1 INTRODUCTION

This volume provides a response to submissions on the draft environmental impact statement (EIS) specifically relating to greenhouse gas emissions associated with the Queensland Curtis LNG (QCLNG) Project. In addition, an updated greenhouse gas emissions inventory for the Project is provided, taking into account continuing evolution and refinement of the Project. The emissions inventory data provided in this volume supersedes that provided in *Volume 7* of the draft EIS.

This volume quantifies greenhouse gas emissions from all components of the QCLNG Project, identifies mitigation measures and benchmarks the LNG Component against existing liquefied natural gas (LNG) facilities. In addition, it considers the Project in the context of proposed legislation as well as detailing legislative compliance, monitoring and reporting requirements.

1.1 RESPONSE TO SUBMISSIONS ON DRAFT EIS

Submissions relating to Project greenhouse gas (GHG) emissions, and in particular draft EIS *Volume 7* are summarised in *Table 7.1.1* below.

Table 7.1.1 Response to Submissions on the draft EIS

Issue Raised	QCLNG Response	Relevant Submission(s)
Methane leakage and release of unburnt methane results in coal seam gas (CSG) extraction, and processing this into LNG, having a larger GHG impact than the mining and subsequent use of coal.	Methane leakage and release of unburnt methane has been accounted for in the QCLNG GHG inventory presented in this chapter and that presented in the draft EIS. While a certain level of fugitive release is unavoidable, the production and usage of LNG is demonstrated as having lower GHG emission impact than the production and usage of coal.	9
Gas sold to new energy markets rather than replacing older dirtier power stations.	Globally and domestically the demand for energy is increasing. The benefit of gas is not only in replacing existing coal-fired power stations but also in being used instead of coal in new generation capacity. LNG extends the benefits of switching to gas by providing other countries with access to a fuel that is economically competitive with coal and which allows them to satisfy their growing energy demands while reducing the rate of growth of GHG emissions.	9
Alternative energy sources such as solar power or wind power should be considered for government investment.	Investment in QCLNG will be from the private, not public sector.	36

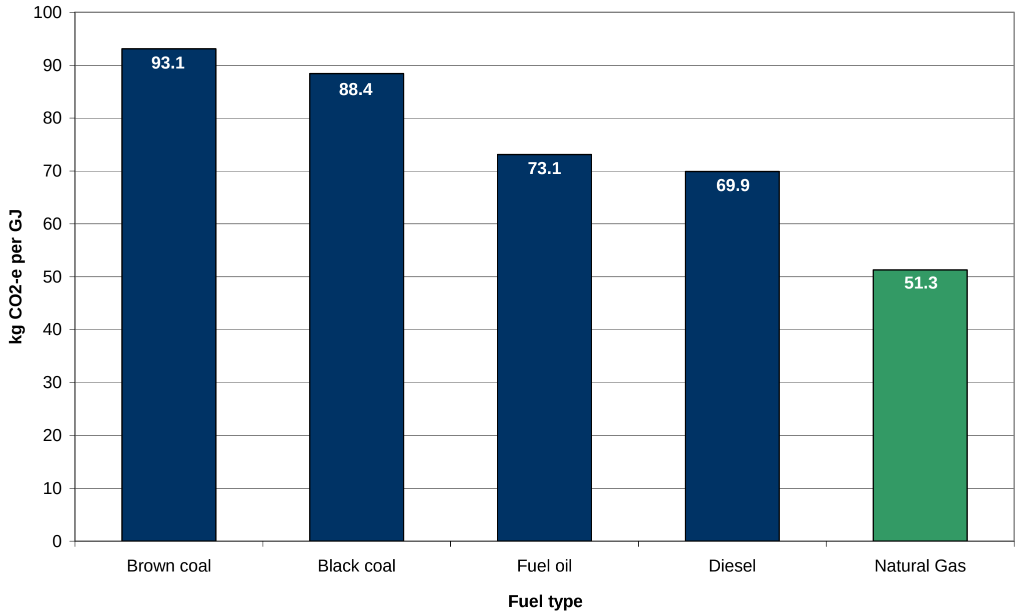
Issue Raised	QCLNG Response	Relevant Submission(s)
Draft EIS suggests that the export of LNG will result in a 35% reduction in CO_2 pollution compared to Chinese coal-fired power. However, the EIS does not provide an ''actual emissions reduction case''.	Refer to *Section 1.2*	30
Ultimate use of LNG will generate at least 670 million tonnes of CO_2-e.	Refer to *Section 1.2.* It remains the case that substituting LNG for coal-fired generation will result in significantly lower levels of CO_2-e.	30
Priority should be given to using gas in the Australian domestic market to reduce Australia's carbon footprint. The most efficient use of Australia's clean energy reserves is to reduce Australia's carbon footprint.	QGC does not expect LNG exports to be at the expense of an increasing share of gas in the Eastern Australia energy mix. Queensland's gas endowment is large and existing incentives to supply the local market are strong. LNG exports provide access to a new market to underpin future resource development. The development of significant infrastructure for LNG will facilitate further development of gas for domestic customers. Australian gas therefore has a role to play both in domestic as well as global emission reduction. QGC is already a major supplier of gas to the domestic market and is committed to continuing to do so.	30
The LNG proponents are part of the GHG problem unless they can demonstrate that these projects directly offset coal-fired generation.	The main markets for LNG from Queensland are developed and developing Asian economies. These countries face the challenge of satisfying increased energy demand while, at the same time, limiting growth in greenhouse gas emissions. On 18 May 2009 BG Group announced that CNOOC (a Chinese company) would purchase 3.6 million tonnes per year of LNG). LNG is providing an economically attractive and lower carbon alternative to indigenous and imported coal.	25, 30

1.2 COMPARISON OF EMISSIONS FROM LNG TO OTHER ENERGY SOURCES

As outlined in the draft EIS, natural gas has a lower carbon intensity than oil or coal. Natural gas produces 51.3 kg CO_2–e per GJ compared with diesel, fuel oil and black coal which emit between 69.9 - 93.1 kg CO_2–e per GJ.

Figure 7.1.1 compares the direct emission intensities of selected fuels on the basis of greenhouse gas emitted per unit of energy.

Figure 7.1.1 Comparative Greenhouse Gas Emissions Intensities of Common Fuels[1]



The figure above illustrates emissions from the direct combustion of various fuels. It does not consider emissions associated with extraction, processing and transportation of these different fuels.

LNG's role in international efforts to reduce greenhouse emissions is further illustrated in *Figure 7.1.2.* The combined emissions from combusting LNG, including emissions from extracting, processing and transporting LNG, are 35 per cent less than the emissions from combusting coal alone. This comparison assumes that state-of-the-art coal-fired power generation technology is used and does not include emissions from extracting, processing and transporting coal. In practice, the benefit of gas, in terms of emissions, is likely to exceed this figure. When exported to markets such as Korea, Taiwan and China, LNG helps reduce the need for more carbon-intensive fuels such as coal.

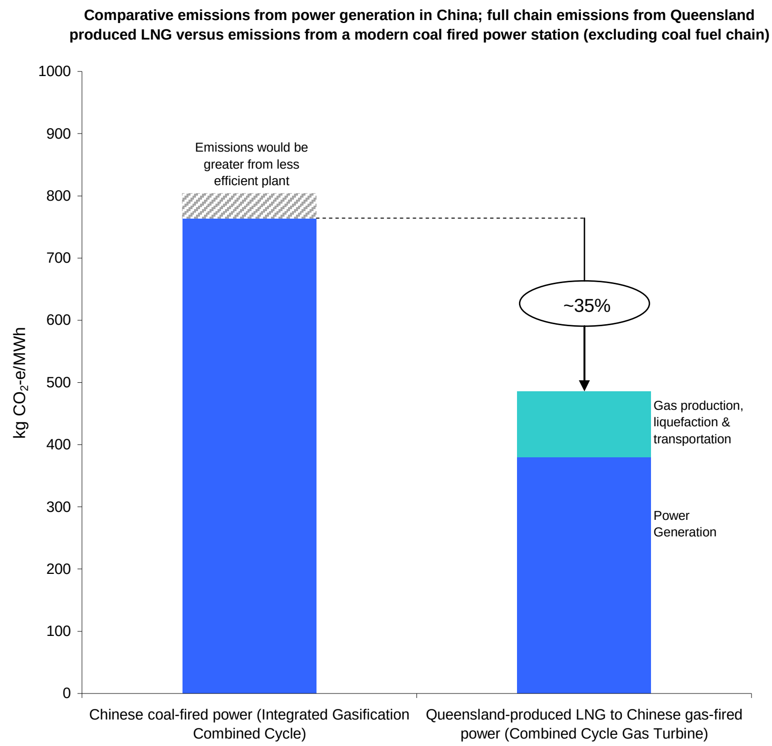
For illustrative purposes, if the full annual production of two trains of LNG (8 million tonnes) were used instead of coal in a market such as China, the net reduction in emissions would be approximately 15 million tonnes for the year. On 18 May 2009 BG Group announced that CNOOC (a Chinese company) would purchase 3.6 million tonnes per year of LNG from the QCLNG Project.

The role of gas, and LNG, in global efforts to tackle climate has long been recognised. To meet growing energy demand while at the same time reducing the growth in greenhouse gas emissions to stabilise their atmospheric concentrations requires the application of a diverse set of energy sources,

1 Source: Australian Government (2008) National Greenhouse and Energy Reporting (Measurement) Determination

technologies and energy efficiency. The use of gas as a primary energy source in place of coal is identified as one such measure that will help society achieve both growth and environmental goals. This is illustrated most recently in the analysis of the International Energy Agency, prepared to inform the Copenhagen Climate Change negotiations.[2]

Figure 7.1.2 Comparison of LNG and Coal Emissions[3]



1.3 POLICY APPROACH

Since the draft EIS, there has been no change in state, federal or QGC policy with respect to greenhouse gases.

2 International Energy Agency, October 2009. How the energy sector can deliver on the climate change agreement in Copenhagen

3 Source: Adapted from Coal in a Sustainable Society, Australia 2001 & BG analysis

2 CHANGES TO THE PROJECT DESCRIPTION

This section describes the changes to the Project description that have impacted on the emission of greenhouse gases. These changes principally involve the Gas Field Component, and have resulted in an increase in the emissions. These changes are described below.

2.1 GAS FIELD COMPONENT CHANGES

The principal drivers for the change in Gas Field Component emissions are:

- an increase in energy requirements due to refinement of the estimated energy demand for water treatment and water pumping and to enable reduction in well pressure in later field life
- an increase in the estimate of gas flared at wells during maintenance activities
- a reduction in the estimate of energy required to power field compression stations (FCSs) and central processing plants (CPPs)
- a change in energy supply for (FCSs) and (CPPs) in the central and south-east tenements from combustion of CSG to supply of energy from the electricity grid. QGC are investigating the option to supply power to the north-west tenements from the electricity grid, although this option is not considered in the GHG estimate.

The changes to the emissions estimate consider scope 1 and scope 2 emissions of greenhouse gases from sources within the boundary of the Project and as a result of the Project's activities. The emissions factors that were used in the draft EIS remain unchanged. Indirect (scope 2) greenhouse gas emissions associated with the purchase of electricity have been added and calculated based on emissions intensity forecasts developed by ACIL Tasman for the Energy Supply Association of Australia (ESAA).

For the purposes of this report, QGC has adopted the emissions intensity of the grid predicted under a scenario where the proposed Carbon Pollution Reduction Scheme (CPRS) has a 10 per cent reduction target to 2020. It has been assumed that emissions intensity from 2020 onwards is constant. QGC considers this to be a conservative scenario for estimating the emissions intensity of the grid. The maximum grid intensity is 0.73 t CO_2-e/MWh in 2012 and declines to 0.61 t CO_2-e/MWh in 2020. A more stringent target would result in a steeper decline in emissions intensity and also emissions associated with this Project.

2.2 LNG PLANT COMPONENT CHANGES

The reference case for the LNG Plant assumes an annual average LNG production per train of 4 million tonnes rather than 3.68 million tonnes assumed in the draft EIS, as a result of efficiency improvements.

Annual greenhouse gas emissions will increase from approximately 0.95 million tonnes per year per train, to approximately 1.01 million tonnes per year per train of LNG. However, the emissions intensity (tonnes of greenhouse gas per tonnes of LNG produced) has decreased slightly, from approximately 0.259 to 0.253.

2.3 *GREENHOUSE GAS EMISSIONS FROM THE PROJECT*

Revised greenhouse gas emissions estimates for the Project life are presented in *Figure 7.2.1.* Annual average Gas Field Component emissions are anticipated to increase over time from approximately 2.1 Million t CO_2-e between 2014 and 2022 to approximately 2.7 million t CO_2-e between 2027 and 2033.

Table 7.2.1 outlines the revised emissions calculations based on the changes to the reference case as described above. It details emission estimates for each phase of the Project's expected life as the Project currently stands. As the Project progresses through detail design, QGC will endeavour to reduce further greenhouse gases throughout the life of the Project.

Table 7.2.1 Project Life Greenhouse Gas Emissions per the Supplementary EIS

Phase	Duration	Total Emissions (Million t CO_2-e)
GAS FIELD		
Construction [2]	24 years	0.7
Operation [1]	24 years	51.0
PIPELINE		
Construction	18 months	0.02
Operation [1]	22 years	0.9
LNG FACILITY		
Construction	89 months[3]	0.1
Commissioning	21 months	0.3
Operation [1]	20 years[1]	55.1
TOTAL PROJECT EMISSIONS		**108.1**

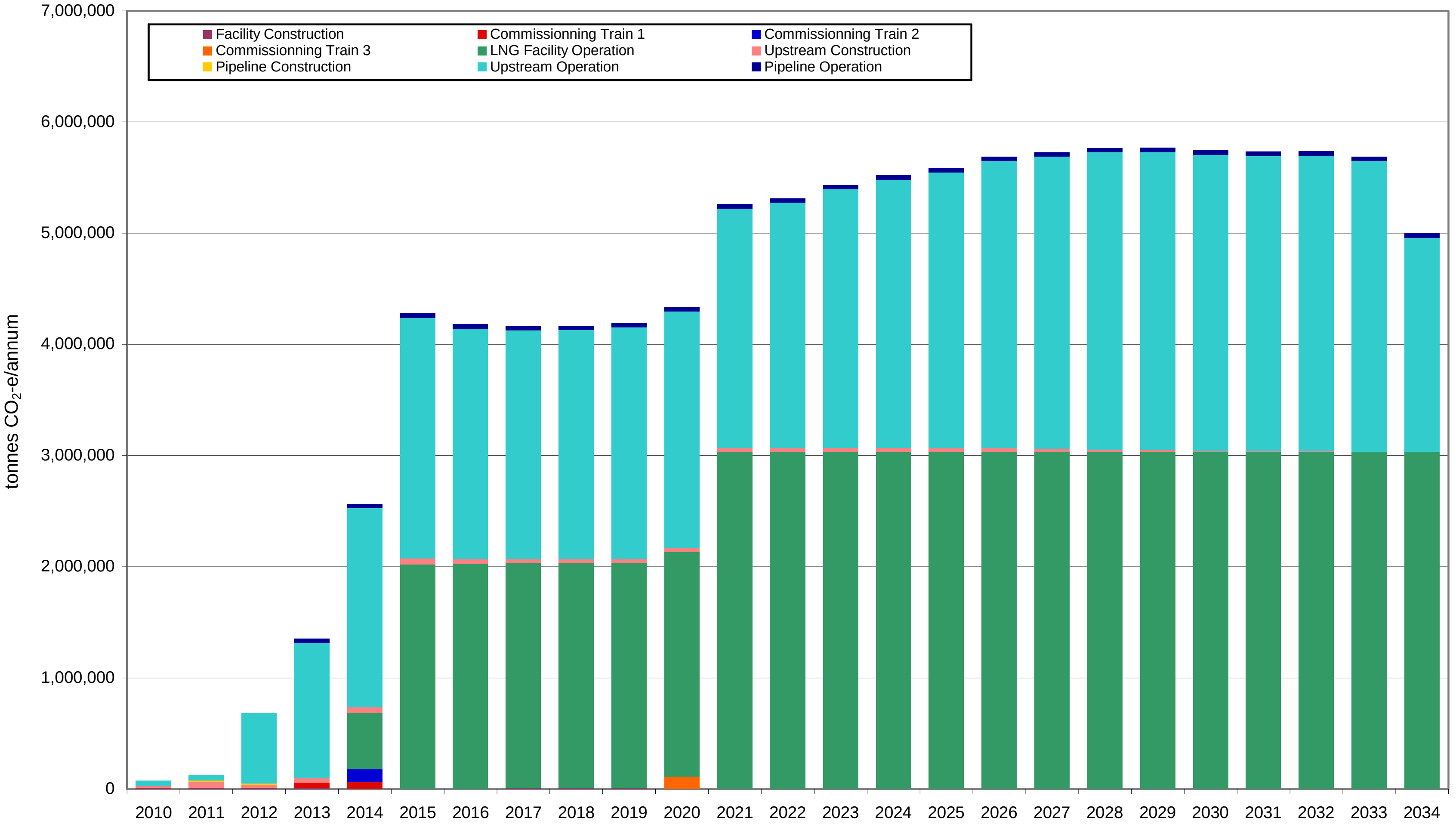
1 Duration of operation is based on an estimated 20-year project life. Total LNG Facility operational emissions are based on 20 years operation.

2 Gas Field construction includes the drilling of new CSG wells, which occurs throughout the life of the Project.

3 LNG Facility construction is estimated based on concurrent construction of trains 1 and 2 as described in *Volume 2, Chapter 14* in addition to indicative construction duration for construction of train-3 subsequent to commission of Train 2.

The total emissions estimate has increased by approximately 14 per cent from the draft EIS estimate as a result of the detailed design changes. This is attributable to an increase in emissions from the Gas Field Component and LNG Facility. Pipeline emissions are unchanged.

Figure 7.2.1 Annual Greenhouse Gas Emissions Estimates over the Project Lifetime for the Supplementary EIS



2.4 MITIGATION MEASURES

Combustion of CSG is the primary source of greenhouse gas emissions from the Project. Mitigation measures have therefore focused on maximising the efficiency of activities that require CSG combustion.

2.4.1 Mitigation in the LNG Facility Design

The draft EIS described the greenhouse gas reduction technologies incorporated into the LNG Facility design, including an outline of the Best Available Techniques (BAT) reduction analysis undertaken, and benchmarked the current design of the LNG Facility against other Australian and international LNG projects. This analysis is presented in full in the draft EIS *Volume 7, Section 2.4.1*.

In summary, application of the BAT process resulted in a 27 per cent reduction in emissions intensity against the concept design, achieved through the application of innovative technology and design. Benchmarking against other Australian and international LNG facilities demonstrated that the Project would feature one of the world's least greenhouse gas-intensive LNG facilities.

2.4.2 Mitigation in the Gas Field Component

QGC will continue to seek opportunities to reduce emissions during the detailed design phase and throughout the operational life of the Project. For the upstream facilities, for example, further evaluation of options for reducing well pressures is ongoing, and QGC is investigating opportunities to further reduce predicted flaring of CSG at wells.

3 CONTRIBUTION TO NATIONAL AND STATE GREENHOUSE EMISSIONS

The revised estimate of emissions from all Project Components during peak operation is 5.8 million t CO_2-e per annum. This is based upon the Project application of a three-train facility on Curtis Island.

In 2007, annual greenhouse gas emissions in Australia were estimated at 597 million t CO_2-e[4]. Emissions in Queensland for that year were estimated to be 182 million t CO_2-e.

Based on this data, it is expected there will be an annual increase in emissions from the Project of approximately 0.96 per cent of Australia's annual emissions in 2007 and a 3.17 per cent increase in Queensland's annual emissions in 2007 based on the current design.

4 Reporting year 2007, Kyoto framework, Australian Greenhouse Emissions Information System http://www.ageis.greenhouse.gov.au/

4 ONGOING MONITORING AND MANAGEMENT

Whilst the final structure and timing of an Australian emissions trading scheme (ETS) is currently unclear, QGC is committed to the ongoing monitoring, managing and reduction of its greenhouse gas emissions. As described in the draft EIS (*Volume 7, Section 4*), QGC remains committed to:

- developing a Greenhouse Gas Management Plan
- implementing an auditing and reporting program (including auditing and reporting requirements under the National Greenhouse and Energy Reporting System and the potential Carbon Pollution Reduction Scheme) through QGC's annual internal performance reporting
- Project commitments relating to minimising energy consumption and greenhouse gas emissions through continual improvement and technological developments.

QGC with its parent BG Group plc are committed to providing leadership in the development of the global LNG industry by producing LNG as efficiently as practicable, and by providing this energy resource to reduce global greenhouse gas emissions. QGC and the BG Group believe that the development of the LNG industry is an important step towards providing sustainable energy sources globally.

5 CONCLUSION

Optimisation of Gas Field Component infrastructure and a 10 per cent increase in the projected output of the LNG Facility has resulted in increased greenhouse gas emissions from the Project. However, this does not materially affect the overall benefit the Project will deliver in terms of global greenhouse gas emissions.

LNG has an important role to play in the management of global greenhouse gas emissions. Where used as a substitute for coal as an energy source, particularly in developing economies, the LNG from the QCLNG Project will reduce greenhouse gas emissions per unit of electricity generated by more than 35 per cent.

To further enhance this benefit, it is important that new energy projects employ technology and designs to reduce the intensity of their emissions. QGC remains committed to selecting technology and designing the QCLNG Project to produce such reductions wherever practicable.

Estimated emissions from all components of the QCLNG Project during peak operation of the LNG Facility's three processing units, or "trains", is 5.8 million t CO_2-e per annum.

The QCLNG Project employs advanced and efficient technology, which, coupled with project optimisation has led to a 27 per cent reduction in greenhouse gas-emissions intensity from concept to current design of the LNG Facility. This means the LNG Component of the Project will be one of the most emissions-efficient in the world.

Opportunities exist also to reduce greenhouse gas emissions from Gas Field infrastructure during the further design and operations stages of the Project. Energy optimisation and flare-gas reduction will be among the environmental goals of the Project.

For all components of the LNG production chain, management, monitoring and auditing of greenhouse gases will be incorporated in a Greenhouse Gas Management Plan, a component of a wider Environment Management Plan (EMP) and QGC's Environmental Management System (EMS). The outcomes of these monitoring results will be publicly available and reported through BG Group's annual Social and Environmental Performance Reporting.