GHG Assessment of new Particleboard plant at Oberon

For Borg Panels

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Northmore Gordon Pty Ltd

ABN 44 136 798 519

49 Dove Street

Cremorne VIC 3121

enquiries@northmoregordon.com

Northmore Gordon is a climate change consulting firm specialising in energy efficiency, renewable energy and greenhouse gas management for the manufacturing and mining sectors.

For further information, please visit our website at http://www.northmoregordon.com

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1 Introduction

1.1 Background

Borg Manufacturing is developing a new manufacturing plant for the production of Particleboard at its existing Oberon facility. As part of the development an Environmental Impact Statement is required, a component of which is an assessment of the likely annual greenhouse (GHG) gas emissions resulting from the operation.

1.2 GuidelinesRelevant policies

This GHG assessment considered relevant national and state policy and guidelines for GHG emissions and assessment. This includes the Renewable Energy (Electricity) Act, the National Greenhouse and Energy Reporting (NGER) Scheme, and the National Greenhouse Energy Report Act 2007. In addition, the GHG assessment followed the accounting standards of the GHG Protocol (World Resources Institute/World Business Council for Sustainable Development 2004) in conjunction with:

- the National Greenhouse Account (NGA) Factors – August 2015
- other published information, including online manufacturer provided data;
- data supplied by the indicative site layouts, process flows, equipment utilisation, and equipment load factors; and
- data from research or prior experience, where information has not been available from the above sources.

Emissions were reported in terms of standardised carbon dioxide equivalent (CO_2-e) values, which account for a number of GHGs, including CO_2, CH_4, N_2O, HFCs, PFCs, and SF6.

1.2.1 Principles

In accordance with the GHG Protocol, this report follows the principles of Relevance, Completeness, Consistency, Transparency, and Accuracy. This is designed to ensure that the reported information represents a faithful, true, and fair account of a company's likely GHG emission.

1.2.2 Scope definitions

The GHG Protocol is probably the most widely used international tool for corporations and government to classify various emissions sources and is used in this report as a guideline. Emissions sources are defined as:

- **Scope 1 emissions**: direct GHG emissions occurring from sources owned or controlled by the company – for example vehicle fleet using non-renewable fuels, and direct non-renewable fuel combustion in gas boilers.
- **Scope 2 emissions**: indirect GHG emissions from purchasing electricity, heat or steam from other parties; and
- **Scope 3 emissions**: indirect emissions (or sinks) which occur due to the company's business activities, but from sources not owned or controlled by the company – for example employee business-related air travel, third party logistics companies, waste.

1.3 Our approach

1.3.1 Boundary of the assessment

Since the operations are established on the same site as an existing operation, the boundary of the assessment is set around the new site works, plus the truck delivery fleet for the new products, and shown in Figure 1.

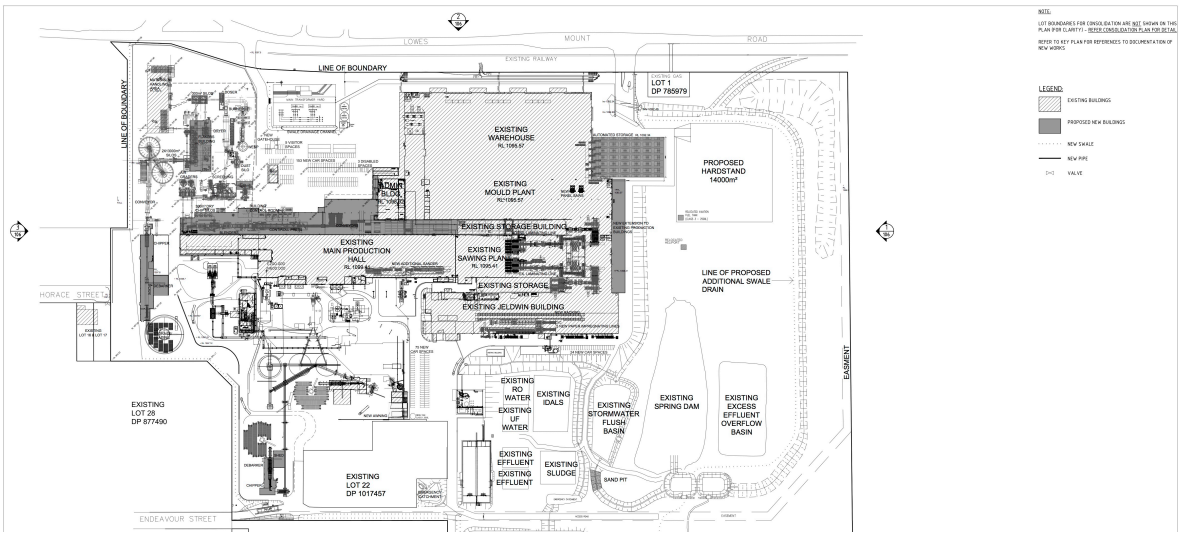

Figure 1: Boundary of GHG assessment – new plant and equipment only, plus new transport

1.3.2 Scope 3 emissions

Under the NGER Act, Scope 1 and 2 emission sources must be accounted for, but reporting Scope 3 emissions sources is optional.

Scope 3 emissions associated with the 'upstream' activities for this operation include but are not limited to those from third-party forestry and harvesting operations (e.g. fuels for vehicle and mobile plant), soil carbon changes in the harvested forests and land systems, employee-related travel and fertiliser use on plantations. These are offset, however, through regrowth of plantation forest. When the wood is grown, there is substantial take-up of atmospheric carbon dioxide from the biosphere.

Scope 3 emissions associated with the 'downstream' use of the products include both (i) sequestration of CO2e since the main product is mostly constructed of natural fibres (wood) and used in building materials, thereby 'locking up' CO2e in permanent and static use, and (ii) potentially substituting for the use of more energy-intensive raw materials. According to research by the Inter-governmental Panel on Climate Change (IPCC)1, the benefits are far greater in the substitution of more energy intensive materials than permanent carbon sequestration in wood products.

A detailed assessment of Scope 3 emissions was not incorporated in this study.

[1] IPCC (2001), *Climate Change 2001: Mitigation*, Chapter 4 - Technological and Economic Potential of Options to Enhance, Maintain, and Manage Biological Carbon Reservoirs and Geo-engineering, Section 4.3.2.1

1.3.3 Construction emissions

GHG emissions from the operation of the plant over multiple decades will far exceed emissions arising from construction. Further, as most of the construction activity will be completed by third party contractors, almost all construction emissions will be considered Scope 3, and excluded from this assessment.

2 Emissions estimates

2.1 Scope 1 GHG emissions sources

Potential Scope 1 emissions during operation of the new plant are projected to arise from:

- Direct combustion of natural gas on site in various heat plants
- Direct use of Diesel in line haul trucks
- Air conditioning gas losses
- SF6 losses from high voltage switch gear
- Direct combustion of biomass[2]

The new plant being proposed is a similar style of operation to the existing one, albeit the existing plant produces MDF and the new one will produce Particle Board. In Borg's FY14-15 NGER report for the site, the plant reported emissions of PFC, SF6 and HFCs at 0 tonnes CO_2e compared with an overall Scope 1+2 emissions of 102,110 tonnes CO_2e. Emissions of these gases in the new plant are expected to be similar, hence they are not considered material in this assessment.

Further, the FY14-15 NGER report indicates Gasoline emissions at only 14 tonnes CO_2e, and hence the Gasoline emission sources are not considered material in this assessment. Electrically driven plant and equipment shall be used where possible.

2.1.1 Scope 1 GHG emissions from natural gas

Natural gas will be used in an industrial boiler for the heating of hot oil for the press, sustaining gas in a hot gas generator and other miscellaneous uses. Suppliers of the plant equipment who have extensive experience in such estimation have estimated the amount of gas to be used. Assumptions for this assessment are:

- Plant operational hours = 8,500 hours p.a.
- Boiler output = 8 MW average when operating (requiring an approximate 10 MW thermal input)

The estimation of GHG emissions is shown in Table 1.

[2] Note that whilst the CO_2e associated with direct combustion of biomass fuels are not generally considered to have a global warming potential there are relatively small quantities of CH_4 and N_2O that need to be reported.

Table 1: Estimation of GHG emissions from natural gas use

Estimated natural gas use (GJ/annum)	Emission Factor (kg CO_2e/GJ)	Annual GHG emissions (Tonnes CO2e/annum)
306,000	51.53	**15,768**

2.1.2 Scope 1 GHG emissions from diesel transport fleet

There will be a net increase in diesel used in the company heavy vehicle fleet as the new plant enters operation. Currently the fleet is used for:

- delivery to the site of wood/biomass for use in manufacturing of the existing MDF product, and
- delivery to the site of raw particle board that is to be lined with Melamine and then re-distributed,
- distribution all of the product including MDF and particle board.

Once the new particle board plant is constructed, the duties of the heavy vehicle fleet will be modified:

- the incoming deliveries of third party particle board will be reduced due to the new ability to manufacture it on site,
- the incoming deliveries of wood for the particleboard process will increase in line with capacity increase.,
- the outgoing particle board deliveries will increase by about 100%, and
- total out-going product deliveries will increase by 30-40%.

The FY14-15 NGER report indicates annual GHG emissions from transport to be 233 tonnes CO_2e, based on diesel use of 86 kL per annum.

We have based our GHG assessment of the additional GHG emissions from Borg's transport fleet attributed to the new plant on estimates by Borg of the future changes in truck movements:

Table 2: Truck Diesel usage and GHG emissions

Scenario	Truck movements (No. Trucks per year)	Change from FY14-15 (%)	Diesel use (kL/ annum)	Emission Factor (kg CO2e/GJ)	Annual GHG emissions (Tonnes CO2e/annum)
Base case (FY14-15)	20,816	0%	86	70.2	233
Operational (2017)	37,145	78%	153	70.2	416
Operational (2027)	54,824	163%	227	70.2	614
Operational (2017-27 average)	45,985	121%	190	70.2	515
Additional transport attributed to new plant based on Operational Average	25,169		**104**	70.2	**282**

Therefore we observe a total increase in total in/out truck movements of about 78% by 2017, and 163% by 2027. Assuming transport distances for each truck movement stays constant, this equates to future GHG emissions from diesel in the range of 416 – 614 tonnes CO_2e/annum. For the purposes of this assessment, the additional GHG emissions attributed to the new plant for the period 2017 to 2027 is estimated to 282 tonnes per annum, giving a total of 515 tonnes CO_2e /annum.

No additional diesel will be used within the boundaries of the new plant since site vehicles, forklifts, cranes and wood chippers will be electric.

2.1.3 Scope 1 GHG emissions from biomass combustion

Waste products from the new plant will be used in a large biomass heat plant to create hot air for the drying process. The hot gas generator fuel from waste product has been estimated by Borg to consist of 11% Resin & Wax and 89% Dry Wood by weight.

The hot gas generator feed requirement has been estimated by Borg to be 80% duty of a 50MW heat plant during operation.

The weighted calorific value of the boiler fuel has been calculated from the waste feed ratios and the corresponding NGA factors[3] to be 17.3 GJ/tonne.

The weighted Emission factor for the boiler fuel has been calculated from the waste feed ratios and the corresponding NGA factors to be 14.7 kg CO2-e/GJ.

[3] Per Borg 2014-15 NGER report, 'Resin & Wax' is assumed to be equal to the NGA factors for "Industrial materials and tyres that are derived from fossil fuels, if recycled and combusted to produce heat or electricity".

Assumptions for the Scope 1 GHG emissions from biomass combustion are:

- Fuel consists of 11% Resin & Wax and 89% Dry Wood by weight.
- Hot gas generator utilisation = 40 MW (average utilisation of 80% in a 50MW heat plant)
- Plant operational hours = 8,500 hours p.a.

The estimation of GHG emissions is shown in Table 3.

Table 3: Estimation of GHG emissions from biomass use

Estimated biomass use (GJ/annum)	Energy content factor GJ/tonne	Estimated biomass use (Tonnes/ annum)	Emission Factor (kg CO2e/GJ)	Annual GHG emissions (Tonnes CO2e/annum)
1,224,000	17.3	70,706	14.6	**17,874**

2.2 Scope 2 GHG emissions

Scope 2 emissions during operation of the new plant will come from the use of grid electricity in the main plant from production equipment and from the mobile plant which include an electric wood chipper, cranes and forklifts on site. The energy consumption of the 1.5 MW capacity electric chipper has been estimated by Borg's suppliers to be 1.15 MW average load when operating with 75% duty of operation. The main plant power usage has been estimated by Borg to be 9943 kVA. We estimated the Power Factor of the main plant to be 0.95.

Assumptions in estimating overall Scope 2 emissions are:

- A 1.5 MW Chipper will operate at 1.15 MW load with a 75% duty cycle
- Other mobile plant electricity consumption such as electric forklifts and cranes are insignificant compared to chipper use and therefore not included
- Main Plant power usage is separate to mobile plant and will operate with a 9943 kVA load and a 0.95 Power Factor
- Plant operational hours = 8,500 hours p.a.

Table 4: Estimation of GHG emissions from electricity use

Electricity Usage	Load (kVA or kW)	Power Factor (kW/ kVA)	Operation hours (Hrs pa)	Duty (%)	Estimated electricity use (MWh/ annum)	Emission Factor (kg CO2e/ kWh NSW)	Annual GHG emissions (Tonnes CO2e pa)
Mobile Plant incl. Chipper	1150	1	8,500	75%	9,775	0.84	8,211
Main Plant	9943	0.95	8,500	100%	80,290	0.84	67,443
Total Use					**90,065**	0.84	**75,654**

2.3 Scope 3 GHG emissions

Not calculated as part of this report.

2.4 Comparison of Scope 1 and 2 emissions intensity of new to existing plant

The following table compares the emissions of the existing plant to the new plant, and shows that the emissions estimates appear reasonable. The output of the new plant is being designed at an additional 500,000m^3 p.a. whereas the existing plant is rated at 220,000m^3 p.a. When comparing two modern manufacturing processes, particleboard plant is about 30-35% more process efficient to make than MDF on a GJ/m3 basis. This assessment estimates that the new plant will increase capacity by 182%, and energy use by 147%. The improvement in energy efficiency is due to:

- The new plant is able to leverage some existing infrastructure, and
- The process is overall more efficient and requires less processing.
- The existing plant is not considered energy efficient at this point in time (though it is currently undergoing changes to improve energy efficiency).

Table 5: Old vs New plant comparison

Item	Old plant	New plant additional	Unit
Production	220,000	500,000	m^3 pa
Scope 1 – Gas	211,719	306,000	GJ pa
	10,867	15,768	Tonnes CO_2e/annum
Scope 1 – Biomass boilers (mix of process waste and green wood)	48,907	70,706	Tonnes biomass
	694,290	1,224,000	GJ/annum
	7,817	18,041	Tonnes CO_2e/annum
Scope 1 – Diesel & Gasoline for transport and mobile plant	292	104	kL/annum
	11,245	4,014	GJ/annum
	784	282	Tonnes CO_2e/annum
Scope 2 – Electricity	96,096	90,065	MWh/annum
	82,262	75,654	Tonnes CO_2e/annum
TOTAL Energy	**1,263,199**	**1,858,247**	**GJ/annum**
TOTAL CO_2e	**101,730**	**109,746**	**CO_2e/annum**
Total CO_2e/m^3	**0.46**	**0.27**	**CO_2e/m^3**

2.5 Summary

Total Scope 1 and 2 GHG emissions are estimated to be as follows.

Table 6: Total Scope 1 and 2 GHG emissions from the new plant

Source	Quantity per annum	Unit	Quantity per annum (GJ/annum)	Annual GHG emissions (Tonnes CO_2e/annum)
Scope 1 – Gas	306,000	GJ	306,000	15,768
Scope 1 – Biomass	70,706	tonnes	1,224,000	18,041
Scope 1 – Diesel for transport	104	kL	4,014	282
Scope 2 – Electricity	90,065	MWh	324,233	75,654
TOTAL			1,858,247	109,746

3 Design to minimise GHG emissions

The new plant has been designed to minimise energy use and therefore greenhouse gas emissions with the following features:

- 50 MWth biomass heat plant (operating on dust from the production process) to produce hot air for the flake drying process. As the inputs to the process are plantation softwood, this is a renewable energy source that significantly offsets potential GHG emissions from using fossil fuel for this process.
- A small 8MW thermal oil heater operating with combustion air preheating operating on gas will be used to generate hot oil for the press and other plant and equipment.
- Variable speed drives on fans and pumps.
- Extensive use of a SCADA system and sub-metering to assist in monitoring plant performance, provide feedback and improve plant control.
- Electric chippers have a higher overall efficiency and lower noise compared with diesel chippers when analysed over the full and part load operating cycles.

Document Control Sheet

Document information

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Client contact	Victor Bendevski		
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