Report

Greenhouse Gas Assessment for Knauf Insulation Glass Wool Manufacturing Facility

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Prepared for

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Executive Summary

The proposed Knauf Insulation (KI) glass wool manufacturing facility is projected to produce up to 200 tonnes/day of glass wool insulation product. This Greenhouse Gas (GHG) assessment has been undertaken to quantify the GHG emissions from the product manufacture.

The GHG assessment has quantified the Scope 1 (direct) and Scope 2 (indirect) emissions for the project. Process sources of GHG (Scope1) are the combustion of natural gas in the furnace and curing oven as well as consumption of limestone, dolomite and soda ash. The plant will also be a large user of electrical power, which is a source of indirect GHG emissions (Scope 2).

The assessment methodology has followed the accounting and reporting principles that are detailed within the World Business Council for Sustainable Development & World Resources Institute's Greenhouse Gas Protocol. This is an internationally adopted methodology that ensures that GHG inventories are relevant, complete, consistent, transparent and accurate.

Since the plant is not yet operational, no direct measurements can be made of the GHG emissions from the site. Emission factors are used to represent typical emissions from site activities. The emission factors used for the project were taken from the Department of Climate Change's National Greenhouse Accounts and other supporting documents. All emissions reported for the project have been presented as mass of carbon dioxide equivalent (CO_2-e), which accounts for the different global warming potentials (GWP) of non-CO_2 gases. The GWP adopted for each GHG emitted are as follows: carbon dioxide - GWP of 1, methane - GWP of 21; and nitrous oxide - GWP of 210, as detailed in the National Greenhouse Accounts (NGA) Factors.

The project is projected to consume the following average quantities of materials for a nominal production rate of 200 tonnes glass wool per day (average production rate of 60,000 tonnes per year):

- 61 GJ/hr of natural gas;
- 21.7 tonnes per day of soda ash;
- 5.5 tonnes per day of limestone;
- 18 tonnes per day of dolomite; and
- 150 MWh of electricity per day from the electrical grid.

For the production of up to 200 tonnes of glass wool product per day, the estimated annual GHG emissions are as follows:

- Scope 1: 34,487 tonnes CO_2-e/year
- Scope 2: 48,728 tonnes CO_2-e/year
- Total GHG emissions (Scope 1 and 2): 83,214 tonnes CO_2-e/year

The GHG emissions are mainly attributable to electricity consumption (59%) and natural gas consumption (33%).

The proposed KI plant will be subject to several Federal Government schemes for reporting of GHG emissions and for improvement in energy efficiency. The plant emissions are above the reporting threshold of 25,000 tonnes per year for the National Greenhouse and Energy Reporting (NGER) Act. Therefore KI will be required to report the project emissions to the NGER. Although details of the Carbon Pollution Reduction Scheme (CPRS) are still being finalised, it is likely that the Project will also be required to participate in the CPRS program. Additionally, with a total energy use (including electrical power and natural gas) estimated at over 0.7 PJ the Project will cross the Energy Efficiency Opportunities (EEO) threshold for required participation (0.5 PJ per year).

The emissions intensity for the product manufacture has been estimated on the basis of a typical annual production rate of glass wool of 60,000 tonnes/yr. The estimated emissions intensity is 1.4 tonnes CO_2-e/tonne glass wool product. No comparative industry data could be obtained to compare the GHG emissions intensity of the KI plant to similar manufacturing operations.

The project has considered the energy efficiency measures that can be adopted in glass wool manufacturing plants. Measures that have been incorporated into the project design include the following:

- Use of natural gas in place of other more emissions-intensive fossil fuels;
- Oxygen-natural gas burners with boosting electrodes;
- Use of cullet as a feedstock; and
- The use of high efficiency electrical motors, particularly for power ratings over 75 KW.

The glass wool insulation that is produced by KI is intended to be installed in residential locations. The use of insulation has been demonstrated to reduce energy consumption in a building, and is actively supported by programs such as the Federal Department of Climate Change's Energy Efficient Homes Package and the NSW Climate Change Fund for residences. Both programs offer rebates to encourage homeowners to insulate their homes for the express purpose of reducing energy use and greenhouse emissions.

Actual energy savings from the use of the KI product cannot be quantified due to variability in each installation, for example due to the house construction components, climatic zone and use of heating and cooling. Several studies have demonstrated that the energy return, that is the energy savings due to the use of the product compared to the energy required for manufacture, is paid back after approximately 5-7 weeks. Compared to the lifetime of the glass wool insulation of up to 50 years, there will be a considerable net cumulative energy saving from the use of the KI product.

The use of the KI product by householders will result in more energy efficient dwellings and will assist in reducing the demand for energy which is used for heating and cooling. Insulation is an important component of the NSW government's Building Sustainability Index (BASIX) program which specifies a target of 25% reduction in greenhouse gas emissions compared to the average NSW home.

1 Introduction

1.1 Project Description

The Knauf Insulation (KI) Glass Wool Plant Project (the Project) is a proposed manufacturing plant for the production of glass wool insulation with a proposed capacity of up to 200 t/day of glass wool. Manufacturing activities would consist of three production lines, specifically one line for rolls of glass wool, one line producing white wool and one recycling line. White wool is similar to rolled glass wool but is composed of smaller individual glass particles and is blown into place during installation rather than rolled out in layers.

During the process raw materials, mainly sand and recycled glass (cullet), are fed into a gas-fired furnace to form molten glass. The molten glass is then formed into fibres which are either sprayed with a binder to form blankets or crushed to form white wool. The blankets are sent through a curing oven before packaging. The recycling process consists of crushing reject blankets and scraps from the other process lines and packaging the resulting small fibre fragments. Additional feedstock includes limestone, dolomite and soda ash, which are added to the furnace and consequently produce carbon dioxide (CO_2) as they are consumed. Process sources of greenhouse gases (GHG) are therefore combustion of natural gas in the furnace and curing oven as well as consumption of limestone, dolomite and soda ash. The plant will also be a large user of electrical power, which is a source of indirect GHG emissions.

This assessment includes Scope 1 and Scope 2 (defined below in Section 3.2) emissions only for the operational phase of the project. Scope 3 emissions such as those resulting from construction and decommissioning of the site and from transport of raw materials and products will not be examined as these are small compared to the annual emissions from product manufacture. The likely reductions in consumer emissions due to the energy-saving qualities of the glass wool insulation product have been addressed qualitatively in the report.

2

Greenhouse Gas Policy Background

2.1 International Policy

2.1.1 Kyoto Protocol

Australia ratified the Kyoto Protocol in December 2007. Its aim is to limit greenhouse gas emissions of countries that ratified the protocol by setting individual mandatory greenhouse gas emission targets in relation to those countries' 1990 greenhouse gas emissions. The UNFCCC will meet in Copenhagen in 2009 and attempt to develop a post-Kyoto (2012) international framework agreement on climate change. Australia has committed to meeting its Kyoto Protocol target of 108% of 1990 emissions by 2008-2012. At the time of writing (May 2009), Australia recently published a baseline report on national GHG emissions but has not yet reported on progress toward Kyoto Protocol or other GHG emissions goals.

2.2 Australia's Policy

The Department of Climate Change released its policy in July 2007 which details Australia's commitment to:

- Reducing Australia's greenhouse gas emissions;
- Adapting to climate change that we cannot avoid; and
- Helping to shape a global solution that both protects the planet and advances Australia's long-term interests.

This Project will likely be required to operate in accordance with the following climate change policies: Carbon Pollution Reduction Scheme, Energy Efficiency Opportunities and the National Greenhouse and Energy Reporting Act.

2.2.1 Carbon Pollution Reduction Scheme (CPRS)

The Carbon Pollution Reduction Scheme (CPRS) White Paper was released in 2008 and outlines the Government's proposed mechanism to reduce GHG emissions from Australian industries to a target of 5% -15% below 2000 levels. The Government maintains a long-term emissions abatement goal of 60% by 2050 (against 2000 levels) to meet Kyoto Protocol requirements.

A key component of the CPRS is the implementation of a trading scheme which will cap total GHG emissions and allow trading in emissions permits, originally scheduled to commence in 2010 but currently delayed until 2011. Liable entities will be required to obtain carbon pollution permits to acquit their GHG emission obligations under the scheme. Industry sectors that will be covered by the CPRS are the stationary energy, transport, fugitive emissions, industrial processes, waste and forestry sectors.

The CPRS is supported by the National Greenhouse and Energy Reporting Act 2007 (NGER) which establishes a national framework for Australian corporations to report Scope 1 and Scope 2 greenhouse gas emissions, reductions, removals and offsets, and energy consumption and production, from July 2008. NGER is described further below.

2.2.2 Energy Efficiency Opportunities (EEO)

The Energy Efficiency Opportunities legislation came into effect in July 2006, and requires large energy users (over 0.5 PJ of energy consumption per year) to participate in the program. The objective of this program is to drive ongoing improvements in energy consumption amongst large users, and businesses are required to identify, evaluate and report publicly on cost effective energy savings opportunities.

Energy Efficiency Opportunities legislation is designed to lead to:

- Improved identification and uptake of cost-effective energy efficiency opportunities;
- Improved productivity and reduced greenhouse gas emissions; and
- Greater scrutiny of energy use by large energy consumers.

The EEO program will be incorporated into the National Framework for Energy Efficiency.

The KI plant will be a large energy user and will likely be required to register with the EEO program.

2.2.3 National Greenhouse and Energy Reporting Act 2007 (NGER)

The NGER Act establishes a national framework for Australian corporations to report Scope 1 and Scope 2 (defined in Section 3.2) greenhouse gas emissions, reductions, removals and offsets and energy consumption and production, from July 2008. It is designed to provide robust data as a foundation to the CPRS.

From 1 July 2008, corporations will be required to register and report if:

- they control facilities that emit 25 kilotonnes or more of greenhouse gas (CO_2-equivalent), or produce/consume 100 terajoules or more of energy; or
- their corporate group emits 125 kilotonnes or more greenhouse gas (CO_2-equivalent), or produces/consumes 500 terajoules or more of energy.

Lower thresholds for corporate groups to 50 kt CO_2-e emissions or 200 TJ of energy production or consumption will be phased in by 2010-2011. Companies must register by 31st August, and report by 31st October, following the financial year in which they meet a threshold. It is anticipated that KI will be required report to the NGER program.

2.2.4 Greenhouse Challenge Plus

The Greenhouse Challenge Plus program is part of the Australian Government's Climate Change Strategy. It is a voluntary program utilising individual agreements to encourage participants to report their greenhouse gas emissions and make progress towards quantified greenhouse abatement measures. All participants have certain responsibilities under the program, including:

- Measure and monitor greenhouse gas emissions;
- Deliver maximum practical greenhouse gas abatement;
- Continuously improve management of greenhouse gas emissions and sinks;
- Work towards any specific milestones set out under individual agreements;

- Provide timely annual reports with agreed content on greenhouse gas emissions and emission reduction activities;
- Make an accurate annual statement about participation in the program including basic greenhouse gas emissions information;
- Promote industry participants' activities in terms of greenhouse gas management and importantly in terms of their membership in the program; and
- Participate in independent verification of annual progress reports.

KI may join the Greenhouse Challenge Plus program.

2.3 State Policy and Initiatives

NSW has a number of climate change and greenhouse policies, though many are not relevant to this Project. The most relevant policies are the NSW Energy Efficiency Strategy, Greenhouse Plan and Climate Change Action Plan.

2.3.1 Energy Efficiency Strategy

The NSW Energy Efficiency Strategy (Strategy) was published in 2007, for the purposes of:

- Reducing greenhouse gas emissions from energy consumption in NSW;
- Reducing the impact of rising energy prices on businesses and the community by lowering energy consumption; and
- Delaying the need to construct additional energy generation and distribution infrastructure in NSW, achieving a cost-saving for the state economy.

In order to achieve these goals the Strategy includes several different programs and targets, including a requirement for large energy users to implement the cost-effective energy savings measures identified in their Energy Savings Action Plans. Businesses defined as large users are those using more than 10 GWh of electricity per year at a single site. Companies identified as large users by the Minister for Utilities must then prepare and implement an Energy Savings Action Plan.

2.3.2 Greenhouse Plan

The NSW Greenhouse Plan was released in November 2005. The plan provides a strategic approach to combating climate change in NSW from 2005 to 2008. The focus of the plan is to reduce emissions from certain sectors, specifically energy, buildings, transport, agriculture, and fugitive emissions from waste, industrial process and fossil fuel production. Few of these are directly relevant to the project. The Greenhouse Plan will be replaced by the Climate Change Action Plan in 2009.

The NSW Government outlined its long-term GHG emission reduction targets in 2005 as follows:

- Reduction of 60% by 2050, and
- Achieving year 2000 GHG emissions in NSW by 2025.

These targets would reduce the NSW GHG emissions to 155.5 Mt CO_2-e by 2025 and 62.2 Mt CO_2-e in 2050; for comparison, the inventory for NSW is 160 Mt CO_2-e (2006 data).

2.3.3 Climate Change Action Plan

The Climate Change Action Plan (CCAP) is due to be finalised in mid-2009. Details are not currently available on the precise requirements of the CCAP, though it will encompass both the Greenhouse Plan and the Energy Efficiency Strategy and will therefore likely include guidelines on energy efficiency and greenhouse gas emissions.

3

Methodology

3.1 Accounting and Reporting Principles

The greenhouse gas inventory for the Project is based on the accounting and reporting principles detailed within the Greenhouse Gas Protocol.[1] The Protocol was first established in 1998 to develop internationally accepted accounting and reporting standards for greenhouse gas emissions from companies. The main principles are as follows:

- Relevance: The inventory must contain the information that both internal and external users need for their decision making.
- Completeness: All relevant emissions sources within the inventory boundary need to be accounted for so that a comprehensive and meaningful inventory is complied.
- Consistency: The consistent application of accounting approaches, inventory boundary and calculation methodologies is essential to producing comparable GHG emissions over time.
- Transparency: Information needs to be archived in a way that enables reviewers and verifiers to attest to its credibility. All parameter, values and methodologies used are accessible and presented within the inventory.
- Accuracy: Data should be sufficiently precise to enable intended users to make decisions with reasonable assurance that the reported information is credible.

3.2 Inventory Boundaries

The GHG emissions to be assessed are considered to be the activities within the proposed KI facility (Scope 1), as well as the consumption of purchased electricity (Scope 2). Direct emissions and some indirect emissions from the project have been assessed.

The Greenhouse Gas Protocol defines direct and indirect emissions through the concept of emission "scopes".

- Scope 1: Direct greenhouse gas emissions. Direct greenhouse gas emissions occur from sources that are owned or controlled by a company. For example:
  - Emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.; and
  - Emissions from on-site power generators.
- Scope 2: Electricity indirect greenhouse gas emissions. This accounts for greenhouse gas emissions from the generation of purchased electricity consumed by the company. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the company. Scope 2 emissions physically occur at the facility where electricity is generated but they are allocated to the organisation that owns or controls the plant or equipment where the electricity is consumed. Scope 2 emissions also capture the importing of energy (such as chilled water or steam) into a site.
- Scope 3: Other indirect greenhouse gas emissions. This is an optional reporting class that accounts for all other indirect greenhouse gas emissions resulting from a company's activities, but occurring from sources not owned or controlled by the company. Examples include extraction

[1] World Business Council for Sustainable Development & World Resources Institute (2004), The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard.

and production of purchased materials; transportation of purchased fuels; and use of sold products and services.

3.3 Calculation Approach

The greenhouse gas emission inventory for the Project is based on the methodology detailed in the Greenhouse Gas Protocol (the Protocol)[2], and the relevant emission factors in the National Greenhouse Accounts (NGA) Factors[3], the *Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2006 – Industrial Processes*[4] and the relevant IPCC Good Practice Guidance.[5]

A spreadsheet model has been specifically developed for the Project and uses the data sources and emission factors detailed below in order to calculate project emissions for an average year and operation, according to the Protocol, using methodology detailed in the NGA Factors.

There are several greenhouse gases including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) that are relevant to the Project. In order to simplify inventory accounting, a unit called carbon dioxide equivalent (CO_2-e) is used. This accounts for the various global warming potentials (GWP) of non-CO_2 gases. The GWP is a measure of the amount of infrared radiation captured by a gas in comparison to an equivalent mass of CO_2, over a fixed lifetime. GHG inventories in this report are expressed as mass of CO_2-e released, following this convention. The GWP adopted for each GHG emitted are as follows: carbon dioxide - GWP of 1, methane - GWP of 21; and nitrous oxide - GWP of 210, as detailed in the NGA Factors.

3.3.1 Activity Data Sources

Data from the following sources have been utilised in the formation of the inventory:

- Knauf Insulation (2009) *New Glass Wool Plant in Australia: Process Description*, which contains a general overview of the proposed plant including descriptions of processes, equipment and emissions;
- Knauf Insulation (2009) *New Glass Wool Plant Australia: Scope of Work (Rev 3, 29 May 2009)*, which provides data on utility use (natural gas and electricity); and
- A spreadsheet from KI titled “logistic sheet.xls” which provides material delivery and process flow for the proposed plant including feedstock input flows.

3.3.2 Emission Factors

Direct measurement of greenhouse gases (GHG) at the emission source can give the most accurate and precise assessment of GHG emissions. This is not feasible for this project as it is still in the initial planning stage and no direct measurements can be made at this point. Emission factors remove the need for site specific testing of emissions. They are factors expressed as the amount of GHG emissions per unit of activity, which can be used to determine inventories for a site. This is typically

[2] World Business Council for Sustainable Development & World Resources Institute (2004), The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard.
[3] Department of Climate Change (2008) National Greenhouse Accounts (NGA) Factors
[4] Australian Greenhouse Office (2006), Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2006: Industrial Processes.
[5] IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories.

much more feasible than testing each source individually, and it is one of the few ways that inventories for proposed sites can be calculated.

Emission factors can be gained from various sources, for example the Department of Climate Change, from site-specific information or from operational details obtained from similar emission sources. The majority of the emission factors used in this report have been sourced from the Department of Climate Change NGA Factors Workbook, November 2008 as indicated in Table 3-1 below.

Table 3-1 Emission Factors Used in Inventory

Emission Source	Emission Factor	Units	Source
Scope 1			
Natural Gas Consumption	51.33	kg CO_2-e/GJ	NGA Factors. Table 2: Emission factors for the consumption of natural gas
Soda Ash Consumption	0.415	tonne CO_2-e per tonne	NGA Factors. Table 22: Soda ash consumption emission factor
Limestone Consumption	0.396	tonne CO_2-e per tonne	NGA Factors. Table 21: Calcination of carbonates emission factors
Dolomite Consumption	0.453	tonne CO_2-e per tonne	NGA Factors. Table 21: Calcination of carbonates emission factors
Scope 2			
Electrical Power Use	0.89	kg CO_2-e/kWh	NGA Factors. Table 5: Indirect (Scope 2) emission factors for consumption of purchased electricity from the grid

3.3.3 Materiality

Materiality is a concept used in accounting and auditing to minimise time spent verifying amounts and figures that do not impact a company's accounts or inventory in a material way. The exact materiality threshold that is used in GHG emissions accounting and auditing is subjective and dependant on the context of the site and the features of the inventory. Depending on the context, the materiality threshold can be expressed as a percentage of a company's total inventory, a specific amount of GHG emissions, or a combination of both.

All emissions that are found within the organisational boundary are included in the inventory unless they are excluded on materiality grounds. Information is considered to be material if, by its inclusion or exclusion it can be seen to influence any decisions or actions taken by users. A material discrepancy is an error (for example, from an oversight, omission or miscalculation) that results in a reported quantity or statement being significantly different to the true value or meaning.

For the purposes of this assessment any small pieces of ancillary equipment and vehicles used on site have been assumed to be immaterial in the context of the total emissions from utility and feedstock use.

Scope 1 and Scope 2 Emissions

The greenhouse gas emissions inventoried for the operational phase of the Project result from the following activities:

- Combustion of natural gas (Scope 1);
- Consumption of carbon-containing feedstock for glass manufacturing, specifically soda ash, limestone and dolomite (Scope 1); and
- Use of electrical power (Scope 2).

The emissions have been estimated on an annual basis, assuming an average rate of production of 200 tonnes per day of glass wool product as defined in documentation provided by KI. Depending on market conditions, the Plant will produce between 100 and 200 tonnes per day. For the purpose of the GHG assessment, the output of the plant is assumed at the design capacity of 200 tonnes per day. This is equivalent to a typical production rate of 60,000 tonnes per year.

As this project represents a new manufacturing facility, Scope 1 and 2 emissions without the project are non-existent.

4.1 Emission Sources

4.1.1 Combustion of Natural Gas

The Project will consume 61 GJ/hr of natural gas on average. This will primarily occur in the glass furnace and curing oven.

4.1.2 Consumption of Feedstock

The Project will require significant amounts of three carbon-containing feedstocks: soda ash, limestone and dolomite. These will be added to the furnace along with the sand to be melted and consequently will emit CO_2. KI estimates that the Project will use 21.7 tonnes per day of soda ash, 5.5 tonnes per day of limestone and 18 tonnes per day of dolomite.

4.1.3 Use of Electrical Power

Electrical power will be used in the glass furnace in conjunction with natural gas via boost electrodes. These electrodes will provide an additional source of heat in the furnace and represent the primary use of electrical power in the Project. KI estimates the Project will require 150 MWh per day from the electrical grid.

4.2 Summary of Scope 1 and Scope 2 Emissions

Estimated emissions for each source as well as totals for Scope 1 and Scope 2 emissions are presented below in Table 4-1. The total GHG emissions from the project are estimated to be 83,214 tonnes CO_2-e/year. The implications of the GHG emissions are discussed in Section 5 below.

4 Scope 1 and Scope 2 Emissions

Table 4-1 Summary of Scope 1 and Scope 2 Emissions (tonnes CO_2-e/year)

Activity Source	GHG Emission
Scope 1	
Natural Gas Consumption	27,429
Soda Ash Consumption	3,287
Limestone Consumption	795
Dolomite Consumption	2,976
Total Scope 1	**34,487**
Scope 2	
Electrical Power Use	**48,728**
Total of Scope 1 and Scope 2	**83,214**

The emissions intensity for the product manufacture has been estimated on the basis of the typical annual production rate of glass wool of 60,000 tonnes/yr. The estimated emissions intensity is 1.4 tonnes CO_2-e/tonne glass wool product. No comparative industry data could be obtained to compare the GHG emissions intensity of the KI plant to similar manufacturing operations, however a discussion on the energy efficiency measures that will be adopted for the project are included in Section 5.3.

Impacts and Mitigation Measures

5.1 Product Use

Home insulation is generally seen as a key factor in reducing energy use in residences, and features prominently in both the Federal Department of Climate Change's Energy Efficient Homes Package in their climate change program for households and the NSW Climate Change Fund for residences. Both programs offer rebates to encourage homeowners to insulate their homes for the express purpose of reducing energy use and greenhouse emissions. The actual reductions in energy consumption at the home depend on several factors unique to each installation such as the house construction components, climatic zone and use of heating and cooling. Studies indicate that the typical reductions are much greater than the use of energy to produce the insulation, resulting in a net reduction in energy use over the life of the product.

The North American Insulation Manufacturers Association (NAIMA) states that on average glass wool insulation saves 12 times as much energy in a year as is consumed in producing the insulation[6], indicating that approximately a month after installation the insulation is providing net energy savings. Similarly the Insulation Council of Australia and New Zealand (ICANZ) states that the recovery period for the energy use and greenhouse gas emissions during manufacture is four to five weeks[7], and are commissioning a full lifecycle analysis of the impacts of glass wool insulation for publication. As the lifespan of insulation is very long (possibly up to 50 years), the accumulated net energy savings over the product lifetime are substantial compared to the energy demand during manufacturing, which represents a once-off energy consumption.

The NSW government has outlined its target of reducing GHG emissions to year 2000 levels by 2025. This will be achieved in part by the use of tools including the Building Sustainability Index (BASIX) which specifies a target of 25% reduction in greenhouse gas emissions compared to the average NSW home. For the building sector, insulation of new and existing homes is an important component of achieving this target. The use of the products from this project will contribute to reduced demand side management (reducing the net electricity demand for grid-connected power), assisting the NSW government to meet GHG emission targets.

5.2 Regulatory Requirements

As the Project is estimated to emit more than 25 kilotonnes of greenhouse gases, it will fall under NGER reporting requirements. Consequently, although the final CPRS legislation and regulations are still pending, it is likely that the Project will also be required to participate in the CPRS program. Under the requirements of the CPRS, the Scope 1 and 2 emissions from the site will be subject to participation in the CPRS. The site will therefore be required to purchase offsets or adopt other mitigation strategies to reduce the site's GHG emissions.

Additionally, with a total energy use (including electrical power and natural gas) estimated at over 0.7 PJ the Project will cross the EEO threshold for required participation (0.5 PJ). This will require the project to determine cost-effective energy efficiency measures that can be adopted in the project.

As details of the NSW Climate Change Action Plan are still unknown, it is unclear what obligations the Project will have to NSW regulations. However, as the Project qualifies as a large energy user under current regulations it is likely to fall under guidelines in the new regulatory structure.

[6] *Green and Competitive: The Energy, Environmental, and Economic Benefits of Fiber Glass and Mineral Wool Insulation Products.* Energy Conservation Management; The Alliance to Save Energy; and Barakat & Chamberlin, 1996.
[7] http://www.icanz.org.au/news/energysavings. Accessed 26 May 2009.

5.3 Mitigation Measures

KI recognizes that glass manufacturing is highly energy-intensive and therefore has already identified some measures to reduce energy use and greenhouse emissions. These measures focus on the glass melting process, as this represents 75-80% of the total energy use for the plant. Techniques proposed for use in the Project include:

- Use of natural gas in place of other more emissions-intensive fossil fuels;
- Oxygen-natural gas burners with boosting electrodes;
- Use of cullet as a feedstock; and
- The use of high efficiency electrical motors, particularly for power ratings over 75 KW.

Oxygen-natural gas burners are highly efficient in heat transfer applications such as glass melting, resulting in lower energy consumption per tonne of product. The electrical boost electrodes provide additional efficiency and reductions in energy use.

Cullet is recycled glass that is added to the furnace feedstock, which has the effect of lowering the temperature from 1500ºC to approximately 1200ºC and further reducing energy use and consequent greenhouse emissions. The use of recycled glass also improves efficiency by reducing the amount of virgin raw materials required for manufacture.

Limitations

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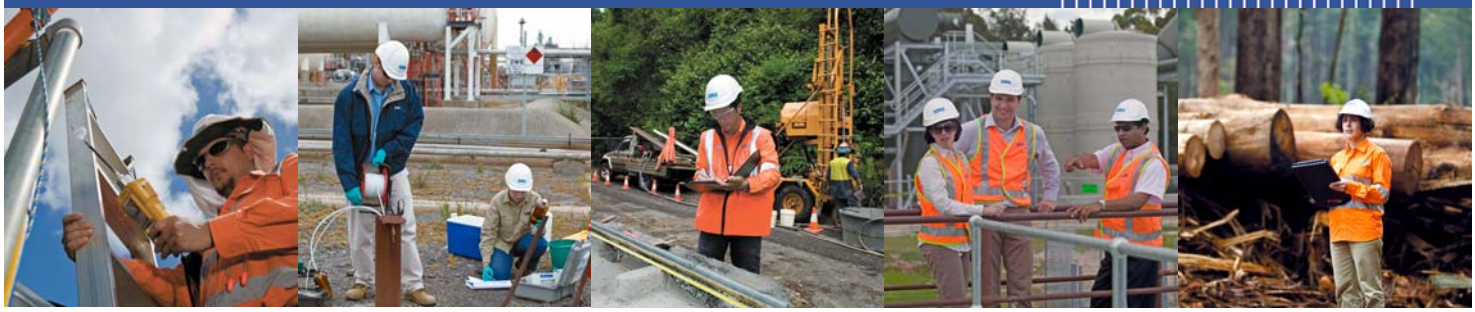

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