

6. GREENHOUSE GAS EMISSIONS

This chapter summarises the findings of the supplementary greenhouse gas assessment undertaken to address updates to the project description made since the Surat Gas Project Environmental Impact Statement (EIS) (Coffey Environments, 2012b) was finalised.

The Supplementary Greenhouse Gas Assessment, prepared by Pacific Environment Ltd (Pacific Environment), is included in Appendix 3. The study supplements the Greenhouse Gas Impact Assessment presented in Appendix D of the EIS, the main findings of which are summarised in Chapter 10 of the EIS.

The revised project description is provided in Chapter 3, Project Description, however aspects relevant to greenhouse gas are also discussed in this chapter. In addition to the study findings, a list of key issues raised in submissions is presented, with responses to all issues provided in Part B, Chapter 19, Submission Responses.

6.1 Studies and Assessments Completed for the EIS

This section provides an overview of the greenhouse gas impact assessment conducted by Pacific Environment (previously PAE Holmes).

The assessment estimated direct (Scope 1) and indirect (Scope 2 and Scope 3) emissions to determine the project's contribution to national and global greenhouse emissions. A short explanation of the scopes of greenhouse gas emissions and the relevant project activities is provided below and in more detail in Chapter 10, Section 10.4.1 of the EIS:

- Scope 1 emissions directly result from project activities including combustion of fuels due to transport, self-generation of power and construction activities, and planned or unplanned releases of gas.
- Scope 2 emissions result from the generation of electricity, heating, cooling or steam by a third-party that is supplied to the project i.e., indirect emissions. Scope 2 emissions include electricity purchased from the grid.
- Scope 3 emissions are generated in the wider economy as a consequence of the project but, similar to Scope 2 emissions, are not generated by the project i.e., indirect emissions. These emissions are associated with fuel cycles, the end-use of produced gas and third-party infrastructure required to export the gas as liquefied natural gas (LNG).

The on-site self-generated power (which generates Scope 1 emissions) during the construction, operation and decommissioning phases was assessed on the basis of a constant supply of coal seam gas (i.e., 10% of feed gas) throughout the 35-year project life. The power supply to 20% of the wells was assessed as being supplied through connection to the Queensland power grid (which generates Scope 2 emissions).

Annual Scope 1, Scope 2 and Scope 3 greenhouse gas emissions were estimated for the 35-year project life with mitigation and management measures directed at reducing Scope 1 and Scope 2 emissions as the project has greatest influence over the management of these sources. The three years expected to produce the greatest Scope 1 and Scope 2 greenhouse gas emissions for ramp-up, operations and ramp-down were as follows:

- Ramp-up year 2019; with 1,856 producing wells and 196 commissioned wells and 8 facilities operating (including one field compression facility). Ramp-up flaring was not assumed for this scenario.
- Operations year 2030 (at which time sustained production of 1,050 TJ/d is anticipated); with 5,798 producing wells, 733 commissioned wells, 174 decommissioned wells and 15 facilities operational (including five field compression facilities). Pilot flaring at production facilities and flaring due to upset conditions and maintenance was assumed for operations. Ramp-up flaring at one central gas processing facility (CGPF) was assumed for this scenario.
- Ramp-down year 2040; with 2,610 producing wells, 351 decommissioned wells and 16 facilities operational (including 6 field compression facilities). Pilot flaring of production facilities and flaring due to upset conditions and maintenance was assumed.

The estimated emissions for each period of the project (i.e., ramp-up, operations at sustained production and ramp-down) are presented in Table 6.1 in carbon dioxide equivalents (CO₂-e). While there are many greenhouse gases, the global warming potential of these gases varies hence carbon dioxide (CO₂) is used as a base unit to present total greenhouse emissions.

The maximum estimated greenhouse gas emissions for the project were for the year 2030. The emissions for the year 2030 represent 0.85% Australian and 0.012% global emissions for the year 2007.

Table 6.1 Peak annual estimates of greenhouse gas emissions for each period

Project Period	Peak Year	Scope 1 (Mt CO ₂ -e/year)	Scope 2 (Mt CO ₂ -e/year)	Scope 3 (Mt CO ₂ -e/year)
Ramp-up (2014 to 2019)	2019	2.36	0.22	18.41
Operation at sustained production (2020 to 2039)	2030	2.81	0.68	23.10
Ramp-down (2040 to 2047)	2040	2.62	0.31	20.32

Note: million tonnes of CO₂-equivalent per year (Mt CO₂-e/year)

Based on the findings of the EIS, Pacific Environment provided expert advice to develop commitments, which would reduce the project's greenhouse gas emissions. These commitments are presented in Table 6.2.

Table 6.2 EIS greenhouse gas commitments

No.	Commitments
C004	Minimise fuel consumption of vehicles by optimising transport logistics.
C005	Select gaskets, seal and vehicle exhaust systems that are suitable for the task.
C006	Arrow will develop a greenhouse gas management plan that will take into account both biodiversity and economic values of carbon.
C007	Consider energy efficiency programs both locally and across the company that contribute to greenhouse gas emission reductions.
C008	Arrow will participate actively in any government-approved emissions trading scheme.
C010	Consider supporting, through corporate community involvement programs, the development of energy efficiency initiatives in the areas where Arrow operates.
C011	Ensure all engines, machinery equipment and pollution control mechanisms are operated and maintained in accordance with manufacturers' recommendations.

Table 6.2 EIS greenhouse gas commitments (cont'd)

No.	Commitments
C016	Prevent venting and flaring of gas as far as practicable and where safe to do so.
C018	Optimise gas-engine operations to minimise duration of operation at low-efficiency levels that may result in increased emissions.
C020	Minimise the disturbance footprint and vegetation clearing.
C021	During the construction phase, minimise greenhouse gas emissions through selection of equipment and the commitment to clear areas progressively. Implement rehabilitation as soon as practicable following construction activities.
C022	Consider supporting gas industry initiatives that seek to improve technology or processes, such as contributions or sponsorship of research and development.
C023	During the decommissioning phase, minimise greenhouse gas emissions by optimising transport logistics and minimising the footprint of disturbance.
C512	Assess the energy-efficiency opportunities and estimate greenhouse emissions associated with the project in accordance with regulatory requirements. Calculate annual greenhouse gas emissions from the project as required under the NGER Act and Energy Efficiency Opportunities program, as well as future carbon price mechanisms.

6.2 Study Purpose

The supplementary greenhouse gas assessment addresses updates to the EIS project description, and considers whether proposed mitigation measures remain relevant and adequate to reduce the project's greenhouse gas emissions.

The main updates to the EIS project description that influence the greenhouse gas assessment relate to the revised field development schedule, the reduced number of production facilities and wells, the change to the proposed primary power supply and the revised distances travelled by project vehicles.

The revised project development schedule (including well and facility commissioning) reflects the current understanding of the gas resource and development across at least eight drainage areas. It is anticipated that the commissioning of the corresponding eight CGPFs will occur over six years, from the commencement of the project. In comparison, the indicative development sequence, that informed the EIS, proposed that six CGPFs would be commissioned over the same period. More detail on the revised project schedule is provided in Chapter 3, Project Description.

The updated project description reduces the total number of CGPFs (from 12 to 8), water treatment facilities (from 6 to 2) and wells (from 7,500 to 6,500). The multi-well pad concept was also introduced. Multi-well pads will consolidate a group of wells (up to 12 with the most common configuration being 9) at one surface location, which reduces the total number of well pad sites and the individual pad area required per well.

The current power supply option being taken forward involves temporary self-generation until connection to the Queensland electricity grid can be made.

The predicted increase in the distance travelled by project vehicles calculated for the revised project description which is used in the supplementary greenhouse gas assessment is presented in Chapter 12, Roads and Transport.

Additional project description updates identified as having the potential to affect the greenhouse gas emission estimates calculated in the EIS are presented in Table 6.3.

Table 6.3 Project design updates relevant to the greenhouse gas assessment

Project Aspect	EIS Chapter 5, Project Description	SREIS Chapter 3, Project Description
Sustained production estimate	<ul style="list-style-type: none"> 80 TJ/d for supply to the domestic gas market and 970 TJ/d for export overseas (including 10% feed gas). Sustained production aimed at 1,050 TJ/d. 	<ul style="list-style-type: none"> 80 TJ/d for supply to the domestic gas market and 1,135 TJ/d for export overseas. Sustained production aimed at 1,215 TJ/d.
Power requirements and options	<ul style="list-style-type: none"> Primarily self-generated power provided through using gas-powered generators. For assessment purposes, 20% of the power for wells supplied by electricity from the grid and the remaining 80% anticipated to be met through on-site power generation i.e., from 10% of the feed gas. 	<ul style="list-style-type: none"> Primary power requirements provided through connection to the Queensland electricity grid. Temporary self-generation may support facilities during ramp-up until electricity from the grid is connected. This may be for a period of up to two years. Power supplied for construction and decommissioning/ rehabilitation activities via diesel generators.
Production wells	<ul style="list-style-type: none"> Wellhead count approximately 7,500, comprising single well pads. For assessment purposes, a 60 kW engine will supply power to a single well. The footprint for a single well pad is approximately 0.5 ha. 	<ul style="list-style-type: none"> Wellhead count approximately 6,500, comprising single and multi-well pads. Multi-well pads will comprise up to 12 wellheads per pad with an average of 9 wellheads, approximately 8 m apart. For assessment purposes, a 749 kW engine will supply 720 kW of temporary power to multi-well pads with 12 wellheads. The footprint for a multi-well pad is approximately 2 ha. The footprint for a single well pad is approximately 1 ha.
CGPFs	<ul style="list-style-type: none"> Twelve CGPFs (six co-located with a water treatment facility) with the capacity to compress 30 to 150 TJ/d of gas. Water treatment facilities with the capacity to treat 30 to 60 ML/d of coal seam gas water. Upset conditions flaring at a CGPF at a rate of 475 TJ/year. Pilot flaring at a rate of 0.02 TJ/d. Power requirement of 10 to 48 MW (supplied by up to 16 engines with 3 MW capacity). Power requirement of 10 to 56 MW where co-located with a water treatment facility (supplied by up to 19 engines with 3 MW capacity). Footprint is approximately 600 m by 250 m (15 ha). 	<ul style="list-style-type: none"> Eight CGPFs with the capacity to compress 75 to 225 TJ/d of gas, with an optional sparing capacity of 75 TJ/d, if required. Two water treatment facilities with the capacity to treat 35 ML/d and 90 ML/d of coal seam gas water. Unplanned and planned maintenance flaring at a CGPF will be at a rate of 662 TJ/year. No pilot flaring at CGPFs. Power requirement of 50 MW for a CGPF with capacity to compress up to 225 TJ/d of gas and sparing capacity. Temporary self-generation power supply configurations include 47 engines with capacity of 1.1 MW or 10 open-cycle gas turbines with capacity of 5.7 MW. Both scenarios present an 'n+1' sparing capacity. Footprint is approximately 18.2 ha.
Surat Basin coal seam gas composition	Methane content estimated at 98.75% by volume.	Methane content estimated at 96.99% by volume.
Traffic		Increase in distance travelled by project vehicles

6.3 Legislative Update

Since the submission of the EIS, there have been a number of changes made to government policy that impact on the management of greenhouse gas emissions.

6.3.1 Kyoto Protocol

In December 2012, parties to the Kyoto Protocol (including Australia) agreed to establish a second commitment period from 1 January 2013 to 2020 (Australian Government, 2012). For the new commitment period, Australia has agreed to reduce its emissions to 5% below the levels reported in the year 2000. Scope 1 and Scope 2 greenhouse gas emissions produced by the Surat Gas Project will be attributable towards Australia's target for the new commitment period.

6.3.2 Carbon Pricing Mechanism

The Australian Government introduced the carbon pricing mechanism on 1 July 2012. Entities are liable under the mechanism if they produce more than 25,000 tonnes of carbon dioxide equivalent (CO₂-e) of covered emissions per year. Liable entities must report their emissions production under the National Greenhouse and Energy Reporting Scheme (NGER Scheme) and pay for each tonne of CO₂-e emitted. Arrow will be a liable entity for the greenhouse gas emissions produced by the Surat Gas Project.

6.3.3 IPCC Fourth Assessment Report

The Australian Government has committed to adopting the updated global warming potentials from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4) (IPCC, 2007b) for the purpose of estimating emissions under the carbon pricing mechanism for the 2017/2018 financial year and determining the equivalent carbon applied to synthetic greenhouse gases from 1 July 2017 (Combet, 2012).

When the relevant policies are updated in line with AR4, then Arrow will be required to calculate greenhouse emissions using the updated global warming potentials.

6.4 Study Method

The revised Scope 1, Scope 2 and Scope 3 greenhouse gas emission estimates for each year of the project life are presented in the supplementary greenhouse gas assessment. The estimates were established using the most recent guidance documentation on greenhouse gas emission estimation techniques. Since submission of the EIS, minor updates relevant to the study have been made to the following guidance documents:

- The Australian National Greenhouse Accounts - National Greenhouse Accounts (NGA) Factors (DCCEE, 2012a).
- The National Greenhouse and Energy Reporting (Measurement) Determination (NGER Determination). Note that only the Scope 2 and Scope 3 emissions factor for electricity consumption from the Queensland grid has been updated since the submission of the EIS. No other updates relevant to the project were identified.
- The National Greenhouse and Energy Reporting System Measurement Technical Guidelines for the estimation of greenhouse gas emissions by facilities in Australia 2012 (Technical Guidelines), (DCCEE, 2012b).

As discussed above, the IPCC AR4 (IPCC, 2007b) presents an updated global warming potential of methane (CH₄) as 25 tonnes CO₂-e/tonne CH₄ (i.e., each tonne of CH₄ has the same global

warming potential as 25 tonnes of CO₂). The IPCC AR4 (IPCC, 2007b) revised global warming potential of nitrous oxide (N₂O) is 298 tonnes CO₂-e/tonne N₂O. As per the EIS, the supplementary greenhouse gas assessment used a global warming potential for methane of 21 tonnes CO₂-e/ tonne CH₄ and a global warming potential for N₂O of 310 tonnes CO₂-e/ tonne N₂O in accordance with the most current NGER Determination.

The Commonwealth Department of Climate Change and Energy Efficiency (DCCEE, now known as the Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education) has indicated that updated global warming potentials will be adopted by the Australian Government from 2017.

It is expected that the updated total Scope 1 and Scope 2 emission estimate for the project would increase by approximately 3% as an indication of the effect that the revised global warming potentials for CH₄ and N₂O will have on estimated emissions.

As a result of the updated global warming potentials, the cumulative Scope 1 and Scope 2 emission estimates prepared for the project would increase by approximately 3% to be applied from 2017 onwards.

Assessment of whether the mitigation measures identified in the EIS remain valid and accurate with consideration of the revised emissions estimated, maintained the focus on reducing Scope 1 and Scope 2 emissions given that the project will have the greatest influence over these sources.

The greenhouse gas emissions of the project activities were estimated for the EIS and SREIS using relevant guidelines and methodologies as required by the Terms of Reference (Section 4.6.3.1). The current NGER Determination and associated documents do not specify a default emission factor or alternative method for estimating gas migration emissions from underground coal seams or other hydrocarbon reservoirs or deposits.

Gas migration emissions occur due to natural seepage mechanisms that are influenced by the geology of the gas bearing and confining formations, and observed seismic events dating back over a period of decades. The extent to which anthropogenic activities influence or exacerbate the natural processes is not well understood. Field investigations and associated research works are underway, by industry and various government entities, to better understand gas migration and release mechanisms, as they relate to both natural and anthropogenic processes. Part of this work will be in consultation with the Clean Energy Regulator to improve and clarify estimation of gas migration emissions from natural and anthropogenic processes.

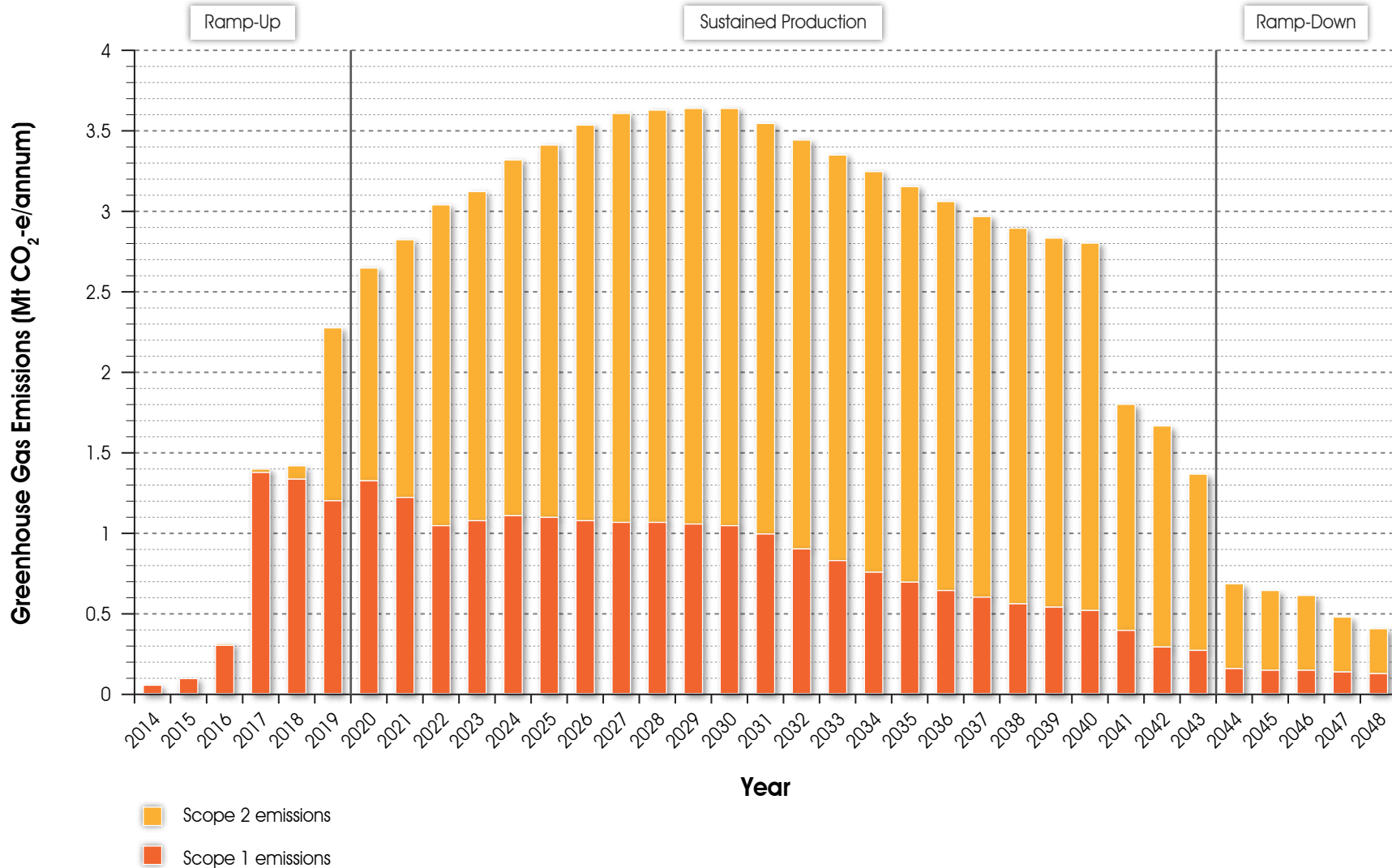
6.5 Study Findings

This section presents the key findings of the supplementary greenhouse gas assessment, including updates to the impacts outlined in the EIS.

6.5.1 Estimated Emissions

Scope 1, 2 and 3 greenhouse gas emissions were estimated for the project life. Scope 1 and 2 emissions provide a good platform for comparing emissions performance against other projects and therefore were considered further.

Figure 6.1 shows the yearly Scope 1 and Scope 2 greenhouse gas emissions associated with the ramp-up, sustained production and ramp-down periods over the life of the project.



Scope 1 emissions are higher during ramp-up due to the combustion of fuel for power generation in the early stages of the project. A significant increase in Scope 2 emissions is then predicted when the production facilities and wells are connected to the Queensland electricity grid for the sustained production and ramp-down phases of the project.

The peak year for Scope 1 and Scope 2 estimated emissions (2029), occurs during the sustained production period of the project, when a large number of wells and all facilities are operating concurrently.

The detailed calculations for the annual Scope 1, 2 and 3 greenhouse gas emissions for the 35-year project life are presented in the Supplementary Greenhouse Gas Assessment, Appendix 3, Table 4.7. The peak year of estimated Scope 1, 2 and 3 greenhouse gas emissions for each of the ramp-up, sustained production and ramp-down periods is presented in Table 6.4 as CO₂-e.

Table 6.4 Greenhouse gas emissions by project period and scope

Category	Activity	Revised Emission Estimates for Peak Year (t CO ₂ -e/year)		
		Ramp-up (2019)	Sustained Production (2029)	Ramp-down (2044)
<i>Scope 1 Emissions</i>				
Fuel Combustion	Coal seam gas combusted in gas-driven generators to provide temporary power to wells and CGPFs.	299,554	8,837	0
	Diesel combustion in generators to provide construction power.	34,237	18,782	3,970
	Diesel combustion in light vehicles, heavy vehicles for construction, operations and decommissioning activities.	31,835	32,063	21,541
Land Clearing	Land clearing.	31,416	14,733	N/A
Fugitive Emissions	Ramp-up flaring.	82,839	N/A	N/A
	Maintenance flaring.	251,199	287,085	0
	Facility-level fugitive emissions (assumed to include high point vents).	200,310	292,345	55,802
	Venting from routine and non-routine activities from equipment and low pressure vents.	267,448	399,326	77,181
<i>Scope 2 Emissions</i>				
Energy Consumption	Electricity supplied to facilities and wells (permanent power supply option).	1,082,089	2,590,340	529,081
<i>Scope 3 Emissions</i>				
Energy Consumption/ Production	End-use (combustion of coal seam gas produced).	14,941,496	22,309,571	4,311,220
	Full fuel cycle (diesel).	5,017	3,859	1,936
	Full fuel cycle (electricity).	150,989	361,443	73,825
	Third-party infrastructure – coal seam gas transmission to Arrow LNG Plant.	6,624	6,624	6,624

Table 6.4 Greenhouse gas emissions by project period and scope

Category	Activity	Revised Emission Estimates for Peak Year (t CO ₂ -e/year)		
		Ramp-up (2019)	Sustained Production (2029)	Ramp-down (2044)
<i>Scope 3 Emissions (cont'd)</i>				
Energy Consumption/ Production	Third-party infrastructure – coal seam gas downstream processing at Arrow LNG Plant.	736,135	2,198,287	424,809
TOTAL Scope 1 Emissions		1,198,838	1,053,171	158,493
TOTAL Scope 2 Emissions		1,082,089	2,590,340	529,081
TOTAL Scope 3 Emissions		15,840,260	24,879,784	4,818,413

Scope 3 emissions from the combustion of the processed gas by end-users are predicted to be the greatest source of emissions for each year.

6.5.2 Potential Impacts and Management Measures

Table 6.5 presents the estimated cumulative Scope 1, 2 and 3 emissions for the EIS and the revised project description for the 35-year life of the project.

Table 6.5 Estimate of cumulative greenhouse gas emissions for project life (Mt CO₂-e)

	Cumulative Greenhouse Gas Emissions Estimates (Mt CO ₂ -e)				
	Scope 1	Scope 2	Scope 1 & 2	Scope 3	Total
Surat Gas Project EIS 2013 to 2047	84.5	11.8	96.3	579.3	675.6
Surat Gas Project SREIS 2014 to 2048	25.2	55.7	80.9	452.9	533.8

Overall, the Scope 1, 2 and 3 revised emissions estimate for the life of the project is approximately 21% less than the estimate presented in the EIS.

The reduced estimate is the result of changes to the project description including a greater understanding of the fluctuation of power requirements over the life of the wells and facilities and development of the project schedule i.e., when wells and facilities are commissioned and decommissioned. As shown in Figure 6.1, the revised greenhouse gas emissions estimate represents the ramp-up, peak and ramp-down phases over the project life. Whereas, the EIS assessed a constant supply of coal seam gas for on-site self-generated power throughout the 35-year project life (i.e., 10% of the feed gas) and therefore Scope 1 emissions due to combustion in stationary engines were constant.

The increase in Scope 2 emissions, estimated for the supplementary greenhouse gas assessment, is a result of the shift towards using power supply from the Queensland electricity grid and away from the self-generated power option, which is a Scope 1 emission.

The Scope 1 and 2 greenhouse gas emissions estimate for the peak year (2029) is presented as CO₂-e in Table 6.6 for comparison with international, national, and state emissions and also for comparison with the greenhouse gas emissions estimated for the EIS.

Review of the estimated annual emissions, determined that the peak year for combined Scope 1 and 2 emissions, based on activities and gas production described in the revised project description, produced 3.6 Mt CO₂-e, in comparison with the 3.5 Mt CO₂-e estimated in the EIS. Although the revised project description presented a reduction in the number of operating wells (6,378 to 4,588) and CGPFs (12 to 8), the increased understanding of the power requirement for wells and facilities has resulted in a higher estimate for the SREIS peak year.

The estimated SREIS Scope 1 and 2 emissions for year 2029 were equivalent to 0.012% and 0.87% of global and Australian emissions for the year 2009, respectively.

Table 6.6 Comparison of estimated greenhouse gas emissions

Geographic Coverage	Year	Source Coverage	Emissions (Mt CO ₂ -e)	SREIS Scope 1 & 2 Proportion (%)
Global ^a	2009	Consumption of fossil fuels	30,086	0.012
Australia ^b	2009	Energy sector	420.3	0.87
Australia ^c (Government Target)	2020	All sectors	530	0.69
Queensland ^d	2009	Total greenhouse gas emissions including land use, land use change and forestry activities	155.1	2.35
Surat Gas Project EIS (peak year)	2030	Scope 1 & 2	3.5	104.5 ^e
Surat Gas Project SREIS (peak year)	2029	Scope 1 & 2	3.6	

^a UNSD (2012).

^b DCCEE (2011a) - Energy sector includes stationary energy, transport and fugitive emissions .

^c Based on 2000 Australian emissions levels for all sectors = 558 Mt CO₂-e (DCCEE, 2010). The Government has committed to reduce carbon pollution by 5 % from 2000 levels by 2020 (DCCEE, 2011b).

^d DCCEE (2011a) - Emissions including land use change.

^e Estimate based on a total Scope 1 and Scope 2 emissions of 3,485,097 tonnes CO₂-e/year for the EIS and of 3,643,511 tonnes CO₂-e/year for the SREIS.

The mitigation measures adopted for the EIS, presented in Chapter 10 of the EIS, are still relevant for reducing the project's greenhouse gas emissions, in light of the revised project description greenhouse gas impacts.

Given that consumption of electricity is a key contributor to total emissions, Pacific Environment also recommends that electrical equipment (e.g., engines, turbines, pumps and compressors) be regularly monitored and maintained, consistent with the Australian Government's Energy Efficiency Opportunities program activities.

Energy efficiency measures and the requirement for equipment maintenance are captured in existing EIS commitments presented below:

- Consider energy efficiency programs both locally and across the company that contribute to greenhouse gas emission reductions [C007].
- Ensure all engines, machinery equipment and pollution control mechanisms are operated and maintained in accordance with manufacturers' recommendations [C011].

6.6 Conclusion

The supplementary greenhouse gas assessment predicted greenhouse gas emissions for the updated project description. The most significant change in the updated project description was the connection to the Queensland electricity grid.

Overall the cumulative greenhouse gas emissions for the 35-year project life for the revised project description have decreased by 21% when compared with the EIS, despite a higher forecast volume of coal seam gas produced. This was due to a greater understanding of the power requirement for wells and facilities and the further development of the project schedule, i.e., when wells and facilities are commissioned and decommissioned.

The revised power supply scenario involving connection to the Queensland electricity grid, results in lower estimates for Scope 1 emissions and higher estimates for Scope 2 emissions for the revised assessment.

The emissions estimate (Scope 1 and Scope 2) for the peak year of 3.6 Mt CO₂-e is slightly higher than the estimate of 3.5 Mt CO₂-e presented in the EIS. The estimated SREIS Scope 1 and 2 emissions for year 2029 were equivalent to 0.012% and 0.87% of global and Australian emissions for the year 2009, respectively.

The mitigation measures detailed in the EIS were determined to be adequate and relevant for reducing greenhouse gas emissions and no changes to the greenhouse gas commitments as a result of the study are proposed.

6.7 Issues Raised in Submissions

Submissions on the EIS raised a diverse range of issues relating to greenhouse gas emissions. The issues fall into broad topics, which are listed below:

- Accuracy of emissions estimation from brine and aggregate transportation.
- Application of the definition for fugitive emissions.
- Arrow's commitment to the application of the mitigation measures and commitments for greenhouse gas emissions.
- Comparison of life cycle emissions for coal seam gas and coal.
- Consideration of alternative forms of power to run the project e.g., solar power.
- Consideration for cumulative emissions.
- Consideration for emissions from exploration activities.
- Consideration for gas migration emissions.
- Consideration for greenhouse gases including hydrofluorocarbons, perfluorocarbons and sulfur hexafluorides.
- Currency and accuracy of emission factors used in emissions estimation.
- Greenhouse gas emission field data collection process.
- Identification of greenhouse gas legislation and presentation of emissions.
- Level of detail on greenhouse gas offsets.

- Method for capture of vented emissions.
- Project's impact on climate change and compliance with climate change legislation.
- Scope of assessment of the resilience of the environment.
- Scope of the Scope 3 emissions assessment.

The topics list is provided to give an idea of the types of issues that have been raised in relation to greenhouse gas and for which responses have been provided under the heading 'Greenhouse Gas', in Part B, Chapter 19, Submission Responses.