labour and services for other businesses. A tight labour market may increase labour costs and subsequent economic pressure on other businesses (see *Volume 8*). QGC will undertake a comprehensive local training and skills development program and will recruit throughout Queensland and Australia
- Good Quality Agricultural Land (GQAL). Impacts from development of CSG fields on agricultural land and mitigation measures to reduce these impacts are identified in *Volume 3, Chapter 5*.

2.5.4.3 Regional Social Impacts

The main regional social concerns of the Project relate to:

- housing. Increased population in communities within and neighbouring the Project area and the impact of this increase on housing affordability (e.g. increased rental costs as a result of tightened rental market)
- work camps. Community perception of work camps (increase in traffic, social behaviour of workers etc)
- health and medical facilities. The effect of increased population on the health system
- law enforcement. The capacity of police resources to cope with an increased population
- education and childcare facilities. The availability of places and the impact of an increase in population on enrolment
- community and welfare services. The impact of increased population on community services already in short supply
- employment. The skill shortages, labour utilisation, accessibility of employment
- social infrastructure. The demand for additional increased social facilities,

e.g. parks, libraries, etc.

- recreational amenity. The continued access to Gladstone Harbour and in the vicinity of Curtis Island for non-commercial fishing during construction and operational phases of the LNG Facility.

2.6 RELATIONSHIP TO OTHER PROJECTS

This section provides an introduction to how the overall QCLNG Project and its individual Project Components relate to other relevant existing or proposed projects. These other proposed projects may have interdependencies with the QCLNG Project through, for example:

- competition for workforce, materials or equipment due to timing of construction and operations
- cumulative environmental and social impacts
- cumulative transport impacts
- co-location/geographic overlap.

The known significant existing or potential projects with these potential interdependencies and environmental impacts are identified in *Table 1.2.2* and in *Appendix 1.6*. Where relevant, they have been taken into account in establishing the baseline environmental and social conditions for the QCLNG Project.

There are also particular items of Ancillary Infrastructure which may be required and developed by other parties which will also have interdependencies with the QCLNG Project. These are discussed in *Section 2.6.2.*

2.6.1 Other Projects Considered

For the purposes of this EIS, the approved or proposed projects outlined in *Table 1.2.2* have been considered for their interdependencies with the QCLNG Project.

The cumulative impacts of these projects on the Gas Field, Pipeline and LNG Facility Components of the QCLNG Project are discussed in *Volume 3, Chapter 18, Volume 4, Chapter 17*, *Volume 5, Chapter 19 and Volume 8*, respectively.

Table 1.2.2 Other Projects Considered

Gas Field Component	Pipeline Component	LNG Component
• Condamine Power Station	• Condamine Power Station	• Gladstone LNG Project: LNG facility (Santos)
• Expansion of QGC CSG fields for domestic markets	• Expansion of QGC CSG fields for domestic markets	• Wiggins Island Coal Terminal
• New Acland Coal Mine: Stage 3 Expansion	• Gladstone LNG Project: CSG Field (Santos)	• Gladstone Pacific Nickel Refinery
• Wandoan Coal Project	• New Acland Coal Mine: Stage 3 Expansion & Wetalla Water Pipeline	• Fisherman's Landing Port Expansion
• Linc Energy Underground Coal Gasification	• Wandoan Coal Project	• Boyne Island Aluminium Smelter Extension
• Spring Gully Power Station	• Linc Energy Underground Coal Gasification	• Aldoga Aluminium Smelter
• Felton Mine and Dimethyl Ether Pilot Plant	• Spring Gully Power Station	• Gladstone LNG (Fisherman's Landing
• Kunioon Open Cut Coal Mine	• Felton Mine and Dimethyl Ether Pilot Plant	• Sun LNG
• Surat Basin Rail	• Kunioon Open Cut Coal Mine	• Curtis Island Bridge/Road
• Nathan Dam Pipelines	• Gladstone LNG Project: Pipeline (Santos)	• Dredging of Swing Basin and Shipping Channel
• GLNG Project – Gas Field	• Central Queensland Gas Pipeline	• GLNG Project – LNG Facility
	• Gladstone - Fitzroy Pipeline	• QCLNG Export Pipeline (Narrows crossing)
	• Surat Basin Rail	
	• Moura Link - Aldoga Rail	
	• Nathan Dam and Pipelines	
	• Boundary Hill Mine Extension	
	• Dawson South Stage 2 Coal Project	
	• Curtis Island Bridge/Road	
	• GLNG Project - Pipeline	

2.6.2 Ancillary Infrastructure Considered

2.6.2.1 Western Basin Strategic Dredging and Disposal Project

GPC[8], a Queensland Government-owned corporation constituted under the *Government Owned Corporations Act 1993* (Qld), administers the Port of Gladstone. It owns and operates under provisions of the *Transport Infrastructure Act 1994* (Qld) port infrastructure and facilities including shipping channels, wharf and port marine operational areas, strategic port land and partially reclaimed lands in areas designated as future strategic port land. Furthermore, under this legislation GPC has the power to undertake dredging works and otherwise maintain or improve navigational channels in its port and to reduce or remove a shoal, bank or accumulation in its port that, in the GPC's opinion, impedes navigation.

The GPC's *50-Year Strategic Plan*[9] anticipates expansion of the port including construction of additional berths on southern Curtis Island and on the mainland along the south-western side of the Port. Furthermore, GPC is considering an extension of port facilities to the north of Fisherman's Landing. These port expansions as well as the proposed marine facilities associated with the LNG facilities on Curtis Island would require dredging of additional shipping channels and swing basins and the placement of dredge material at approved on- or offshore locations.

In March 2009, GPC announced the Western Basin Strategic Dredging and Disposal Project (WBSDD Project) which effectively brings forward its 50-Year Strategic Plan objectives and proposes to develop five new shipping channel and berthing areas/stages and a major new reclamation site to accommodate the dredged material from the dredging works required for these channel/berthing area developments and other long-term needs of the Port.

The WBSDD Project was subsequently designated as a significant project by the Queensland Government and a controlled action under the *EPBC Act* by the Australian Government, both stipulating that it be subject to an environmental assessment. Draft ToR for the EIS have has been released for public comment and GPC is currently undertaking environmental and engineering studies for the EIS which is due to be released late in 2009.

Stage/Area 1a identified in the WBSDD Project includes the new shipping channel, swing basin development and existing channel upgrade required by the QCLNG Project (and the new shipping channel, swing basin development and existing channel upgrade required by the GLNG Project). The QCLNG Project depends on the timely assessment, approval and completion of work in order to undertake operations. Therefore QGC has undertaken environmental assessment of its Swing Basin and Channel requirements as part of this EIS (See *Volume 2, Chapter 14*). However, QGC will make its assessment data available to GPC which may also form part of the overall EIS undertaken for the GPC SDD Project.

8 Formerly the Central Queensland Port Authority (CQPA).

9 Gladstone Port Corporation, *GPC 50 -year Strategic Plan (2008)*, available at www.gpcl.com.au . Accessed 14 February 2009.

Interrelationship to QCLNG Project

QGC is seeking Commonwealth and State environmental approvals for its Swing Basin and Channel component pursuant to this EIS. These approvals if given by the respective governments are proposed to be transferred to GPC as the party to undertake the required dredging/reclamation works within the Port of Gladstone. Should GPC's WBSDD Project result in Commonwealth and State environmental approvals prior to the QCLNG Project approvals (for its Swing Basin and Channel component), QGC would withdraw its EPBC Act Referral from consideration by the Commonwealth and would not seek State approvals for these works.

GPC may, depending on the above outcomes and commercial drivers,[10] undertake to develop the approved QGC Shipping Channel and Swing Basin component directly on behalf of QGC, or as part of the overall approved Stage 1a development of the WBSDD Project.

QGC has entered into a Heads of Agreement with the GPC to develop the following plans and agreements:

- LNG shipping navigational requirements and operations within the Port of Gladstone
- design and development of the Curtis Island Shipping Channel and Swing Basin connecting the existing Targinie Channel to the LNG Facility
- data and information sharing to assist the GPC in preparing environmental planning and impact assessment studies
- Front-End Engineering and Design (FEED) information for the layout and construction of the shipping channel, swing basin dredging works and dredge spoil management
- Engineering, Procurement and Construction (EPC) for the dredging and spoil management works
- QGC's capital and operations cost contributions to the GPC's dredging works to develop the shipping channel/swing basin and material management.

2.6.2.2 Curtis Island Bridge and Roads

Early in the development planning for the QCLNG Project, QGC undertook preliminary feasibility on the construction of a bridge and access roads on the mainland and island to facilitate access from the mainland to the LNG Precinct on Curtis Island. This also involved studies commissioned jointly by Santos Limited, QGC and the Queensland Department of Infrastructure and Planning (QDIP).

These bridge/road components were referred by Santos Limited (Santos) in

10 As identified by GPC in, *Port of Gladstone Western Basin Strategic Dredging and Disposal Project, Initial Advice Statement*, Gladstone Ports Corporation, March 2009. Available at: http://www.dip.qld.gov.au/projects/transport/harbours-and-ports/port-of-gladstone-western-basin-strategic-dredging-and-disposal-project.html . Accessed 23 April 2009.

February 2008 (EPBC 2008 4060) under the EPBC Act, designated as a controlled action in March 2008 and are assessed in the GLNG Project EIS.[11]

Interrelationship to QCLNG Project

In August 2008, QGC also referred the potential development of a bridge and roads to the Commonwealth Minister for the Environment (along with six referrals for other aspects of the Project) under the EPBC Act and in September 2008 had referrals for the following designated as controlled actions:

- Curtis Island Bridge (EPBC 2008/4400)
- Mainland Road and bridge approach (EPBC 2008/4403)
- Curtis Island Road (EPBC 2008/4404)

However, following QGC's front-end engineering and design (FEED) work undertaken it was decided that the bridge/road development would not form part of QGC's base case for the QCLNG development.

Therefore, QGC currently does not propose to develop a bridge and associated roads and has subsequently applied to withdraw the above EPBC referrals. Consequently, approval is not sought for their development and they are not proposed infrastructure assessed under this EIS. QGC has however discussed the concept of a bridge and road development in this EIS, but only to contrast them against QGC's preferred alternative of Marine Transportation Operations.

2.6.2.3 Development of Infrastructure to Supply Treated Associated Water

Under the *P&G Act*, CSG proponents are required to treat associated Water, a by-product of CSG extraction on the production tenements. In addition, under the under the *Environmental Protection Act 1994* (Qld), associated water is considered to be a waste associated with an industrial activity. As a result, use of the water for any purpose is heavily regulated, requiring environmental authorities, development approvals, registration certificates and water licences

QGC is exploring a range of on-tenement management and treatment options and infrastructure for the QCLNG Project Associated Water, which are discussed and assessed in this EIS (See *Volume 3, Chapter 11*).

However, associated water permitted to be taken off a gas producer's tenements comes under the control of the *Water Act 2000* (Qld). In these circumstances, any other party who acquires that water and takes it off the producer's tenements for other beneficial uses may be required to seek additional environmental permits and water licences as required under the *Water Act*.[12]

11 See GLNG website at: www.glng.com.au/ . Accessed 12 July 2009.

12 The issue of management of CSG water both on-tenement and off-tenement is explained in the Queensland Government policy paper: *Management of water produced from coal seam gas production Discussion paper*,

Interrelationship to QCLNG Project

QGC has described plans and undertaken environmental assessment for its preferred approach and a number of options for the on-tenement management and treatment of all the Associated Water produced from the QCLNG Project in this EIS.

There are also several other potential beneficial use options for the associated water which because of lack of technical development and feasibility have not to date been explored further. In addition, QGC is in commercial discussions with other parties seeking to purchase water for use in industrial and commercial processes. These other potential ex-tenement beneficial water uses and infrastructure are not included in this EIS.

However, should QGC either propose other ex-tenement associated water beneficial uses, or enter into agreements with a party for the sale and purchase of the water, additional environmental assessment and permitting for this activity (and any infrastructure) will need to be undertaken.

2.6.2.4 Future Development of other CSG Resources

Since 2001, QGC has conducted CSG field activities involving the development of approximately 250 wells and associated infrastructure that produces CSG under contract to the domestic market for electricity generation, fertiliser manufacture and other industrial use.

QGC continues to explore, identify new acreage, joint-venture and acquisition opportunities to develop further CSG resources in Queensland and the development of other domestic projects.

Interrelationship to QCLNG Project

The development of any future potential sources and infrastructure for domestic sales of CSG is outside the scope of this EIS. Similarly, the development of additional reserves which provides the opportunity for underpinning and further developing resources required for additional LNG production and export sales is outside the scope of this EIS.

However, should QGC identify additional resources which are proposed to be added to the reserves for the QCLNG Project, any additional or new environmental assessment, planning processes and applications for CSG activities and infrastructure will be undertaken under provisions of the relevant legislation as required.

available at http://www.dip.qld.gov.au/resources/report/coal-seam-gas-water-discussion-paper.pdf . Accessed 3 May 2009.

2.7 ALTERNATIVES TO THE PROJECT

A broad assessment of the following alternatives to the QCLNG Project was undertaken and is discussed further in *Sections 2.7.1* and *2.7.2*:

- a no project option
- alternative products and markets for CSG.

Alternative options for the specific Project Components and Ancillary Infrastructure are discussed in detail in *Volume 2*. These alternatives include:

- alternative locations and sites of the QGC Project Components and Ancillary Infrastructure
- alternatives to access the LNG Facility site (Curtis Island Bridge/Road versus Marine Transportation Operations)
- alternative technologies, methods and development plans for the Project Components
- strategies and plans for alternative uses of Associated Water.

2.7.1 A "No Project" Option

A standard approach to weighing alternatives for a project as a whole is to consider potential environmental, social and economic consequences if the project does not proceed.

The investment case for the QCLNG Project involves a multi-billion dollar investment in Queensland's CSG industry that will provide thousands of jobs and generate significant royalties and tax revenues for the Queensland and Australian Governments. It will also provide new supplies of natural gas, in the form of LNG, at a time when countries are seeking cleaner, more efficient supplies of energy.

The development of CSG projects such as the QCLNG Project represents a preferred option over construction of additional coal-generated power – both in Australia and in countries to which the LNG will be exported and utilised. CSG-to-LNG projects effectively monetise a significant potentially stranded mineral resource of Queensland and Australia. Therefore, QGC believes that this EIS helps demonstrate that the "no project" option would not only significantly disadvantage Queensland and Australia but also potentially encourage the greater use of coal-fired power, and lead to an increase in greenhouse gas intensity and emissions as a result.

2.7.2 Alternative Products and Markets

Alternative products and markets are categorised as:

- alternative use of Queensland's resource
- alternative products from CSG
- alternative markets for products from CSG

Each of these is discussed below.

2.7.2.1 *Alternative Uses of Queensland's Resources*

Coal Mining

Due to the depth of gas-bearing coal seams in the Walloon Fairway of the Surat Basin, conventional open-cut mining of these coal resources is not currently economically viable.

Future underground coal mining may still be viable in the region following CSG extraction, since the coal seam will be intact. Prior extraction of CSG could have benefits for the coal miner since methane in the coal is a safety hazard for mining.

There are provisions in the *Mineral Resources Act 1989* (Qld) and *Petroleum and Gas (Production and Safety) Act 2004* (Qld) that govern how holders of coal and petroleum tenure should cooperate when they propose to produce in proximity to one and other. These provisions allow the two industries to develop resources to mutual advantage.

Underground Coal Gasification

Underground coal gasification (UCG) is a process by which coal is converted in situ to a combustible gas that can be used as a fuel or chemical feedstock.

UCG involves drilling holes into the coal seam, heating the coal in place and introducing a mix of air or oxygen and steam to cause gasification rather than combustion of the coal. The resulting "syngas" can be used as feedstock for a gas-to-liquids (GTL) plant and for power generation in a gas turbine.

There are a number of potential issues and constraints associated with UCG development in the region[13,14].

Oil Shale

Oil and kerosene shales have been reported in the Walloon Coal Measures in the Injune area and in the Oralla formation near Oralla (*Quarantotto, 1989*[15]). Following completion of CSG extraction, these oil shales will be available for extraction. However, oil shale extraction is an unproven technology in the region.

13 Department of Mines and Energy. Review of Queensland Mining Legislation – Discussion Paper, 2007

14 WS Atkins Consultants Ltd. Review of Environmental Issues of Underground Coal Gasification, 2004. Report No. COAL R272 DTI/Pub URN 04/1880

15 Quarantotto, P. Hydrogeology of the Surat Basin, Queensland, 1989 Department of Mines and Energy.

Reason for Selection of Preferred Option

Technical

CSG extraction technology is well understood and tested. It is a simple and effective method for utilising the CSG resource. In addition, the coal seam remains intact following CSG extraction, and could therefore be exploited at a later date when and if future economic and technological options make this viable.

Commercial

QGC's domestic gas operations show that CSG extraction is financially viable. It is unlikely that a commercially viable underground coal mining operation would be established in the Surat Basin. Surface mining of the Macalister seam occurs in areas adjacent to CSG fields. UCG and oil shale mining are currently financially unproven technologies in Australia.

Social

All the reviewed options will at some level cause social disturbance through changed land use and demographics and will provide social benefits through the creation of employment.

Environmental

UCG has potential significant environmental impacts which are not well understood, especially land subsidence, groundwater contamination and the creation and mobilisation of combustion-related compounds.

Open-cut coal mining and oil shale mining will have larger environmental impacts than CSG as a result of large-scale ground disturbance and landform changes required to mine either the coal or the oil deposits within the CSG field. CSG extraction has a minor environmental footprint compared to UCG, coal mining and oil shale mining.

All three resource uses are associated with significantly higher greenhouse gas emissions than from the extraction and use of coal seam gas.

Government Policy

At international, Commonwealth and state level there are numerous policies to promote the production of energy from sources less emissions-intensive than coal. CSG is almost 50 per cent less emissions-intensive than brown coal.[16]

On 18 February 2008, the Queensland Government announced its Underground Coal Gasification Policy.[17] While this policy establishes a

16 Australian Government Department of Climate Change (October 2008) National Greenhouse Accounts (NGA) Factors, Department of Climate Change.

17 See Queensland Department of Mines and Energy at http://www.dme.qld.gov.au/mines/underground_coal_gasification_policy.cfm . Accessed 21 April 2009.

framework for the trial of UCG technology to determine its scientific and commercial viability in Queensland, it also stated that the Minister of Mines and Energy would favour coal seam gas development outside the trial areas. New leases for UCG would be granted only where there is no overlap with CSG.

In August 2008, the Queensland Government made a decision to suspend for at least 20 years exploration and development over the McFarlane oil shale resource in the Whitsunday's region of north Queensland.

The decision was made to protect the region's high environmental values and existing land use activities. The policy decision effectively suspends the development of the oil shale industry in Queensland for at least two years pending investigation of the industry's potential economic, environmental and social impacts.

2.7.2.2 Alternative Products from CSG

QGC already supplies gas to the domestic market and will continue to do so (see *Section 2.4*).

The QCLNG project allows QGC to access new large-scale markets to develop Queensland's CSG resources. Access to new markets is required since the state has much greater CSG production potential than can be absorbed by the eastern Australia gas market.

This section considers alternatives to LNG for accessing large-scale markets.

Gas to Liquids (GTL)

One method of producing energy, which utilises natural gas, is GTL. In this process natural gas is converted to a liquid. This liquid can take the form of diesel, aviation fuels, middle distillates, methanol and dimethyl ether (DME). However, methanol is the most common liquid in commercial production.

New methods are being trialled to create substitutes for other fuels. At present, a large amount of transportation relies on diesel. Once the appropriate GTL has been developed, it could be directly substituted for diesel in the majority of machinery.

Liquefied Natural Gas (LNG)

LNG is considered the only feasible method for transporting natural gas over long distances. Natural gas is liquefied at -162°C, which results in a 600 per cent reduction in volume. Once liquefied, the LNG is transported in special ships for use in power generation and industrial applications.

Reason for Selection of Preferred Option

Technical

Liquefaction of natural gas is a proven technology that is safe and reliable and is currently used by BG Group and other operators around the world. GTL technology is much less mature and carries a higher technical risk.

Commercial

BG Group has shown that LNG is a financially-viable product in high demand on the world market.

For GTL plants to be economically viable they must be very large scale and close to large local markets to avoid significant transportation costs. The process is highly capital intensive, requires proprietary technology and is subject to significant commercial risks.

Social

All options will at some level cause social disturbance through changed land use and demographics and will provide social benefits through the creation of employment.

Environmental

The commonly used parameters for defining the efficiency of LNG and GTL facilities are Carbon Efficiency (CE) and Thermal (Energy) Efficiency (TE). Carbon Efficiency is essentially a measure as to how best the carbon atom in the feedstock is used to produce the final product. Alternatively this could be referred to as how the production of carbon dioxide, a waste stream, is minimised in the process. The CE of the GTL process is around 77 per cent with the remainder of the carbon converted to CO_2. LNG production on the other hand has a CE of around 92 per cent.

Thermal Efficiency is a measure of how the total energy in the feedstock is used to produce the final hydrocarbon product. The TE of GTL is considered low and is typically around 60 per cent. LNG has a TE of between 88 per cent and 92 per cent.

2.7.2.3 *Alternative Markets for Products from CSG*

Assuming the domestic market had sufficient potential scale, products from CSG could be supplied to either the domestic or foreign market.

Natural gas is predominantly supplied to domestic and foreign markets as:

- feedstock for domestic use (through retail supplier)
- feedstock for gas-driven power plants
- feedstock for industrial and manufacturing processes (e.g. fertiliser manufacture)

Liquefaction of natural gas is required for the supply of natural gas to markets (usually by ship) at too great a distance from the source to make a supply pipeline economical. This means, in the majority of cases, supplying a foreign market.

Reason for Selection of Preferred Option

Technical

Both domestic and international markets are viable on a technical basis.

Commercial

Demand for LNG in the Pacific Basin is expected to continue to grow significantly over the next two decades. This is driven by economic growth in traditional LNG markets, but also the emergence of new markets, as more countries look to increase the share of natural gas in their fuel mix, in order to reduce greenhouse gas emissions.

The domestic market cannot absorb the potential supply of CSG. As such, the supply of gas to foreign markets presents the best opportunity for commercialising Queensland's CSG reserves.

Social

The CSG production process, including processing of LNG, will provide thousands of jobs, stimulate economic growth in Queensland, generate state and national revenue and produce associated flow-on benefits to the community from increased demand for goods and services.

Environmental

Natural gas offers a cleaner, more efficient supply of energy to meet demand in both domestic and foreign markets.

Government Policy

The Queensland Government's climate change strategy, *ClimateSmart 2050*, outlines a long-term strategy for tackling climate change, including an increase to the Queensland Gas Scheme target from 13 per cent to 18 per cent by 2020. QGC, as a major supplier of CSG, can contribute significantly to achieving this target, while delivering the QCLNG Project.