Austar Coal Mine

Austar Coal Mine
ENVIRONMENTAL ASSESSMENT

Proposed Stage 3 Extension
to Underground Mining &
Associated Infrastructure

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Greenhouse Gas and Energy Assessment

Austar Coal Mine

Austar Coal Mine Project – Stage 3 Greenhouse Gas and Energy Assessment

September 2008

Umwelt
Environmental Consultants

Austar Coal Mine Project – Stage 3
Greenhouse Gas and Energy Assessment

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on behalf of

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EXECUTIVE SUMMARY

Umwelt (Australia) Pty Limited was commissioned by Austar Coal Mine Pty Limited (Austar) to conduct a Greenhouse Gas and Energy Assessment (GHGEA) of the existing and projected Stage 3 ('the Project') operations of the Austar Mine Complex. The GHGEA is a component of the Environmental Assessment for the Austar Part 3A Major Projects Development Application (DA).

The NSW Minister for Planning approved a modification to DA29/95 in September 2006 which allowed for the introduction of Longwall Top Coal Caving (LTCC) technology into Austar Coal Mine Pty Ltd (Austar), a subsidiary of Yancoal Australia Pty Limited (Yancoal) near Cessnock. This technology allows for significantly increased resource extraction and increased operational energy efficiency. Austar proposes to incorporate this LTCC technology to extract up to 7 metres of coal and to utilise the existing approved coal handling, preparation and handling facilities (CHPP) to process coal from Project operations.

The Project will continue to mine from the Greta Coal Seam and supply premium quality, high volatile, low ash bituminous coal with high specific energy and high fluidity that can be utilised in a range of blends for the international and regional for soft coking, semi coking and thermal markets. The bituminous coal type is meeting high market demand and is considerably more energy efficient in combustion and produces less greenhouse gas emissions than lower grades of coal. The market demand will thus be met by other sources should the Project not proceed. These sources may potentially have poorer quality coal or less energy efficient operations and may result in increased GHG emissions per unit of energy.

A significant component of the GHGEA is complex and involves interactive and the use of, at times, industry-generic approximate variables. The potential economies of scale and net energy and resource savings achieved by utilising existing infrastructure and operations instead of establishing an extensive new development are considerable. The Project will be utilising all existing production resources at Austar including the Ellalong Drift and Pit Top, Coal Handling and Preparation Plant (CHPP) at Pelton, and the rail and transport provide connection to South Maitland Railway. The potential and assumed savings of GHG emissions as a result of the continued infrastructure utilisation and energy efficient LTCC operations at Austar is also considerable.

Central to the extended use of LTCC technology at the site, with respect to greenhouse gas (GHG) emissions, is the significantly increased energy efficiency in resource extraction using the methodology. Results from recent Austar assessment data indicate that approximately an additional 500 kW out of 9700 kW of power is required for the addition of LTCC technology (5 per cent) when compared to traditional longwall methodology resulting in approximately 53.7 per cent more resource recovery for a 5 per cent increase in energy usage.

The GHGEA is based on the energy efficient LTCC and takes into consideration changes in operation over the life of the Project. For the 14-year period, between Project commencement and down-turn (that is, between 2011 and 2023), the total Onsite Fuel Emissions will be approximately **19,488 t CO_2-e/kJ**. The annual mean Onsite Fuel emissions are estimated as **1,392 t CO_2-e/kJ**.

For the same time period the total Stationary Source Emissions will be approximately 914,718 kg $C0_2$-e/kWh or **914.718 t $C0_2$-e/kWh**. These calculations are based on an estimated mean consumption of electricity of 61,177,000 kWh. The annual mean Stationary Source Emissions are projected to be approximately **65,337 kg $C0_2$-e/kWh** or **65.337 t $C0_2$-e/kWh.**

Fugitive emissions from the underground mining of coal, the offsite transport of the product and the potential contribution of the product to global GHG emission from the combustion of coal are also estimated and described. Austar is classified as a Class B Mine (‘non-gassy’) with an assumed coal seam CH_4 content of 0.02 per cent by volume and therefore fugitive emissions of coal seam CH_4 during the life of the mining operation are expected to be low.

The results of the greenhouse gas and energy assessment indicate that the ongoing and extended utilisation of LTCC technology will result in significantly increased greenhouse gas emissions efficiency compared with standard longwall mining operations per tonne of product coal. The total calculated anticipated greenhouse gas savings attributable to the Project represents a considerable saving in keeping with National and NSW State greenhouse reduction and energy efficiency objectives. Mitigation measures have also been identified and outlined as part of this assessment. Given the small contribution that the Project may make to global GHG emission, it is reasonable to conclude that there will be no measurable environmental effects resulting from GHGs from the Project.

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APPENDICES

1.0 Introduction

1.1 The Project

The NSW Minister for Planning approved a modification to DA29/95 in September 2006 which allowed for the introduction of Longwall Top Coal Caving (LTCC) technology into Austar Coal Mine Pty Ltd (Austar), a subsidiary of Yancoal Australia Pty Limited (Yancoal) near Cessnock. This technology allows for significantly increased resource extraction and increased operational energy efficiency. Austar proposes to incorporate this LTCC technology to extract up to 7 metres of coal, and reduced greenhouse gas (GHG) emissions per tonne of coal product, to utilise the existing approved coal handling, preparation and handling facilities (CHPP) to process coal from Stage 3 operations (‘the Project’).

The Project is the subject of this Greenhouse Gas and Energy Assessment (GHGEA) which forms a component of the Environmental Assessment provided for the Part 3A Major Project application under *Environmental Planning and Assessment Act 1979* (EP&A Act). The Project will require the approval of the NSW Minister for Planning. The key components of the Project include:

1. Longwall extraction of up to 7 metres of coal from longwall panels A6 to A17 within the Greta Coal Seam (refer to Figure 1.2 in the main text) using LTCC technology.

   Extraction will occur at a rate of up to 3.6 million tonnes per year (Mtpa) of Run of Mine Coal (ROM). Use of existing Ellalong Drift and Pit Top Facilities for coal handling, preparation and emplacement of reject materials and the use on-site transport systems will continue. Operations are expected to wind-down between 2023-2025. The GHGEA calculations and estimates will therefore include the assumed operational years from the commencement of mining of mining of LWA6 in 2011 to completion of mining in LWA17 2025.

2. Construction and operation of new Surface Infrastructure Site and access road off Quorrobolong Road, south-west of Kitchener (refer to Figures 1.2 and 1.3 in the main text).

   The proposed Surface Infrastructure Site will include upcast and downcast ventilation shafts, main ventilation fan, bath house, workshop, electricity substation and distribution line, service boreholes, offices and store. Access to longwalls in the Project area for men and materials will be via the proposed new Surface Infrastructure Site.

1.1.1 Longwall Top Coal Caving (LTCC)

The extended use of LTCC at the site will allow for significantly increased and ongoing development opportunity. Stage 1 (panels A1 and A2) and Stage 2 (A3 to A5) both currently utilise LTCC technology to extract up to 6.0 metres of coal.

The establishment of a detailed energy monitoring model by Austar for all operations has also provided a strong base for the GHGEA. The scope of this GHGEA is therefore to form a macro assessment of the site: baseline data from current Stage 1 and Stage 2 operations and coal production facilities as at 2007 and projected energy use and greenhouse gas emissions from the incorporation of the Project are captured.

1.1.1.1 LTCC Energy Efficiency

Central to the extended use of LTCC technology at the site, with respect to GHG emissions, is the significantly increased energy efficiency in resource extraction using the methodology. Results from recent Austar assessment data indicate that approximately an additional 5 per cent increase (that is, 500 kW out of 9700 kW) in power usage is required for the addition of LTCC technology which is predicted to result in approximately 53.7 per cent more resource recovery.

1.1.2 Greta Coal Seam and Product

Austar is classified as a Class B Mine ('non-gassy') according to the *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2006: Energy (Fugitive Fuel Emissions)* (DCCa, 2006). Class B Mines have an assumed coal seam CH_4 content of 0.02 per cent by volume.

The Greta Coal Seam at the Austar site also has naturally very low coal seam methane characteristics. Coal produced at Austar is typically high volatile, low ash bituminous, high specific energy, high fluidity coal which can be utilised in a range of blends for the soft coking, semi coking and thermal markets. The coal has a medium to high sulphur content with the sulphur generally occurring in the top sections of the seam. Both organic and pyritic sulphur are present in the seam. The total sulphur in the product coal is typically marketed at less than 1.5 per cent by controlling the working section and by screening and washing of the raw coal delivered to the CHPP (HLA, 1995).

The majority (98 per cent) of the product is transported offsite to the Port of Newcastle by the Austar Railway that connects to the South Maitland Railway and Main Northern Railway. Coal product is stored at the Port of Newcastle for further export. Up to 60,000 tonnes (approximately 2 per cent) of product coal may also be transported to the Port of Newcastle or other destinations by road.

1.1.3 Economies of Scale

A significant component of this GHGEA is complex and involves interactive and estimated variables. The potential economies of scale and net energy savings achieved by utilising existing infrastructure and operations instead of establishing extensive new development are considerable.

The Project will be utilising all existing production resources at Austar including the Ellalong Drift and Pit Top, Pelton Coal Handling and Preparation Plant (CHPP), the rail and transport facilities and relying on minimal construction. The potential and assumed savings of GHG emissions as a result of the continued infrastructure utilisation and energy efficient LTCC operations at Austar is also considerable.

2.0 Greenhouse and Energy Assessment

2.1 Assessment Methodology

In direct accordance with the *National Greenhouse and Energy Reporting System* (NGERS) (DCCb, 2008) and the established methodology the *National Greenhouse and Energy Report (Measurement) Technical Guidelines 2008 v1.0* (NGERS:TG) (DCCc, 2008), all calculations have been additionally made through the Department of Environment Water Heritage and the Arts (DEWHA) Emissions Calculator. The Calculator currently uses algorithms and formulae modelled in the NGERS:TG. Calculations are also in compliance with the United Nations Framework Convention on Climate Change (UNFCCC) reporting categories, as adopted and implemented by the Department of Climate Change.

All calculations are currently based on production of 3.6 Mtpa of ROM and include the following parameters as provided by Austar:

1	maximum demand is 9.07 MWh (or 9070 kWh)
2	average usage is 6.82 MWh (or 6820 kWh)
3	total weekly usage is 1.15 GW (or 1,150,000 kWh)
4	weekly production and wash of 69918 tonnes of resource
5	annual Production over 46 weeks per year is 3.6 Mtpa ROM

The *National Greenhouse and Energy Reporting (Measurement) Determination* (the Determination) was made under subsection 10 (3) of the Act and provides methods, and criteria for methods for the estimation and measurement of the following categories arising from the operation of facilities: greenhouse gas emissions; the production of energy; and the consumption of energy. These categories have been applied as framework to this GHGEA.

2.1.1 Assessment Structure and Data

The GHGEA has been prepared using aggregate data, calculations and supplementary information provided by directly Austar. The data covered current and projected annual electricity and fuel consumption, the projected annual production schedule, and coal seam methane gas emissions estimations for the Project. The assessment takes the following structure:

1	an assessment of the sources of energy consumption and greenhouse gas emissions at Austar in accordance with nationally and internationally recognised assessment guidelines.
2	calculation of energy consumption and greenhouse gas emissions from underground coal mining operations and production by using nationally and internationally recognised methodology.
3	summary and management/mitigation measure for the Project. The assessment assumes that the ongoing utilisation of LTCC technology is optimizing operational energy efficiency.

Calculations have been made with the specific assumptions, methodology, algorithm and guidelines outlined the following agency documents and legislation:

- Department of Climate Change *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2006: Energy (Fugitive Fuel Emissions);*

- Department of Climate Change *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2006: Energy (Stationary Sources);*

- Department of Climate Change *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2006: Energy (Transport);*

- Department of Climate Change *National Greenhouse and Energy Reporting (Measurement) Technical Guidelines, 2008 v1.0;*

- World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) Greenhouse Gas Protocol 2004 (GHG Protocol); and

- *National Greenhouse Energy Reporting Act, 2007.*

2.1.2 Limitations and Assumptions

2.1.2.1 GHGEA Scope Limitations

As stated, the GHGEA has been made using aggregate data provided by Austar (refer to **Appendix A**). The data is specific to current and projected operations and energy arrangements for Austar. A breakdown of the specific activities under the different emissions and consumption categories is currently not achievable. Additional assumptions for emissions that are generated outside the parameters of the Austar operations are discussed in **Section 2.2.1.2**.

2.1.3 Operational Assumptions

The following assumptions have formed the basis of the GHGEA. Austar operations have been staged according to scheduled activities and timeframes and are based on the achievement of maximum Project production (between 2011 and 2023-2025). The specific Project Operational Assumptions are indicated in **Table 2.1** and the specific Project Production Assumptions are provided in **Table 2.2**.

Table 2.1 – Project Operational Assumptions

Activity	Assumption
Road Transport	• Assumes the diesel quantity consumed by the 5 Austar four-wheel-drive vehicles used for onsite transport is accounted for the in Austar site diesel consumption total; • Assumes that the diesel quantity consumed in the transport of product coal by road is included in the Austar site diesel consumption total; and • Assumes that road transport offsite is considered a Scope 3 emission.
Diesel Consumption	• Assumes the vast majority of Diesel Oil consumption is standard Automotive Diesel Oil (ADO) and is primarily for the purpose of resource extraction. ADO Oil and associated EF will provide the basis of calculation.

Table 2.2 – Project Production Assumptions

Activity	Period	Assumption
Austar Operations	2007	**BASELINE**
	2011	**Commencement of the Project** one longwall, two development units, 3.6 Mtpa ROM, higher ventilation for duty, new pit top established at Kitchener; and conveyor system installation.
	2015	**Full Production** one longwall, two development units, 3.6 Mtpa ROM, higher ventilation for duty and ventilation system installation.
	2023-2025	**Completion of Operations** operations, principally developments units and peak tonnes/load on the conveyor.
Demand Load		• mine uses 1.15GW in operation (46 weeks per year); • mines uses 0.6GW when not producing (6 weeks per year); and • yearly usage is 52.9 GW+ 3.6 GW = 56.5GW per year.

2.1.4 Data Assumptions

The GHGEA assumes that the aggregate energy demand, electricity consumption and fuel consumption data, provided by Austar, is full, complete and accurate. The data from the year 2007 is considered the baseline in this assessment. This data is used as calculation for assessing GHGEA onsite.

2.1.5 Assessment Definitions

2.1.5.1 Greenhouse Gases (GHGs)

The *National Greenhouse and Energy Reporting Act 2007* (the Act) defines a GHG as:

a) carbon dioxide;
b) methane;
c) nitrous oxide;
d) sulphur hexafluoride;
e) a hydrofluorocarbon of a kind specified in regulations; or
f) a perfluorocarbon of a kind specified in regulations.

The Act specifies that GHG will be measured in carbon dioxide equivalents (CO_2-e). This equivalent would be determined by multiplying the amount of gas by a regulation-specified value. The global warming potential (GWP) of GHGs and is an index representing the combined effect of the differing multiplications of GHG remaining in the atmosphere and the relative effectiveness in absorbing outgoing infrared radiation.

GWP has been agreed internationally for use in national inventories under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol to the United Nations Framework Convention on Climate Change (United Nations, 1998) (Kyoto Protocol).

2.1.5.2 Emission Categories

The *National Greenhouse and Energy Reporting (Measurement)*: *Technical Guidelines* (DCCc, 2008) (NGER: TG) defines three Scopes of emission categories for a project. Scope 1 and Scope 2 form the structure of this GHGEA and capture the operational and production elements of Austar. The emission categories are defined as follows:

Scope 1	covers *direct emissions* from the combustion of fuels (for example, diesel) and industrial processes within the boundary of the mining operation;
Scope 2	covers *indirect emissions* from the mining operation's consumption of purchased electricity that is produced by another organisation; and
Scope 3	includes *other indirect emissions* as a result of the mining operation's activities that are not from sources owned or controlled by the organisation or involve the offsite transportation (transport, combustion) of the product.

Scope 3 will be categorised, assessed and data provided according to both the impact on analysis of the Project GHGEA and potential mitigation measures that may be incorporated.

2.1.6 Emissions Factors

Unless otherwise stated, the Emissions Factors (EF) listed have been sourced from the *Technical Guidelines for the Estimation of Greenhouse Emissions and Energy at Facility Level* (DCCd, 2007) and the NGERS:TG which have been designed to support national reporting under the *National Greenhouse and Energy Reporting Act 2007*.

The default emission factors listed in these Guidelines have been estimated by the Department of Climate Change using the Australian Greenhouse Emissions Information System (AGEIS) and are determined simultaneously with the production of Australia's National Greenhouse Accounts. The methods are consistent with international guidelines and are subject to international expert review each year.

2.1.7 Oxidation Factors for CO_2

The NGERS: TG (DCCc, 2008) default EF includes the effects of oxidation. The oxidation factor (OF) reflects the fact that 100 per cent of the carbon is not actually combusted, in general, as often there is a small unburnt residual (for example, soot). Default OF are taken from the *National Inventory Report* 2005 *Revised* (DCCe, 2008) for Australia and are used in conjunction with facility-specific EF in the absence of any facility-specific information on actual levels of oxidation (DCCc, 2008).

2.2 Assessment Results

2.2.1 Fugitive Emissions

2.2.1.1 Scope 1 Fugitive Emissions

Scope 1 Fugitive Emissions are those that are produced from activities within the parameters of Austar Mine Complex and as a result of the current and projected operational activities. These emissions specifically arise from activities relating to coal, oil and gas. Where emission factors are related to energy throughput, the energy content of fuel is expressed in terms of gross calorific value (GCV). The *Tier 1* methodology will be applied to the assessment of Austar operations.

2.2.1.1.1 Onsite Fuel Combustion

Onsite Fuel Combustion Sources

Onsite fuel combustion from the onsite transport of product and personnel (off-road) and onsite operations (industrial and mining) are included in the aggregate data set provided by Austar (Austar Diesel Total).

GHG emissions from mobile sources consist of gaseous products of engine fuel combustion (exhaust emissions) and gas leakage from vehicle (fugitive emissions), essentially comprising: CO_2 emissions due to the oxidation of fuel carbon content during fuel combustion; CH4, N_2O, NOx, CO, SO2 and non-methane volatile organic compounds (NMVOCs) emission resulting from incomplete fuel combustion, reactions between air and fuel constituents during fuel combustion, and post-combustion reactions; and fugitive emissions of NMVOCs, due to fuel evaporation.

CO_2 emissions from the combustion of transport fuels are calculated by *Tier 1* methods by multiplying the fuel consumption for each type of mobile engine by a country-specific or default CO_2 emissions factor (in g/MJ) and an oxidation factor. This assigns the total carbon content of the fuel to CO_2 emissions and solid products, even though under actual engine operating conditions a portion of the carbon in fuel is released as CH_4, CO and NMVOCs. All emissions factors relating to energy consumption are given in terms of gross calorific value (GCV) (DCCc, 2008)**.**

Onsite Fuel Combustion Calculation

The following formula is provided in the *NGERS: TG* (DCCc, 2008) to estimate GHG emissions from the combustion of each type of fuel listed (refer to **Appendix B**). Emissions are generally expressed in tonnes of CO_2 per GJ and the GWP of the relatively small quantities of CH_4 and N_2O emitted.

Most of the emissions occur at the point of final fuel consumption, but there are also indirect emission associated with the production and transport of fuel. All emissions factors incorporate the relevant oxidation factors. With the assumed use of standard ADO (a transport fuel) at Austar, the emissions may be estimated using the following formula. The results are presented in **Table 2.3**.

GHG Emissions (t CO_2-e) = Q (kL) x EF_{xoij}

where:

Q is the quantity of fuel in thousands of litres (sourced from inventory or supplier invoices or production records);

EF_{oxij} is the relevant emission factor (refer to **Appendix B**). Emission factors for combustion of transport fuels are reported in **Appendix B** in CO_2-e per kL.

EF for ADO (Full-cycle) is 2.9 (t CO_2-e/kJ)

Table 2.3 – Calculation of Onsite Fuel Combustion

Period	Formula		Calculation
2007	Onsite Fuel Emissions (t CO_2-e)	= Q (kL) x EF $_{xoij}$	= 480kL x 2.9
Baseline only			
			= 1,392
2011	Onsite Fuel Emissions (t CO_2-e)	= Q (kL) x EF $_{xoij}$	= 480kL x 2.9
			= 1,392
2015	Onsite Fuel Emissions (t CO_2-e)	= Q (kL) x EF $_{xoij}$	= 480kL x 2.9
			= 1,392
2023-25	Onsite Fuel Emissions (t CO_2-e)	= Q (kL) x EF $_{xoij}$	= 480kL x 2.9
			= 1,392
		Mean	= 1,392
		Life of Maximum Production (Years)	= 14
		Total for Project (Estimate)	= 14 x 1,392
			= 19,488

As stated in **Section 1.1**, the GHGEA is based on the time estimate for the Project to extant identified coal resources (that is, between 2011 and 2025). For the 14-year period the total Onsite Fuel Emissions will be approximately **19,488t CO_2-e/kJ**. The mean yearly onsite emissions are calculated as **1,392 t CO_2-e/kJ**. These results are also detailed in the Emissions Calculator data in **Appendix C.**

2.2.1.1.2 Fugitive Emissions from Underground Mining

Underground Mining Fugitive Emissions Source

Fugitive emissions from underground mines involves the release of CH_4 and CO_2 during the mining process due to the fracturing of coal seams, overburden and underburden strata. Emissions also arise from post-mining activities such as the stockpiling of coal from the release of residual gases within the coal not released during the mining process (DCCc, 2008: 142).

Austar is classified as a Class B Mine ('non-gassy') according to the *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2006: Energy (Fugitive Fuel Emissions)* (DCCa, 2006). Class B Mines have an assumed coal seam CH_4 content of 0.02 per cent, so any estimation of fugitive emission from underground mining may feasibly be an overestimate.

Underground Mining Fugitive Emissions Calculations

Method 1 from the *NGER:TG* provides a formula for estimation of fugitive emissions potentially released during underground mining operations. The fugitive emissions will ultimately be presented as t CO_2-e/Mtpa of ROM for the GHGEA. The formula is as follows. Results are presented in **Table 2.4**:

$$E_j = Q \times EF_j$$

where:

E_j the fugitive emissions of methane (*j*) that result from the extraction of coal from the mine during the year measured in CO_2-e tonnes;

Q the quantity of run of mine coal extracted from the mine during the year measure in tonnes (*3.6 Mtpa ROM*);

EF_j emission factor for methane (*j*), measured in CO_2-e tonnes per tone of run-of-mine coal extracted from the mine. The calculation will be provided as yearly mean only, not as total, due to the potential projected variation in production.

EF for non-gassy mine is 0.008 *(t CO_2-e/3.6Mtpa of ROM)*

Table 2.4 – Calculation of Fugitive Emissions from Underground Mining

Period	Formula		Calculation
2007	Fugitive Emissions (t CO_2-e)	= Q x EF_j	= 3,600,000 x 0.008
			= 28,800
Baseline only			
2011	Fugitive Emissions (t CO_2-e)	= Q x EF_j	= 3,600,000 x 0.008
			= 28,800
2015	Fugitive Emissions (t CO_2-e)	= Q x EF_j	= 3,600,000 x 0.008
			= 28,800
2023-25	Fugitive Emissions (t CO_2-e)	= Q x EF_j	= 3,600,000 x 0.008
			= 28,800
		Mean	= **28,800** t CO_2-e/3.6Mtpa ROM

As stated, the fugitive emissions from underground mining are presented as an estimated yearly mean, due to the potential projected variation in production. The production of 3.6 Mtpa ROM is the maximum expected. The yearly mean fugitive emissions is **28,800 t CO_2-e/3.6Mtpa ROM.** As stated, Austar is a “non-gassy” mine.

2.2.1.2 Scope 3 Fugitive Emissions

Scope 3 fugitive emissions relating to the Project are those that occur outside of the parameters of the Austar Mine Complex. The World Business Council for Sustainable Development and the World Resources Institute *Greenhouse Gas Protocol 2004* (WRI, 2004) considers the reporting of Scope 3 emissions to be optional principally due to the complexity of these calculations. It must be acknowledged that there are also a range of scientific and practical implications for the assessment of Scope 3 emissions. The issue of double-counting of emissions and the assumptions underlying the assessment of indirect emissions is considerable.

The GHG Protocol specifically acknowledges the importance of the avoidance of double-counting of GHG emissions. On an international scale, double-counting needs to be avoided when compiling national inventories under the Kyoto Protocol. Scope 3 emissions assessments are currently largely speculative and are therefore limited. The GHGEA defines Scope 3 fugitive emissions to include the following:

- transport of product coal outside the Austar Mine Complex parameters;
- combustion of Austar product coal in local and international markets;

- disposal of waste generated outside the Austar Mine Complex parameters;
- employee business travel (in vehicles or aircraft not owned by the reporting organisation);
- employee commuting to and from work;
- extraction, production and transport of purchased fuels consumed;
- extraction, production and transport of other purchased materials or goods;
- purchase of electricity that is consumed in a transport and delivery system (reported by end user);
- out-sourced activities; and
- transportation of products, materials and waste.

As a result, the GHGEA includes an outline of Scope 3 fugitive emissions for context, global perspective and general estimation only. These emissions are produced by third party organisations outside the parameters of the Project and the Austar Mine Complex.

2.2.1.2.1 Offsite Fuel Combustion

Description of Offsite Fuel Combustion

<u>Regional Transport of Product by Road</u>

Austar transports up to 60,000 tonnes per year of coal product and coal fines by road to markets that are not possible to service using rail. This includes small coal loading facilities at the Port of Newcastle that service ships that are not loaded by Port Waratah Coal Services, and some specialist end users that require special sized coal that needs to be transported by road to protect the sizing integrity. Coal product is also transported by road to end users who require coal product to be transported by road owing to location and/or facility constraints. Historically small amounts of coal fines that have restricted markets (that is, power stations) have also been transported by road from the mine.

Export of Product by Rail and Ship

<u>Transport to the Port of Newcastle</u>

When adopting the freight method (for example, rail or ship) of calculation, knowledge of the total freight distance and also the total freight weight is required. The use of the Austar Railway that connects to the South Maitland Railway to transport coal is considered a Scope 3 emission and is presented in this GHGEA for information and consideration only. The calculation is based on gross tonnes per kilometre (GTK).

The following is an indication and estimation of emissions for Scope 3 railway freight from Austar to the Port of Newcastle per one-way trip. The calculation is based on data provided by Austar and indicated by Pacific National Carriers, the train operators. The freight weight is approximately 2,200 tonnes per train, there are usually four locomotives per train and the freight distance is approximately 75 kilometres from Austar to the Port of Newcastle (one-way).

Calculation of Offsite Fuel Combustion by Rail

Assessment is by tonnes per GTK where the consumption of ADO is assumed to be an average of 0.005 L per gross tonne kilometre (Affleck, 2002) on this basis. Approximately 4.364 t CO_2 per journey is generated, as set out in **Table 2.5**.

Table 2.5 – Emissions from Rail Transport (per GTK) for the Project

Rail Freight	Vehicle Type	Weight (tonnes)	Distance (km)	Unit	Freight tonne/ km	tonne/ CO_2
Austar – Newcastle	Locomotive	2,200	75	GTK	165,000	4.364
APPROXIMATE TOTAL						4.364

Transport from the Port of Newcastle

As stated, when adopting the freight method of calculation, particularly for shipping, knowledge of the total freight distance and also the total freight weight is essential. This data is currently not available for the GHGEA. Calculations would be subject to the possibility of double-counting and general estimation (refer to **Section 2.2.1.2**).

Offsite and Offshore Coal Consumption

Based on 3.0 Mtpa, the annual mean greenhouse emissions produced from the offsite and offshore combustion of coal produced by Austar (assuming that all product coal is burnt and equally) is estimated to be approximately 7170 kt CO_2-e or **7.17 Mt CO_2-e** (NGERS Online Calculator, DCC) and is based on NSW EF only. This is a very general estimate, and does not include any variables.

The GHG released from the offshore combustion of this 3.6Mtpa of Austar product coal (estimated above) would **potentially contribute only 0.00062 per cent** of the annual global GHG emissions from the consumption of coal (refer to **Section 2.2.3.1**). The 2005 *World Carbon Dioxide Emissions from the Consumption of (all) Coal, Most Recent Annual Estimates, 1980-2006* (EIAc, 2007) was 11,357.19 Mt CO_2-e.

2.2.2 Stationery Source Emissions

2.2.2.1 Scope 2 Consumption of Electricity

Consumption of Electricity Source

Stationery source (*indirect*) emissions are those that are physically produced by another organisation, most particularly in the form of electricity. Austar has an established modelling and calculation methodology to assess, measure and predict their electricity consumption (refer to **Appendix A**). The methodology and EF used to estimate annual emissions of GHG from stationery sources within the energy sector covers fuels including: coal, coke, brown coal briquettes and coke oven gas, petroleum products, natural gas, and town gas.

The Intergovernmental Panel on Climate Change (IPCC) Guidelines (IPCC, 1995) specify the following steps in calculating the CO_2 emissions from fuel use by stationary sources. This formula is integral to the Emissions Calculator:

- estimate consumption of each fuel in material (mass/volume) units;
- convert to standard energy units (TJ); multiply by carbon emission factor (tC/TJ) for each fuel;
- subtract quantity of carbon stored;
- correct for incomplete combustion of carbon, by multiplying by an oxidation factor; and
- convert emissions calculated as carbon to full molecular weight of CO_2.

Consumption of Electricity Calculation

The following formula is listed in the *NGA Factors* (refer to **Appendix D**) to estimate GHG emissions from the combustion of each type of fuel listed. Indirect emissions factors for the consumption of purchased electricity (refer to **Appendix D**) are provided by State because electricity flow between states are constrained by the capacity of the interstate interconnectors and in some cases there are no interconnections. The factors estimate emissions of CO_2, CH_4 and N_2O expressed together as CO_2-e. All emissions factors incorporate the relevant oxidation factors. The greenhouse gas emissions in tonnes of CO_2-e attributable to the quantity of electricity used may be calculated with the following equation. The results are detailed in **Table 2.6**.

GHG Emissions (t CO_2-e) = Q x EF /1000

where:

Q is the electricity consumed by the reporting organisation expressed in kWh;

EF is the emission factor expressed in kg $C0_2$-e/kWh (refer to **Appendix D**).

EF for NSW (Full-cycle) is 1.068

Therefore:

Table 2.6 – Calculation of Stationary Source Emissions

Period	Formula		Calculation
2007	Stationary Source Emissions (t CO_2-e)	= Q x EF/100	= 56,500,000kWh x 1.068/1000
			= 60,3420
2011	Stationary Source Emissions (t CO_2-e)	= Q x EF/100	= 64,320,000kWh x 1.068/1000
			= 68,693.68
2015	Stationary Source Emissions (t CO_2-e)	= Q x EF/100	= 70,150,000kWh x 1.068/1000
			= 74,920.20
2023-25	Stationary Source Emissions (t CO_2-e)	= Q x EF/100	= 70,150,000kWh x 1.068/1000
			= 74,920.20
		Mean (Consumption)	= 61,177,000kWh
		Mean (Emissions)	**= 65,337 kg $C0_2$-e/kWh**
		Life of Project (Years)	= 14
		Total for Project (Estimate)	= 14 x 65,337 kg $C0_2$-e/kWh
			= 914,718 kg $C0_2$-e/kWh

For the time period for the Project to reach maximum production then down-turn (between 2011 and 2025), the approximate Stationary Source Emissions will be approximately **914,718** kg $C0_2$-e/kWh or **914.718 t $C0_2$-e/kWh.** The annual mean consumption of electricity is 61,177,000 kWh. The annual mean Stationary Source Emissions are projected to be approximately **65,337 kg $C0_2$-e/kWh** or **65.337 t $C0_2$-e/kWh.**

2.2.3 Qualitative Assessment of Emissions

2.2.3.1 Global Emissions

The preceding sections included calculations of the GHG emissions associated with the Project, including a general overview and assessment of the emissions resulting from the end use of product coal.

As there are no accepted methods for undertaking an assessment of the impacts that these emissions may have on the global climate, a comparative analysis of project-related emissions to global emissions has been undertaken. Ignoring the significant consideration of double-counting of Scope 3 emissions, it is possible to assume that the Project may contribute to up **0.00062 per cent of global emissions** from the combustion of coal.

It must be noted that the coal produced by the Project will be meeting market demand and that should the Project not proceed, this demand will be met from other sources. These sources may have poorer quality coal or less energy efficient operations and may result in increased GHG emissions per unit of energy. By way of example, generation of the same amount of energy may result in increased GHG emissions per until of energy from the combustion of coal.

Given the small contribution that the Project may make to global GHG emission, it is reasonable to conclude that there will be no measurable environmental effects resulting from GHGs from the Project. It is, however, recognised that global warming is affected by the cumulative effect of many contributions.

The NGER:TG details the respective energy content factor (GJ/t). As an approximate comparison, black coal for electricity (NSW) has an energy content of 27.0 GJ/t (includes anthracite, bituminous and sub-bituminous) compared with only 10.2 GJ/t for lignite (brown coal). Coal from Austar Coal Mine has an energy content of 28 GJ/t. The less coal carbon content and energy content factor, the greater quantity that has to be burned to produce the same amount of energy generated by bituminous coal. The greater quantity of product that needs to be burned; the more GHG emissions. It is therefore far more energy and GHG emission efficient to combust bituminous coal than lesser quality coals.

3.0 Mitigation and Minimisation

The continued utilisation of LTCC technology as integral to Austar operations is energy efficient. Continued operations will ensure maximum resource extraction for minimal additional energy consumption. Austar will also assess and consider implementation, where feasible, GHG, energy management and mitigation initiatives during the Project. Some of the opportunities for improving energy efficiency and reducing GHG emissions from the Project are discussed below. Austar GHG mitigation measures are largely focussed on energy management, energy efficiency and the potential reduction in ADO consumption.

A range of energy reduction measures will be considered as part of the ongoing operations at Austar Coal Mine. These include:

- review energy efficiency in plant and equipment procurement, consideration be given to the life cycle costs advantages obtained by using energy efficient components (for example, high efficiency conveyors, external lighting, and efficient ventilation systems);
- review the opportunity to install additional sub metering for offices, workshops, conveyors and the CHPP facility;
- review operational initiatives such as turning off idling plant equipment;
- review control and temperature settings for air conditioning units in offices and switchrooms;
- review automatic control of external and internal lighting including workshop and bath house lighting and office and high bay lighting;
- review potential energy efficiency opportunities in water pumping and dust suppression systems (for example, variable speed drive pumps);
- review changes in power consumption with installation of new equipment and install power factor correction equipment to suit;
- review the coal operations and potential for improvement: coal preparation reduces moisture and ash content, sulphur, nitrogen and other contaminants. This results in reduced emissions of greenhouse gases and other pollutants when the coal is used; and
- consider the application of the in-force National Greenhouse and Energy Reporting System (NGERS) and the Carbon Pollution Reduction System (CPRS) on Austar operations.

More broadly, major emission reductions from coal mining and coal will also come from increasingly energy-efficient mining operations, reduced travel distance, improved coal preparation and improved water treatment and management.

4.0 Conclusions

The proposal by Austar Coal Mine Pty Limited to develop the Austar Coal Mine (an aggregate of the former Ellalong, Pelton, Cessnock No.1 and Bellbird South Collieries) (Umwelt, 2007) presents an opportunity for considerable energy efficiency and stabilisation of greenhouse gas emissions associated with the resource removal. GHG reductions that have been identified are associated with the transport of product currently relied upon for daily operations, storage and distribution.

Results from recent Austar assessment data indicate that approximately an additional 500 kW out of 9700 kW of power is required for the addition of LTCC technology (5 per cent) to traditional longwall methodology resulting in approximately 53.7 per cent more resource recovery making the LTCC method considerably more energy efficient than standard longwall mining operations.

Austar have an established energy consumption calculation methodology that provides clear data on demand load for current and future operations. Austar also have a clear understanding of the ADO consumption for the entire site. With continued implementation of this key resource, Austar can predict and manage, with increasing accuracy, the operational demand of the project. Additional delineation of the various operational and production activities that individually consume energy and produce GHG emissions may also be possible with extended use of the existing methodology.

The results of the GHGEA indicate that the ongoing and extended utilisation of LTCC technology will result in significant reductions in greenhouse gas emissions compared with standard longwall mining operations per tonne of product coal. The total calculated anticipated greenhouse gas savings attributable to the Project represent a considerable saving in keeping with National and NSW State greenhouse reduction objectives.

A significant component of this assessment is complex and involves many variables and estimates including: the potential savings achieved by utilising existing infrastructure and operations instead of establishing extensive new development. The Project will be utilising all existing production resources at Austar including the Ellalong Drift and Pit Top, CHPP and Pelton, the rail and transport facilities and relying on minimal construction. The potential and assumed savings of GHG emissions as a result of the continued infrastructure utilisation and energy efficient LTCC operations at Austar is considerable

5.0 References

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APPENDIX A

Austar Electricity Methodology and Aggregate Data 2007 to 2023-2025

Power Demand Load commencement 2011 Based on Model

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Longwall	2739	2739	2739	2739	2739	2739	2739	2739	2739	2739	2739	2739	2739	2739	2739
Development	763	763	763	763	763	763	763	763	763	763	763	763	382	95	0
Conveyors	2739	2739	2739	2739	3739	3739	3739	3739	3739	3739	3739	3739	3739	3739	3739
Washery	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286
Ventilation fans	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
Pit Top	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101
Pumps	413	413	413	413	413	413	413	413	413	413	413	413	413	413	413
N2 Plant	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320
Compressers	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391
Power factor Correction	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525
TOTAL Modelled Peak Demand Load (kW)	*11027*	*11027*	*11027*	*11027*	*12027*	*12027*	*12027*	*12027*	*12027*	*12027*	*12027*	*12027*	*11646*	*11360*	*11264*

2007 Present Usage @ 69918t per week

Electricity useage in 2007	1.15GW @ 46 weeks per year	0.6GW @ 6 weeks per year
	52.9	3.6
Total Consumption	**56.5**	

Power Demand Load commencement 2011 Based on 2007 Data when producing 69918t per week

	2007	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
Modelled Peak Demand Load (kW)	9687	11027	11027.37	11027.37	11027.37	12027.41	12027.37	12027.37	12027.37	12027.37	12027.37	12027.37	12027.37	11645.8	11359.62	11264.23	
% Change	na	1.1383	1.1383	1.1383	1.1383	1.2416	1.2416	1.2416	1.2416	1.2416	1.2416	1.2416	1.2416	1.2022	1.1726	1.1628	
Annual Consumption (GW)	56.5	64.32	64.32	64.32	64.32	70.15	70.15	70.15	70.15	70.15	70.15	70.15	70.15	67.92	66.25	65.70	1018.33

Average Power Consumption 67.17673 GW

Austar Fuel Consumption 480,000 L per year

AVAERAGE DEMAND TWO DEVELOPMENT UNITS AND LONGWALL AS 20TH FEBRUARY 2007

	Individual components	Rated kW (kW) Input)	Rated Size (kW (Output)	Diversity	Demand Load
Long Wall					
	Hyd Pump 1	222.2	200	0.6	133.32
	Hyd Pump 2	222.2	200	0.3	66.66
	Hi Set Pump	222.2	200	0.6	133.32
	Sh Water Pump	222.2	200	0.5	111.1
	MG1	600	540	0.6	360
	MG2	600	540	0.4	240
	TG1	600	540	0.6	360
	TG2	600	540	0.4	240
	Crusher	444.4	400	0.4	177.76
	BSL	444.4	400	0.5	222.2
	Shearer	1388.9	1250	0.5	694.45
SUB TOTAL		*5566.5*	*5010*	*5.4*	*2738.81*
Development Unit 1					
	Cutter ABM 1	300	270	0.4	120
	Pumps ABM 1	111.1	100	0.4	44.44
	Conv ABM 1	40	36	0.4	16
	Loader ABM 1	40	36	0.4	16
	Sh Car 1	120	108	0.2	24
	Vent Fan 1	166.7	150	0.7	116.69
	Br Feeder 1	111.1	100	0.4	44.44
SUB TOTAL		*888.9*	*800*	*2.9*	*381.57*
Development Unit 2					
	Cutter ABM 2	300	270	0.4	120
	Pumps ABM 2	111.1	100	0.4	44.44
	Conv ABM 2	40	36	0.4	16
	Loader ABM 2	40	36	0.4	16
	Sh Car 2	120	108	0.2	24
	Vent Fan 2	166.7	150	0.7	116.69
	Br Feeder 2	111.1	100	0.4	44.44
SUB TOTAL		*888.9*	*800*	*2.9*	*381.57*
Conveyors					
	NW2 Conv	77.8	70	0.5	38.9
	NW3 Conv	122.2	110	0.5	61.1
	CVA1 M3	1250	1125	0.5	625
	CVA2 M1	40	36	0.5	20
	CVA3 M1	244.4	220	0.5	122.2
	CVA3 M2	244.4	220	0.5	122.2
	CVA3 LTU	41.1	37	0.1	4.11
	CVA5 M1	244.4	220	0.5	122.2
	CVA5 M2	244.4	220	0.5	122.2
	CVA5 LTU	41.1	37	0.1	4.11
	CVA6 M1	244.4	220	0.5	122.2
	CVA6 M2	244.4	220	0.5	122.2
	CVA6 LTU	41.1	37	0.1	4.11
	CVA7 M1	244.4	220	0.5	122.2
	CVA7 LTU	41.1	37	0.1	4.11
	CVA6 M4	244.4	220	0.5	122.2
	C200	0		0.5	0
	C300	0		0.5	0
SUB TOTAL		*3609.6*	*3249*	*7.4*	*1739.04*
Washery					
	Washery	2286.3	0	1	2286.3
SUB TOTAL		*2286.3*	*0*	*1*	*2286.3*
Main Mine Fan					
	Fan VVVF	1500	0	0.3	450
SUB TOTAL		*1500*	*0*	*0.3*	*450*
Pit Top					
	Austar Office	40		1	40
	Winder	416.7	375	0.05	20.8
	Kitchener Office	0		1	0
SUB TOTAL		*0*	*0*	*1*	*60.8*
Pumps					
	Pumps x 4	41.1	37	0.4	16.44
	3x55kW pmps	61.1	55	0.5	30.55
	Surf BH Pmp	388.9	350	0.9	350.01
	37kW Pump	41.1	37	0.4	16.44
SUB TOTAL		*532.2*	*479*	*2.2*	*413.44*
N2 Plant					
	N2 Emerg Plant	800	0	0.4	320
SUB TOTAL		*800*	*0*	*0.4*	*320*
Compressors					
	Comp x 2	277.8	250	0.6	166.68
	Comp. 2 x160kW	320	0	0.7	224
SUB TOTAL		*597.8*	*250*	*1.3*	*390.68*
Power Factor Correction					
	PFC 1200kVAr	750	0	0.7	525
SUB TOTAL		*750*	*0*	*0.7*	*525*
		Rated kW (kW) Input)	**Rated Size (kW (Output)**	**Diversity**	**Demand Load**
GRAND TOTAL		**16670.2**	**10588**	**24.8**	**9687.2**

9305.673 8924.103
8825.673 8444.103

3216228

AVAERAGE DEMAND TWO DEVELOPMENT UNITS AND LONGWALL

	Individual components	Rated kW (kW) Input)	Rated Size (kW (Output)	Diversity	Demand Load
Long Wall					
	Hyd Pump 1	222.2	200	0.6	133.32
	Hyd Pump 2	222.2	200	0.3	66.66
	Hi Set Pump	222.2	200	0.6	133.32
	Sh Water Pump	222.2	200	0.5	111.1
	MG1	600	540	0.6	360
	MG2	600	540	0.4	240
	TG1	600	540	0.6	360
	TG2	600	540	0.4	240
	Crusher	444.4	400	0.4	177.76
	BSL	444.4	400	0.5	222.2
	Shearer	1388.9	1250	0.5	694.45
SUB TOTAL		*5566.5*	*5010*	*5.4*	*2738.81*
Development Unit 1					
	Cutter ABM 1	300	270	0.4	120
	Pumps ABM 1	111.1	100	0.4	44.44
	Conv ABM 1	40	36	0.4	16
	Loader ABM 1	40	36	0.4	16
	Sh Car 1	120	108	0.2	24
	Vent Fan 1	166.7	150	0.7	116.69
	Br Feeder 1	111.1	100	0.4	44.44
SUB TOTAL		*888.9*	*800*	*2.9*	*381.57*
Development Unit 2					
	Cutter ABM 2	300	270	0.4	120
	Pumps ABM 2	111.1	100	0.4	44.44
	Conv ABM 2	40	36	0.4	16
	Loader ABM 2	40	36	0.4	16
	Sh Car 2	120	108	0.2	24
	Vent Fan 2	166.7	150	0.7	116.69
	Br Feeder 2	111.1	100	0.4	44.44
SUB TOTAL		*888.9*	*800*	*2.9*	*381.57*
Conveyors					
	NW2 Conv	77.8	70	0.5	38.9
	NW3 Conv	122.2	110	0.5	61.1
	CVA1 M3	1250	1125	0.5	625
	CVA2 M1	40	36	0.5	20
	CVA3 M1	244.4	220	0.5	122.2
	CVA3 M2	244.4	220	0.5	122.2
	CVA3 LTU	41.1	37	0.1	4.11
	CVA5 M1	244.4	220	0.5	122.2
	CVA5 M2	244.4	220	0.5	122.2
	CVA5 LTU	41.1	37	0.1	4.11
	CVA6 M1	244.4	220	0.5	122.2
	CVA6 M2	244.4	220	0.5	122.2
	CVA6 LTU	41.1	37	0.1	4.11
	CVA7 M1	244.4	220	0.5	122.2
	CVA7 LTU	41.1	37	0.1	4.11
	CVA6 M4	244.4	220	0.5	122.2
	C200	2000		0.5	1000
	C300	0		0.5	0
SUB TOTAL		*5609.6*	*3249*	*7.4*	*2739.04*
Washery					
	Washery	2286.3	0	1	2286.3
SUB TOTAL		*2286.3*	*0*	*1*	*2286.3*
Main Mine Fan					
	Fan VVVF	1500	0	0.5	750
SUB TOTAL		*1500*	*0*	*0.5*	*750*
Pit Top					
	Austar Office	40		1	40
	Winder	416.7	375	0.05	20.8
	Kitchener Office	40		1	40
SUB TOTAL		*40*	*0*	*1*	*100.8*
Pumps					
	Pumps x 4	41.1	37	0.4	16.44
	3x55kW pmps	61.1	55	0.5	30.55
	Surf BH Pmp	388.9	350	0.9	350.01
	37kW Pump	41.1	37	0.4	16.44
SUB TOTAL		*532.2*	*479*	*2.2*	*413.44*
N2 Plant					
	N2 Emerg Plant	800	0	0.4	320
SUB TOTAL		*800*	*0*	*0.4*	*320*
Compressors					
	Comp x 2	277.8	250	0.6	166.68
	Comp. 2 x160kW	320	0	0.7	224
SUB TOTAL		*597.8*	*250*	*1.3*	*390.68*
Power Factor Correction					
	PFC 1200kVAr	750	0	0.7	525
SUB TOTAL		*750*	*0*	*0.7*	*525*
GRAND TOTAL		**Rated kW (kW) Input)**	**Rated Size (kW (Output)**	**Diversity**	**Demand Load**
		18710.2	**10588**	**25**	**11027.2**

10645.67 10264.1

10165.67 9784.103

AVAERAGE DEMAND TWO DEVELOPMENT UNITS AND LONGWALL

	Individual components	Rated kW (kW) Input)	Rated Size (kW (Output)	Diversity	Demand Load
Long Wall					
	Hyd Pump 1	222.2	200	0.6	133.32
	Hyd Pump 2	222.2	200	0.3	66.66
	Hi Set Pump	222.2	200	0.6	133.32
	Sh Water Pump	222.2	200	0.5	111.1
	MG1	600	540	0.6	360
	MG2	600	540	0.4	240
	TG1	600	540	0.6	360
	TG2	600	540	0.4	240
	Crusher	444.4	400	0.4	177.76
	BSL	444.4	400	0.5	222.2
	Shearer	1388.9	1250	0.5	694.45
SUB TOTAL		*5566.5*	*5010*	*5.4*	*2738.81*
Development Unit 1					
	Cutter ABM 1	300	270	0.4	120
	Pumps ABM 1	111.1	100	0.4	44.44
	Conv ABM 1	40	36	0.4	16
	Loader ABM 1	40	36	0.4	16
	Sh Car 1	120	108	0.2	24
	Vent Fan 1	166.7	150	0.7	116.69
	Br Feeder 1	111.1	100	0.4	44.44
SUB TOTAL		*888.9*	*800*	*2.9*	*381.57*
Development Unit 2					
	Cutter ABM 2	300	270	0.4	120
	Pumps ABM 2	111.1	100	0.4	44.44
	Conv ABM 2	40	36	0.4	16
	Loader ABM 2	40	36	0.4	16
	Sh Car 2	120	108	0.2	24
	Vent Fan 2	166.7	150	0.7	116.69
	Br Feeder 2	111.1	100	0.4	44.44
SUB TOTAL		*888.9*	*800*	*2.9*	*381.57*
Conveyors					
	NW2 Conv	77.8	70	0.5	38.9
	NW3 Conv	122.2	110	0.5	61.1
	CVA1 M3	1250	1125	0.5	625
	CVA2 M1	40	36	0.5	20
	CVA3 M1	244.4	220	0.5	122.2
	CVA3 M2	244.4	220	0.5	122.2
	CVA3 LTU	41.1	37	0.1	4.11
	CVA5 M1	244.4	220	0.5	122.2
	CVA5 M2	244.4	220	0.5	122.2
	CVA5 LTU	41.1	37	0.1	4.11
	CVA6 M1	244.4	220	0.5	122.2
	CVA6 M2	244.4	220	0.5	122.2
	CVA6 LTU	41.1	37	0.1	4.11
	CVA7 M1	244.4	220	0.5	122.2
	CVA7 LTU	41.1	37	0.1	4.11
	CVA6 M4	244.4	220	0.5	122.2
	C200	2000		0.5	1000
	C300	2000		0.5	1000
SUB TOTAL		*7609.6*	*3249*	*7.4*	*3739.04*
Washery					
	Washery	2286.3	0	1	2286.3
SUB TOTAL		*2286.3*	*0*	*1*	*2286.3*
Main Mine Fan					
	Fan VVVF	1500	0	0.7	1050
SUB TOTAL		*1500*	*0*	*0.7*	*1050*
Pit Top					
	Austar Office	40		1	40
	Winder	416.7	375	0.05	20.8
	Kitchener Office	40		1	40
SUB TOTAL		*40*	*0*	*1*	*100.8*
Pumps					
	Pumps x 4	41.1	37	0.4	16.44
	3x55kW pmps	61.1	55	0.5	30.55
	Surf BH Pmp	388.9	350	0.9	350.01
	37kW Pump	41.1	37	0.4	16.44
SUB TOTAL		*532.2*	*479*	*2.2*	*413.44*
N2 Plant					
	N2 Emerg Plant	800	0	0.4	320
SUB TOTAL		*800*	*0*	*0.4*	*320*
Compressors					
	Comp x 2	277.8	250	0.6	166.68
	Comp. 2 x160kW	320	0	0.7	224
SUB TOTAL		*597.8*	*250*	*1.3*	*390.68*
Power Factor Correction					
	PFC 1200kVAr	750	0	0.7	525
SUB TOTAL		*750*	*0*	*0.7*	*525*
		Rated kW (kW) Input)	**Rated Size (kW (Output)**	**Diversity**	**Demand Load**
GRAND TOTAL		**20710.2**	**10588**	**25.2**	**12327.2**

11945.67 11564.1
11465.67 11084.1

AVAERAGE DEMAND THREE DEVELOPMENT UNITS AND LONGWALL

Component Name	Rated kW (kW) Input)	Rated Size (kW (Output)	Diversity	Demand Load
Comp x 2	277.8	250	0.6	166.68
Pumps x 4	41.1	37	0.4	16.44
NW Conv	416.7	375	0.5	208.35
NW Winch	61.1	55	0.25	15.275
A5 Con Winch	61.1	55	0.25	15.275
A2 Conv	277.8	250	0.3	83.34
Hyd Pump 1	222.2	200	0.6	133.32
Hyd Pump 2	222.2	200	0.3	66.66
Hi Set Pump	222.2	200	0.6	133.32
Sh Water Pun	222.2	200	0.5	111.1
MG1	600	540	0.6	360
MG2	600	540	0.4	240
TG1	600	540	0.6	360
TG2	600	540	0.4	240
Crusher	444.4	400	0.4	177.76
BSL	444.4	400	0.5	222.2
Shearer	1388.9	1250	0.5	694.45
Cutter ABM 1	300	270	0.4	120
Pumps ABM 1	111.1	100	0.4	44.44
Conv ABM 1	40	36	0.4	16
Loader ABM 1	40	36	0.4	16
Sh Car 1	120	108	0.2	24
Sh Car 2	120	108	0.2	24
Vent Fan 1	166.7	150	0.7	116.69
Br Feeder 1	111.1	100	0.4	44.44
Cutter ABM 3	300	270	0.5	150
Pumps ABM 3	111.1	100	0.5	55.55
Conv ABM 3	40	36	0.5	20
Loader ABM 3	40	36	0.5	20
Sh Car 5	120	108	0.3	36
Vent Fan 3	166.7	150	0.7	116.69
A1 Con	277.8	250	0.5	138.9
3x55kW pmps	61.1	55	0.5	30.55
Surf BH Pmp	388.9	350	0.9	350.01
LW 1kV Fan	4.4	4	0.7	3.08
LW 1kV Pmp	4.1	3.7	0.7	2.87
37kW Pump	41.1	37	0.4	16.44
NW2 Conv	77.8	70	0.5	38.9
NW3 Conv	122.2	110	0.5	61.1
SC7 Pump	120	108	0.3	36
Vent Fan 4	166.7	150	0.7	116.69
Cutter ABM 4	300	270	0.5	150
Pump ABM 4	111.1	100	0.5	55.55
ABM 4 Conv 1	40	36	0.5	20
ABM 4 Loade	40	36	0.5	20
CVA2 M1	40	36	0.5	20
CVA3 M1	244.4	220	0.5	122.2
CVA3 M2	244.4	220	0.5	122.2
CVA3 LTU	41.1	37	0.1	4.11
CVA5 M1	244.4	220	0.5	122.2
CVA5 M2	244.4	220	0.5	122.2
CVA5 LTU	41.1	37	0.1	4.11
CVA6 M1	244.4	220	0.5	122.2
CVA6 M2	244.4	220	0.5	122.2
CVA6 LTU	41.1	37	0.1	4.11
CVA7 M1	244.4	220	0.5	122.2
CVA7 LTU	41.1	37	0.1	4.11
CVA6 M4	244.4	220	0.5	122.2
Fan VVVF	16		1	16
PFC 2000kVA	750		0.7	525
Washery	2286.3		1	2286.3
No 1 Shaft	0		1	0
3.3kV Load	1200		0.5	600
PFC 1200kVA	0		1	0
Comp. 2 x160	320		0.7	224
Fan VVVF2	750		0.7	525
N2 Emerg Pla	800		0.4	320
VVVF Pump	90		0.7	63
Office	40		1	40
DW load	350		0.2	70
				11271.41

AVAERAGE DEMAND THREE DEVELOPMENT UNITS AND LONGWALL

	Individual component	Rated kW (kW) Input	Rated Size (kW (Output)	Diversity	Demand Load
Long Wall					
	Hyd Pump 1	222.2	200	0.6	133.32
	Hyd Pump 2	222.2	200	0.3	66.66
	Hi Set Pump	222.2	200	0.6	133.32
	Sh Water Pump	222.2	200	0.5	111.1
	MG1	600	540	0.6	360
	MG2	600	540	0.4	240
	TG1	600	540	0.6	360
	TG2	600	540	0.4	240
	Crusher	444.4	400	0.4	177.76
	BSL	444.4	400	0.5	222.2
	Shearer	1388.9	1250	0.5	694.45
SUB TOTAL		*5566.5*	*5010*	*5.4*	*2738.81*
Development Unit 1					
	Cutter ABM 1	300	270	0.4	120
	Pumps ABM 1	111.1	100	0.4	44.44
	Conv ABM 1	40	36	0.4	16
	Loader ABM 1	40	36	0.4	16
	Sh Car 1	120	108	0.2	24
	Vent Fan 1	166.7	150	0.7	116.69
	Br Feeder 1	111.1	100	0.4	44.44
SUB TOTAL		*888.9*	*800*	*2.9*	*381.57*
Development Unit 2					
	Cutter ABM 2	300	270	0.4	120
	Pumps ABM 2	111.1	100	0.4	44.44
	Conv ABM 2	40	36	0.4	16
	Loader ABM 2	40	36	0.4	16
	Sh Car 2	120	108	0.2	24
	Vent Fan 2	166.7	150	0.7	116.69
	Br Feeder 2	111.1	100	0.4	44.44
SUB TOTAL		*888.9*	*800*	*2.9*	*381.57*
Development Unit 3					
	Cutter ABM 3	300	270	0.4	120
	Pumps ABM 3	111.1	100	0.4	44.44
	Conv ABM 3	40	36	0.4	16
	Loader ABM 3	40	36	0.4	16
	Sh Car 3	120	108	0.2	24
	Vent Fan 3	166.7	150	0.7	116.69
	Br Feeder 3	111.1	100	0.4	44.44
SUB TOTAL		*888.9*	*800*	*2.9*	*381.57*
Conveyors					
	NW2 Conv	77.8	70	0.5	38.9
	NW3 Conv	122.2	110	0.5	61.1
	CVA2 M1	40	36	0.5	20
	CVA3 M1	244.4	220	0.5	122.2
	CVA3 M2	244.4	220	0.5	122.2
	CVA3 LTU	41.1	37	0.1	4.11
	CVA5 M1	244.4	220	0.5	122.2
	CVA5 M2	244.4	220	0.5	122.2
	CVA5 LTU	41.1	37	0.1	4.11
	CVA6 M1	244.4	220	0.5	122.2
	CVA6 M2	244.4	220	0.5	122.2
	CVA6 LTU	41.1	37	0.1	4.11
	CVA7 M1	244.4	220	0.5	122.2
	CVA7 LTU	41.1	37	0.1	4.11
	CVA6 M4	244.4	220	0.5	122.2
SUB TOTAL		*2359.6*	*2124*	*5.9*	*1114.04*
Washery					
	Washery	2286.3	0	1	2286.3
SUB TOTAL		*2286.3*	*0*	*1*	*2286.3*
Main Mine Fan					
	Fan VVVF	1500	0	0.5	750
SUB TOTAL		*1500*	*0*	*0.5*	*750*
Pit Top					
	Office	40		1	40
SUB TOTAL		*40*	*0*	*1*	*40*
Pumps					
	Pumps x 4	41.1	37	0.4	16.44
	3x55kW pmps	61.1	55	0.5	30.55
	Surf BH Pmp	388.9	350	0.9	350.01
	37kW Pump	41.1	37	0.4	16.44
SUB TOTAL		*532.2*	*479*	*2.2*	*413.44*
N2 Plant					
	N2 Emerg Plant	800	0	0.4	320
SUB TOTAL		*800*	*0*	*0.4*	*320*
Compressors					
	Comp x 2	277.8	250	0.6	166.68
	Comp. 2 x160kW	320	0	0.7	224
SUB TOTAL		*597.8*	*250*	*1.3*	*390.68*
Power Factor Correction					
	PFC 1200kVAr	750	0	0.7	525
SUB TOTAL		*750*	*0*	*0.7*	*525*
GRAND TOTAL		**Rated kW (kW) Input**	**Rated Size (kW (Output)**	**Diversity**	**Demand Load**
		17099.1	**10263**	**25.9**	**9197.98**

8816.41 8434.84
8336.41 7954.84

AVAERAGE DEMAND THREE DEVELOPMENT UNITS AND LONGWALL

Component Name	Rated kW (kW) Input)	Rated Size (kW (Output)	Diversity	Demand Load
Comp x 2	277.8	250	0.6	166.68
Pumps x 4	41.1	37	0.4	16.44
NW Conv	416.7	375	0.5	208.35
NW Winch	61.1	55	0.25	15.275
A5 Con Winch	61.1	55	0.25	15.275
A2 Conv	277.8	250	0.3	83.34
Hyd Pump 1	222.2	200	0.6	133.32
Hyd Pump 2	222.2	200	0.3	66.66
Hi Set Pump	222.2	200	0.6	133.32
Sh Water Pump	222.2	200	0.5	111.1
MG1	600	540	0.6	360
MG2	600	540	0.4	240
TG1	600	540	0.6	360
TG2	600	540	0.4	240
Crusher	444.4	400	0.4	177.76
BSL	444.4	400	0.5	222.2
Shearer	1388.9	1250	0.5	694.45
Cutter ABM 1	300	270	0.4	120
Pumps ABM 1	111.1	100	0.4	44.44
Conv ABM 1	40	36	0.4	16
Loader ABM 1	40	36	0.4	16
Sh Car 1	120	108	0.2	24
Sh Car 2	120	108	0.2	24
Vent Fan 1	166.7	150	0.7	116.69
Br Feeder 1	111.1	100	0.4	44.44
Cutter ABM 3	300	270	0.5	150
Pumps ABM 3	111.1	100	0.5	55.55
Conv ABM 3	40	36	0.5	20
Loader ABM 3	40	36	0.5	20
Sh Car 5	120	108	0.3	36
Vent Fan 3	166.7	150	0.7	116.69
A1 Con	277.8	250	0.5	138.9
3x55kW pmps	61.1	55	0.5	30.55
Surf BH Pmp	388.9	350	0.9	350.01
LW 1kV Fan	4.4	4	0.7	3.08
LW 1kV Pmp	4.1	3.7	0.7	2.87
37kW Pump	41.1	37	0.4	16.44
NW2 Conv	77.8	70	0.5	38.9
NW3 Conv	122.2	110	0.5	61.1
SC7 Pump	120	108	0.3	36
Vent Fan 4	166.7	150	0.7	116.69
Cutter ABM 4	300	270	0.5	150
Pump ABM 4	111.1	100	0.5	55.55
ABM 4 Conv 1	40	36	0.5	20
ABM 4 Loader 1	40	36	0.5	20
CVA2 M1	40	36	0.5	20
CVA3 M1	244.4	220	0.5	122.2
CVA3 M2	244.4	220	0.5	122.2
CVA3 LTU	41.1	37	0.1	4.11
CVA5 M1	244.4	220	0.5	122.2
CVA5 M2	244.4	220	0.5	122.2
CVA5 LTU	41.1	37	0.1	4.11
CVA6 M1	244.4	220	0.5	122.2
CVA6 M2	244.4	220	0.5	122.2
CVA6 LTU	41.1	37	0.1	4.11
CVA7 M1	244.4	220	0.5	122.2
CVA7 LTU	41.1	37	0.1	4.11
CVA6 M4	244.4	220	0.5	122.2
Fan VVVF	16		1	16
PFC 2000kVAr	750		0.7	525
Washery	2286.3		1	2286.3
No 1 Shaft	0		1	0
3.3kV Load	1200		0.5	600
PFC 1200kVAr	0		1	0
Comp. 2 x160kW	320		0.7	224
Fan VVVF2	750		0.7	525
N2 Emerg Plant	800		0.4	320
VVVF Pump	90		0.7	63
Office	40		1	40
DW load	350		0.2	70
			TOTAL AVERA(	11271.41

APPENDIX B

National Greenhouse Accounts (NGA) Factors – Fuel Combustion Emissions (Stationary Energy) 2008

where: Q is the quantity of fuel in thousands of litres or GJ (sourced from inventory or supplier invoices or production records).

EF_{oxij} is the relevant emission factor. Emission factors for combustion of transport fuels are reported in Table 3 in both kg CO_2-e per GJ and tonnes of CO_2-e per kL. These comprise scope 1 (point source/fuel combustion) emission factors (Columns B or C), scope 3 (indirect/fuel extraction) emission factors (columns D or E) and the full fuel cycle emission factors (Columns F or G), all including CO_2 and non-CO_2 gases. For reporting under **Greenhouse Challenge Plus**, emissions factors for scope 1 and scope 3 should be used to separately calculate and report direct and indirect emissions. Division by 1000 converts kg to tonnes.

Table 3: Fuel combustion emission factors (Transport Fuels)

Fuel	Energy content	EF for scope 1		EF scope 3		Full fuel cycle emission factor [d]	
	A	B	C	D	E	F	G
	GJ/kL	kg CO_2-e/GJ	t CO_2-e/kL	kg CO_2-e/GJ	t CO_2-e/kL	kg CO_2-e/GJ	T CO_2-e/kL
Motor gasoline (petrol)	34.2	67.0	2.3	5.3	0.2	72.3	2.5
Diesel (Automotive Diesel Oil)	38.6	69.8	2.7	5.3	0.2	75.2	2.9
Aviation gasoline	33.1	67.1	2.2	5.3	0.2	72.4	2.4
Aviation turbine	36.8	69.6	2.6	5.3	0.2	74.9	2.8
Fuel oil	39.7	73.5	3.0	5.3	0.2	78.9	3.2
Liquefied petroleum gas	26.2	60.2	1.6	5.3	0.1	65.5	1.7
Biofuels							
Ethanol (molasses)[b]	23.4	0.4	0.0	54.8	1.3	54.8	1.3
Ethanol (wheat starch waste)[b]	23.4	0.4	0.0	54.5	1.3	54.5	1.3
Biodiesel (Canola) [b]	23.4	0.4	0.0	62.1	1.5	62.5	1.5
Biodiesel (tallow) [b]	23.4	0.4	0.0	57.2	1.3	57.6	1.3
	GJ/m^3		t CO_2-e/m^3	kg CO_2-e/GJ	t CO_2-e/m^3	kg CO_2-e/GJ	t CO_2-e/m^3
Natural gas (LDV) [c]	0.0393	57.0	0.0022	11.4	0.0005	68.4	0.0027
Natural gas (HDV) [c]	0.0393	53.6	0.0021	11.4	0.0005	65.0	0.0026

Source: Department of Climate Change 2007, Table 78.

Notes: All emission factors incorporate relevant oxidation factors (sourced from the DCC's National Inventory Report). a The emission factors for natural gas engines are indicative only. Many natural gas engines, whether dual

APPENDIX C

Department of Environment Water Heritage and the Art (DEWHA) Emissions Calculator Results for Austar 2023-2025

AUSTAR GHGEA EMISSIONS CALCULATIONS (refer to Notes below)

The emission factors used in this AGO emissions calculator tool are consistent with the AGO Factors and Methods Workbook, version December 2006. It calculates the total emissions (made up of Scope 1 + Scope 2 + Scope 3, formerly known as "full fuel cycle" or "direct and indirect emissions"). Differing from the previous version, the emission factors for total emissions also apply for transport energy.
http://www.greenhouse.gov.au/workbook

For a breakdown of all emissions into direct and indirect emissions please use the AGO online reporting tool OSCAR. This web-based database application is in line with the World Resource Institute (WRI) model that breaks emissions down into three scopes.

To access OSCAR please go to www.challenge.edgar.gov.au. This link will take you to the entry site. You will need a user name and password to enter your organisation's own area. In case you haven't been provided with your user name and password yet, you can use the contact details provided on the site to contact your Greenhouse Challenge Plus team.

Activity A:	Emission inventory for Activity/Site A
Activity B:	Emission inventory for Activity/Site B
Activity B:	Emission inventory for Activity/Site C
Activity C:	Emission inventory for Activity/Site D
Summary	A summary of all the activities. The summary can be copied into the progress report
cfg	Configuration. Allows selection of workbook used
factors	contains all the factors, do not modify this sheet.
wrkb	contains list of workbooks, do not modify this sheet.
factors	contains all the factors, do not modify this sheet.
Units	Unit conversion used by the automatic calculations. Do not modify.

2007 Spreadsheet version: 2
http://www.greenhouse.gov.au/challenge

Austar Stage 3 Note: April 2008

This calculator from the Department of Climate Change, uses the Factors and Methods Workbook and the results of which (if participating in the Greenhouse Challenge Plus) feed directly into the National Greenhouse Accounts.

For consistency with the National Greenhouse Energy Regulation System (NGERS), this emissions calculator has been chosen.

Additional Note: While the *Factors and Methods Workbook 2006* has been superseded by National Greenhouse Accounts (NGA) Factors: *updating and replacing the AGO Factors* and Methods Workbook (NGA Factors), 2008 - additional and final cross-referencing and cross-calculations have been performed to ensure that the emissions are consistent with the latest document.

Site/Activity A Acitivity/Site name: **Austar Operations 2007 (3Mt)**

Select state: NSW

Emissions inventory							
Fuel/process	**Consumption units**	**Unit**	**Basic units**	**factors**		**kg CO_2-e**	**Tonnes CO_2-e**
Electricity	56,500,000	kWh	56,500,000.00 kWh	1.068	kg CO_2-e/kWh	60342000	60,342.0
Natural Gas (non-transport)		GJ	0.00 GJ	71.3	kg CO_2-e/GJ	0	0.0
LPG - (non-transport)		kt	0.00 t	3.3	t CO2/t	0	0.0
Industrial Diesel Oil		L	0.00 kL	3.1	t CO2/kL	0	0.0
Petroleum Products Transport							
Petrol/Gasoline		kL	0.00 kL	2.6	t CO2/kL	0	0.0
Automotive Diesel Oil	480,000	L	480.00 kL	2.9	t CO2/kL	1392000	1,392.0
LPG - transport		kL	0.00 kL	1.8	t CO2/kL	0	0.0
Natural Gas/CNG LDV		m3	0.00 m^3	0.0027	kg CO_2/m^3	0	0.0
Natural Gas/CNG HDV		m3	0.00 m^3	0.0026	kg CO_2/m^3	0	0.0
Marine/Industrial Diesel Fuel		kL	0.00 kL	3.1	t CO2/kL	0	0.0
Aviation Gasoline		kL	0.00 kL	2.5	t CO2/kL	0	0.0
Aviation Turbine		kL	0.00 kL	2.9	t CO2/kL	0	0.0
Waste							
Co-mingled		t	0.00 t	0.9	t CO2-e/t	0	0.0
Paper and paper board		kg	0.00 t	2.5	t CO2-e/t	0	0.0
Textiles (excluding synthetics)		t	0.00 t	1.5	t CO2-e/t	0	0.0
Wood/straw		t	0.00 t	3.2	t CO2-e/t	0	0.0
Garden		t	0.00 t	1.1	t CO2-e/t	0	0.0
Food/Garden		t	0.00 t	0.9	t CO2-e/t	0	0.0
Medical		t	0.00 t	0.3	t CO2-e/t	0	0.0
Concrete/metal/plastic/glass		t	0.00 t	0.0	t CO2-e/t	0	0.0
Synthetic gases							
SF_6		t	0.00 t	23,900	t CO2-e/t	0	0.0
HFC's		t	0.00 t		t CO2-e/t	0	0.0
Fugitive emissions							
CH4		t	0.00 t	21	t CO2-e/t	0	0.0
CO2		t	0.00 t	1	t CO2-e/t	0	0.0
Other							
Other		<UNIT>	<UNIT>		t CO2-e/unit	0	0.0
Other		<UNIT>	<UNIT>		t CO2-e/unit	0	0.0
Other		<UNIT>	<UNIT>		t CO2-e/unit	0	0.0
Gross Emissions							**61,734.0**
Offsets (should be entered as negative figures)							
Gross Offsets							**0.0**
Net Emissions							**61,734.0**

Site/Activity B Acitivity/Site name: **Austar Operations 2011 (3Mt)**

Select state: NSW

Emissions inventory

Fuel/process	Consumption units	Unit	Basic units	factors	kg CO_2-e	Tonnes CO_2-e
Electricity	64,320,000	kWh	64,320,000.00 kWh	1.068 kg CO_2-e/kWh	68693760	68693.8
Natural Gas (non transport)		GJ	0.00 GJ	71.3 kg CO_2-e/GJ	0	0.0
LPG - (non-transport)		t	0.00 t	3.3 t CO2/t	0	0.0
Industrial Diesel Oil		L	0.00 kL	3.1 t CO2/kL	0	0.0
Petroleum Products Transport						
Petrol/Gasoline		kL	0.00 kL	2.6 t CO2/kL	0	0.0
Automotive Diesel Oil	480,000	L	480.00 kL	2.9 t CO2/kL	1392000	1392.0
LPG - transport		kL	0.00 kL	1.8 t CO2/kL	0	0.0
Natural Gas/CNG LDV		m3	0.00 m^3	0.0027 kg CO_2/m^3	0	0.0
Natural Gas/CNG HDV		m3	0.00 m^3	0.0026 kg CO_2/m^3	0	0.0
Marine/Industrial diesel fuel		kL	0.00 kL	3.1 t CO2/kL	0	0.0
Aviation Gasoline		kL	0.00 kL	2.5 t CO2/kL	0	0.0
Aviation Turbine		kL	0.00 kL	2.9 t CO2/kL	0	0.0
Waste						
Co-mingled		t	0.00 t	0.9 t CO2-e/t	0	0.0
Paper and paper board		kg	0.00 t	2.5 t CO2-e/t	0	0.0
Textiles (excluding synthetics)		t	0.00 t	1.5 t CO2-e/t	0	0.0
Wood/straw		t	0.00 t	3.2 t CO2-e/t	0	0.0
Garden		t	0.00 t	1.1 t CO2-e/t	0	0.0
Food/Garden		t	0.00 t	0.9 t CO2-e/t	0	0.0
Medical		t	0.00 t	0.3 t CO2-e/t	0	0.0
Concrete/metal/plastic/glass		t	0.00 t	0.0 t CO2-e/t	0	0.0
Synthetic gases						
SF_6		t	0.00 t	23,900 t CO2-e/t	0	0.0
HFC's		t	0.00 t	t CO2-e/t	0	0.0
Fugitive emissions						
CH4		t	0.00 t	21 t CO2-e/t	0	0.0
CO2		t	0.00 t	1 t CO2-e/t	0	0.0
Other						
Other		<UNIT>	<UNIT>	t CO2-e/unit		0.0
Other		<UNIT>	<UNIT>	t CO2-e/unit		0.0
Other		<UNIT>	<UNIT>	t CO2-e/unit		0.0
Gross Emissions						**70085.8**
Offsets (should be entered as negative figures)						
Gross Offsets						**0.0**
Net Emissions						**70085.8**

Site/Activity C Acitivity/Site name: **Austar Operations 2015 (3Mt)**

Select state: NSW

Emissions inventory						
Fuel/process	**Consumption units**	**Unit**	**Basic units**	**factors**	**kg CO_2-e**	**Tonnes CO_2-e**
Electricity	70,150,000	kWh	70,150,000.00 kWh	1.068 kg CO_2-e/kWh	74920200	74920.2
Natural Gas (non-transport)		GJ	0.00 GJ	71.3 kg CO_2-e/GJ	0	0.0
LPG - (non-transport)		t	0.00 t	3.3 t CO2/t	0	0.0
Industrial Diesel Oil		L	0.00 kL	3.1 t CO2/kL	0	0.0
Petroleum Products Transport						
Petrol/Gasoline		kL	0.00 kL	2.6 t CO2/kL	0	0.0
Automotive Diesel Oil	480,000	L	480.00 kL	2.9 t CO2/kL	1392000	1392.0
LPG - transport		kL	0.00 kL	1.8 t CO2/kL	0	0.0
Natural Gas/CNG LDV		m3	0.00 m^3	0.0027 kg CO_2/m^3	0	0.0
Natural Gas/CNG HDV		m3	0.00 m^3	0.0026 kg CO_2/m^3	0	0.0
Marine/Industrial diesel fuel		kL	0.00 kL	3.1 t CO2/kL	0	0.0
Aviation Gasoline		kL	0.00 kL	2.5 t CO2/kL	0	0.0
Aviation Turbine		kL	0.00 kL	2.9 t CO2/kL	0	0.0
Waste						
Co-mingled		t	0.00 t	0.9 t CO2-e/t	0	0.0
Paper and paper board		kg	0.00 t	2.5 t CO2-e/t	0	0.0
Textiles (excluding synthetics)		t	0.00 t	1.5 t CO2-e/t	0	0.0
Wood/straw		t	0.00 t	3.2 t CO2-e/t	0	0.0
Garden		t	0.00 t	1.1 t CO2-e/t	0	0.0
Food/Garden		t	0.00 t	0.9 t CO2-e/t	0	0.0
Medical		t	0.00 t	0.3 t CO2-e/t	0	0.0
Concrete/metal/plastic/glass		t	0.00 t	0.0 t CO2-e/t	0	0.0
Synthetic gases						
SF_6		t	0.00 t	23,900 t CO2-e/t	0	0.0
HFC's		t	0.00 t	t CO2-e/t	0	0.0
Fugitive emissions						
CH4		t	0.00 t	21 t CO2-e/t	0	0.0
CO2		t	0.00 t	1 t CO2-e/t	0	0.0
Other						
Other		<UNIT>	<UNIT>	t CO2-e/unit		0.0
Other		<UNIT>	<UNIT>	t CO2-e/unit		0.0
Other		<UNIT>	<UNIT>	t CO2-e/unit		0.0
Gross Emissions						**76312.2**
Offsets (should be entered as negative figures)						
Gross Offsets						**0.0**
Net Emissions						**76312.2**

Site/Activity D Acitivity/Site name: **Austar Operations 2023 to 2025 (3Mt)**

Select state: NSW

Emissions inventory

Fuel/process	Consumption units	Unit	Basic units	factors	kg CO_2-e	Tonnes CO_2-e
Electricity	70,150,000	kWh	70,150,000.00 kWh	1.068 kg CO_2-e/kWh	74920200	74920.2
Natural Gas (non-transport)		GJ	0.00 GJ	71.3 kg CO_2-e/GJ	0	0.0
LPG - (non-transport)		t	0.00 t	3.3 t CO2/t	0	0.0
Industrial Diesel Oil		L	0.00 kL	3.1 t CO2/kL	0	0.0
Petroleum Products Transport						
Petrol/Gasoline		kL	0.00 kL	2.6 t CO2/kL	0	0.0
Automotive Diesel Oil	480,000	L	480.00 kL	2.9 t CO2/kL	1392000	1392.0
LPG - transport		kL	0.00 kL	1.8 t CO2/kL	0	0.0
Natural Gas/CNG LDV		m3	0.00 m^3	0.0027 kg CO_2/m^3	0	0.0
Natural Gas/CNG HDV		m3	0.00 m^3	0.0026 kg CO_2/m^3	0	0.0
Marine/Industrial diesel fuel		kL	0.00 kL	3.1 t CO2/kL	0	0.0
Aviation Gasoline		kL	0.00 kL	2.5 t CO2/kL	0	0.0
Aviation Turbine		kL	0.00 kL	2.9 t CO2/kL	0	0.0
Waste						
Co-mingled		t	0.00 t	0.9 t CO2-e/t	0	0.0
Paper and paper board		kg	0.00 t	2.5 t CO2-e/t	0	0.0
Textiles (excluding synthetics)		t	0.00 t	1.5 t CO2-e/t	0	0.0
Wood/straw		t	0.00 t	3.2 t CO2-e/t	0	0.0
Garden		t	0.00 t	1.1 t CO2-e/t	0	0.0
Food/Garden		t	0.00 t	0.9 t CO2-e/t	0	0.0
Medical		t	0.00 t	0.3 t CO2-e/t	0	0.0
Concrete/metal/plastic/glass		t	0.00 t	0.0 t CO2-e/t	0	0.0
Synthetic gases						
SF_6		t	0.00 t	23,900 t CO2-e/t	0	0.0
HFC's		t	0.00 t	t CO2-e/t	0	0.0
Fugitive emissions						
CH4		t	0.00 t	21 t CO2-e/t	0	0.0
CO2		t	0.00 t	1 t CO2-e/t	0	0.0
Other						
Other		<UNIT>	<UNIT>	t CO2-e/unit		0.0
Other		<UNIT>	<UNIT>	t CO2-e/unit		0.0
Other		<UNIT>	<UNIT>	t CO2-e/unit		0.0
Gross Emissions						**76312.2**
Offsets (should be entered as negative figures)						
Gross Offsets						**0.0**
Net Emissions						**76312.2**

Emission summary tables of all sites/activities, can be copied into progress report.

Summary all sites/activities			
Fuel/process	**Consumption (Units)**	**Conversion factor**	**CO_2-e (Tonnes)**
Electricity	261,120,000 kWh	1.068 kg CO2-e/kWh	278876
Natural Gas (non-transport)	GJ	71.3 kg CO2-e/GJ	
LPG - (non-transport)	t	3.3 t CO2/t	
Industrial Diesel Oil	kL	3.1 t CO2/kL	
Petroleum Products Transport			
Petrol/Gasoline	kL	2.6 t CO2/kL	
Automotive Diesel Oil	1,920 kL	2.9 t CO2/kL	5568
LPG - transport	kL	1.8 t CO2/kL	
Natural Gas/CNG LDV	m^3	0.0027 kg CO2/m3	
Natural Gas/CNG HDV	m^3	0.0026 kg CO2/m3	
Marine/Industrial Diesel Fuel	kL	3.1 t CO2/kL	
Aviation Gasoline	kL	2.5 t CO2/kL	
Aviation Turbine	kL	2.9 t CO2/kL	
Waste			
Co-mingled	t	0.9 t CO2-e/t	
Paper and paper board	t	2.5 t CO2-e/t	
Textiles (excluding synthetics)	t	1.5 t CO2-e/t	
Wood/straw	t	3.2 t CO2-e/t	
Garden	t	1.1 t CO2-e/t	
Food/Garden	t	0.9 t CO2-e/t	
Medical	t	0.3 t CO2-e/t	
Concrete/metal/plastic/glass	t	0 t CO2-e/t	
Synthetic gases			
SF6	t	23900 t CO2-e/t	
HFC's	t	t CO2-e/t	
Fugitive emissions			
CH4	t	21 t CO2-e/t	
CO2	t	1 t CO2-e/t	
Other			
Other	<UNIT>	t CO2-e/unit	
Other	<UNIT>	t CO2-e/unit	
Other	<UNIT>	t CO2-e/unit	
TOTAL GROSS EMISSIONS			**284444**
Offset			
TOTAL OFFSETS			
Net Emissions			**284444**

Emission by Site/Activity:

Site/Activity:	tonnes CO2-e
Austar Operations 2007 (3Mt)	61,734
Austar Operations 2011 (3Mt)	70,086
Austar Operations 2015 (3Mt)	76,312
Austar Operations 2023 to 202!	76,312
Total	**284,444**

Site/Activity A

Site/Activity:	**Austar Operations 2007 (3Mt)**		
Fuel/process	**Consumption (Units)**	**Conversion factor**	**CO_2-e (Tonnes)**
Electricity	56,500,000 kWh	1.068 kg CO2-e/kWh	60342
Natural Gas (non-transport)	GJ	71.3 kg CO2-e/GJ	
LPG - (non-transport)	t	3.3 t CO2/t	
Industrial Diesel Oil	kL	3.1 t CO2/kL	
Petroleum Products Transport			
Petrol/Gasoline	kL	2.6 t CO2/kL	
Automotive Diesel Oil	480 kL	2.9 t CO2/kL	1392
LPG - transport	kL	1.8 t CO2/kL	
Natural Gas/CNG LDV	m^3	0.0027 kg CO2/m3	
Natural Gas/CNG HDV	m^3	0.0026 kg CO2/m3	
Marine/Industrial Diesel Fuel	kL	3.1 t CO2/kL	
Aviation Gasoline	kL	2.5 t CO2/kL	
Aviation Turbine	kL	2.9 t CO2/kL	
Waste			
Co-mingled	t	0.9 t CO2-e/t	
Paper and paper board	t	2.5 t CO2-e/t	
Textiles (excluding synthetics)	t	1.5 t CO2-e/t	
Wood/straw	t	3.2 t CO2-e/t	
Garden	t	1.1 t CO2-e/t	
Food/Garden	t	0.9 t CO2-e/t	
Medical	t	0.3 t CO2-e/t	
Concrete/metal/plastic/glass	t	0.0 t CO2-e/t	
Synthetic gases			
SF6	t	23900 t CO2-e/t	
HFC's	t	t CO2-e/t	
Fugitive emissions			
CH4	t	21 t CO2-e/t	
CO2	t	1 t CO2-e/t	
Other			
Other	<UNIT>	t CO2-e/unit	
Other	<UNIT>	t CO2-e/unit	
Other	<UNIT>	t CO2-e/unit	
TOTAL GROSS EMISSIONS			**61734**
Offset			
TOTAL OFFSET			
TOTAL NET EMISSIONS			**61734**

Site/Activity B

Site/Activity:	**Austar Operations 2011 (3Mt)**		
Fuel/process	**Consumption (Units)**	**Conversion factor**	**CO_2-e (Tonnes)**
Electricity	64,320,000 kWh	1.068 kg CO2-e/kWh	68694
Natural Gas (non transport)	GJ	71.3 kg CO2-e/GJ	
LPG - (non-transport)	t	3.3 t CO2/t	
Industrial Diesel Oil	kL	3.1 t CO2/kL	
Petroleum Products Transport			
Petrol/Gasoline	kL	2.6 t CO2/kL	
Automotive Diesel Oil	480 kL	2.9 t CO2/kL	1392
LPG - transport	kL	1.8 t CO2/kL	
Natural Gas/CNG LDV	m3	0.0027 kg CO2/m3	
Natural Gas/CNG HDV	m3	0.0026 kg CO2/m3	
Marine/Industrial diesel fuel	kL	3.1 t CO2/kL	
Aviation Gasoline	kL	2.5 t CO2/kL	
Aviation Turbine	kL	2.9 t CO2/kL	
Waste			
Co-mingled	t	0.9 t CO2-e/t	
Paper and paper board	t	2.5 t CO2-e/t	
Textiles (excluding synthetics)	t	1.5 t CO2-e/t	
Wood/straw	t	3.2 t CO2-e/t	
Garden	t	1.1 t CO2-e/t	
Food/Garden	t	0.9 t CO2-e/t	
Medical	t	0.3 t CO2-e/t	
Concrete/metal/plastic/glass	t	t CO2-e/t	
Synthetic gases			
SF6	t	23900 t CO2-e/t	
HFC's	t	t CO2-e/t	
Fugitive emissions			
CH4	t	21 t CO2-e/t	
CO2	t	1 t CO2-e/t	
Other			
Other	<UNIT>	t CO2-e/unit	
Other	<UNIT>	t CO2-e/unit	
Other	<UNIT>	t CO2-e/unit	
TOTAL GROSS EMISSIONS			**70086**
Offset			
TOTAL OFFSET			
TOTAL NET EMISSIONS			**70086**

Site/Activity C

Site/Activity:	**Austar Operations 2015 (3Mt)**				
Fuel/process	**Consumption (Units)**		**Conversion factor**		**CO_2-e (Tonnes)**
Electricity	70,150,000	kWh	1.068	kg CO2-e/kWh	74920
Natural Gas (non-transport)		GJ	71.3	kg CO2-e/GJ	
LPG - (non-transport)		t	3.3	t CO2/t	
		kL	3.1	t CO2/kL	
Petroleum Products Transport					
Petrol/Gasoline		kL	2.6	t CO2/kL	
Automotive Diesel Oil	480	kL	2.9	t CO2/kL	1392
LPG - transport		kL	1.8	t CO2/kL	
Natural Gas/CNG LDV		m3	0.0027	kg CO2/m3	
Natural Gas/CNG HDV		m3	0.0026	kg CO2/m3	
Marine/Industrial diesel fuel		kL	3.1	t CO2/kL	
Aviation Gasoline		kL	2.5	t CO2/kL	
Aviation Turbine		kL	2.9	t CO2/kL	
Waste					
Co-mingled		t	0.9	t CO2-e/t	
Paper and paper board		t	2.5	t CO2-e/t	
Textiles (excluding synthetics)		t	1.5	t CO2-e/t	
Wood/straw		t	3.2	t CO2-e/t	
Garden		t	1.1	t CO2-e/t	
Food/Garden		t	0.9	t CO2-e/t	
Medical		t	0.3	t CO2-e/t	
Concrete/metal/plastic/glass		t		t CO2-e/t	
Synthetic gases					
SF6		t	23900	t CO2-e/t	
HFC's		t		t CO2-e/t	
Fugitive emissions					
CH4		t	21	t CO2-e/t	
CO2		t	1	t CO2-e/t	
Other					
Other		<UNIT>		t CO2-e/unit	
Other		<UNIT>		t CO2-e/unit	
Other		<UNIT>		t CO2-e/unit	
TOTAL GROSS EMISSIONS					**76312**
Offset					
TOTAL OFFSET					
TOTAL NET EMISSIONS					**76312**

Site/Activity D

Site/Activity:	Austar Operations 2023 to 2025 (3Mt)				
Fuel/process	**Consumption (Units)**		**Conversion factor**		**CO_2-e (Tonnes)**
Electricity	70,150,000	kWh	1.068	kg CO2-e/kWh	74920
Natural Gas (non-transport)		GJ	71.3	kg CO2-e/GJ	
LPG - (non-transport)		t	3.3	t CO2/t	
Industrial Diesel Oil		kL	3.1	t CO2/kL	
Petroleum Products Transport					
Petrol/Gasoline		kL	2.6	t CO2/kL	
Automotive Diesel Oil	480	kL	2.9	t CO2/kL	1392
LPG - transport		kL	1.8	t CO2/kL	
Natural Gas/CNG LDV		m3	0.0027	kg CO2/m3	
Natural Gas/CNG HDV		m3	0.0026	kg CO2/m3	
Marine/Industrial diesel fuel		kL	3.1	t CO2/kL	
Aviation Gasoline		kL	2.5	t CO2/kL	
Aviation Turbine		kL	2.9	t CO2/kL	
Waste					
Co-mingled		t	0.9	t CO2-e/t	
Paper and paper board		t	2.5	t CO2-e/t	
Textiles (excluding synthetics)		t	1.5	t CO2-e/t	
Wood/straw		t	3.2	t CO2-e/t	
Garden		t	1.1	t CO2-e/t	
Food/Garden		t	0.9	t CO2-e/t	
Medical		t	0.3	t CO2-e/t	
Concrete/metal/plastic/glass		t		t CO2-e/t	
Synthetic gases					
SF6		t	23900	t CO2-e/t	
HFC's		t		t CO2-e/t	
Fugitive emissions					
CH4		t	21	t CO2-e/t	
CO2		t	1	t CO2-e/t	
Other					
Other		<UNIT>		t CO2-e/unit	
Other		<UNIT>		t CO2-e/unit	
Other		<UNIT>		t CO2-e/unit	
TOTAL GROSS EMISSIONS					**76312**
Offset					
TOTAL OFFSET					
TOTAL NET EMISSIONS					**76312**

Configuration for factors used

Only the latest workbook version can be chosen.

Workbook version used for electricity and gas:	2006 Dec AGO Factors and Methods Workbook
Workbook version used for rest:	2006 Dec AGO Factors and Methods Workbook

	Electricity-2006			
	workbook version	**ID**	**state**	**kg CO2/kWh**
1	1	1_1	ACT	1.068
2	1	1_2	NSW	1.068
3	1	1_3	NT	0.716
4	1	1_4	QLD	1.046
5	1	1_5	SA	1.042
6	1	1_6	TAS	0.060
7	1	1_7	VIC	1.325
8	1	1_8	WA	0.929

		Natural Gas distribution (non transport)-2006			
	W	full fuel cycle values and only values for sm			FFC/PC
		ID	**state**	**kg CO2/GJ**	FFC
1	1	1_1	ACT	71.3	FFC
2	1	1_2	NSW	71.3	FFC
3	1	1_3	NT	53.6	FFC
4	1	1_4	QLD	68.8	FFC
5	1	1_5	SA	73.8	FFC
6	1	1_6	TAS		FFC
7	1	1_7	VIC	63.6	FFC
8	1	1_8	WA	60.7	FFC

This sheet contains data for the automatic selection of factors. Please do not modify this sheet.

	Electricity-2005			
	workbook version	**ID**	**state**	**kg CO2/kWh**
1	1	1_1	ACT	0.985
2	1	1_2	NSW	0.985
3	1	1_3	NT	0.814
4	1	1_4	QLD	1.155
5	1	1_5	SA	1.007
6	1	1_6	TAS	0.031
7	1	1_7	VIC	1.467
8	1	1_8	WA	0.992

		Natural Gas distribution (non transport)			
	W	full fuel cycle values and only values for sm			FFC/PC
		ID	**state**	**kg CO2/GJ**	FFC
1	1	1_1	ACT	71.3	FFC
2	1	1_2	NSW	71.3	FFC
3	1	1_3	NT	53.6	FFC
4	1	1_4	QLD	68.8	FFC
5	1	1_5	SA	73.8	FFC
6	1	1_6	TAS		FFC
7	1	1_7	VIC	63.6	FFC
8	1	1_8	WA	60.7	FFC

	Transport fuels-2006	kg CO2/kL			t CO2/kL	
WB ID	ID	calculated value	Value in PR	FFC/PS	Value to be used	Comment for calculated value
1	1_ADO low sulfur (<500ppm)	3000		FFC	3	
1	1_ADO ultra low sulfur (<50ppm)	3000		FFC	3	
1	1_ADO(current fuel)	3000		FFC	2.9	
1	1_Automotive Gasoline	2800		FFC	2.6	
1	1_Aviation Gasoline	2600		FFC	2.5	
1	1_Aviation Turbine	2900		FFC	2.9	
1	1_fuel oil	3300		FFC	3.3	
1	1_IDF	3100		FFC	3.1	
1	1_LPG	1800		FFC	1.8	
1	1_Natural Gas HDV	2600		FFC	0.0026	
1	1_Natural Gas LDV	2700		FFC	0.0027	

	Transport fuels-2005	kg CO2/kL			t CO2/kL	
WB ID	ID	calculated value	Value in PR	FFC/PS	Value to be used	Comment for calculated value
1	1_ADO low sulfur (<500ppm)	3000		FFC	3	
1	1_ADO ultra low sulfur (<50ppm)	3000		FFC	3	
1	1_ADO(current fuel)	3000		FFC	3	
1	1_Automotive Gasoline	2800		FFC	2.8	
1	1_Aviation Gasoline	2600		FFC	2.6	
1	1_Aviation Turbine	2900		FFC	2.9	
1	1_fuel oil	3300		FFC	3.3	
1	1_IDF	3100		FFC	3.1	
1	1_LPG	1800		FFC	1.8	
1	1_Natural Gas HDV	2600		FFC	2.6	
1	1_Natural Gas LDV	2700		FFC	2.7	

	Other fuels non transport-2005	calculated value	Value as written I PR	FFC/PS	Rounded value to be used		Comment
					t CO2/unit		
1	1_Industrial Diesel Oil	3069	kg CO2/kL	FFC	3.1		
1	1_LPG - non-transport	3312.96	kg CO2/t	FFC	3.3		t CO2/t LPG
2	2_Industrial Diesel Oil						
2	2_LPG - non-transport						

	Other fuels non transport-2006	calculated value	Value as written I PR	FFC/PS	Rounded value to be used		Comment
					t CO2/unit		
1	1_Industrial Diesel Oil	3069	kg CO2/kL	FFC	3.1		
1	1_LPG - non-transport	3312.96	kg CO2/t	FFC	3.3		t CO2/t LPG
2	2_Industrial Diesel Oil						
2	2_LPG - non-transport						

Waste-2006				kg CO2/tonnes	
WB ID	ID	calculated	value from PR	value to be used	Comment
1	1_comingled	900.0		0.900	
1	1_concrete metal	0.0		0.000	
1	1_food	900.0		0.900	
1	1_garden	1100.0		1.100	
1	1_medical	300.0		0.300	
1	1_paper	2500.0		2.500	
1	1_textile	1500.0		1.500	
1	1_wood	2700.0		3.200	

Waste-2005				kg CO2/tonnes	
WB ID	ID	calculated	value from PR	value to be used	Comment
1	1_comingled	900.0		0.900	
1	1_concrete metal	0.0		0.000	
1	1_food	900.0		0.900	
1	1_garden/Park	1100.0		1.100	
1	1_medical	300.0		0.300	
1	1_paper	2500.0		2.500	
1	1_textile	1500.0		1.500	
1	1_wood/Straw	2700.0		2.700	

Workbooks

ID	Description
1	2006 Dec AGO Factors and Methods Workbook

This sheet contains data for the automatic selection of factors. Please do not modify this sheet.

Unit conversion:

		KWh	
1	GJ	277.777778	
2	GWh	1000000	
3	kWh	1	
4	MJ	0.2777778	
5	MWh	1000	
6	Wh	0.001	
		GJ	
1	J	1E-09	
2	KJ	0.000001	
3	MJ	0.001	
4	GJ	1	
5	TJ	1000	
6	PJ	1000000	
		kilolitres	
1	L	0.001	
2	hL	0.1	
3	kL	1	
4	m^3	1	
5	ML	1000	
		T	
1	g	0.000001	
2	kg	0.001	
3	t	1	
4	kt	1000	
5	Mt	1000000	
6	kL	0.5213	(valid only for LPG, 2005)

This sheet contains data for the automatic KPI calculation.
Please do not modify this sheet.

Natural GAS (CNG):		m3
1	MJ	0.02531646
2	GJ	25.3164557
3	m^3	1

Natural GAS (non trans		GJ
1	J	1E-09
2	KJ	0.000001
3	MJ	0.001
4	GJ	1
5	TJ	1000
6	PJ	100000
7	m^3	0.0395

APPENDIX D

National Greenhouse Accounts (NGA) Factors – Emissions Factors for Indirect Emissions (Electricity and Use) 2008

as carbon dioxide equivalent (CO_2-e). The greenhouse gas emissions in tonnes of CO_2-e attributable to the quantity of electricity used may be calculated with the following equation.

GHG emissions (t CO_2-e) = Q x EF / 1000

where: Q (Activity) is the electricity consumed by the reporting organisation expressed in kWh, and

EF is the relevant emission factor expressed in kg CO_2-e/kWh in Columns A, C and E, Table 5.

OR

GHG emissions (t CO_2-e) = Q x EF / 1000

where: Q (Activity) is the electricity consumed expressed in GJ, and

EF is the relevant emission factor expressed in kg CO_2-e/GJ in Columns B, D and F, Table 5.

Emission factors are reported for scope 2, scope 3 and the full fuel cycle (the sum of scope 2 and scope 3). The emission factor for scope 2 covers emissions from fuel combustion at power stations associated with the consumption of purchased electricity from the grid.

The emission factor for scope 3 covers both the emissions from the extraction, production and transport of fuels used in the production of the purchased electricity (i.e. fugitive emissions and stationary and mobile fuel combustion emissions) and also the emissions associated with the electricity lost in transmission and distribution on the way to the consumer (from both fuel combustion and fuel extraction)—see the *Technical Guidelines* for more details on the emission factor definitions.

Greenhouse Challenge Plus members should use the factors to separately calculate and report their scope 2 and scope 3 emissions.

Division by 1000 converts kg to tonnes.

Table 5: Indirect emission factors for consumption of purchased electricity from the grid—for end users (not distributors)

Financial year	EF for scope 2		EF for scope 3		Full fuel cycle EF (EF for scope 2+EF for scope 3)	
	A	B	C	D	E	F
	kg CO_2-e/kWh	kg CO_2-e/GJ	kg CO_2-e/kWh	kg CO_2-e/GJ	kg CO_2-e/kWh	kg CO_2-e/GJ
NSW and ACT	0.89	249	0.17	47	1.06	295
VIC	1.22	340	0.08	23	1.31	364
QLD	0.91	252	0.13	37	1.04	289
SA	0.84	233	0.14	39	0.98	272
WA (SWIS)	0.87	242	0.10	29	0.98	271
TAS	0.12	35	0.01	2	0.13	37
NT	0.69	190	0.11	30	0.79	221

Source: Department of Climate Change 2007.