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INTERTISSUE
INTERTISSUE BIOMASS BOILER
GREENHOUSE GAS ASSESSMENT

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1 GREENHOUSE GAS ASSESSMENT

Intertissue Ltd. is developing a biomass-fuelled boiler (the Facility) to provide steam to the existing tissue paper manufacturing process.

The Facility will combust pre-processed waste wood biomass fuels (herein referred to as fuel), and will displace an existing gas fired boiler which currently supplies heat to the tissue paper manufacturing process. The existing gas fired boiler will be retained on site, but will be used to provide a back-up heat supply when the Facility is not available due to maintenance or unplanned shutdown.

The combustion of fuel results in the continuous release of combustion products, among which are greenhouse gases such as carbon dioxide (CO_2). In this report, the carbon dioxide emissions associated with the operation of the Facility have been calculated, and other greenhouse gases released (for example N_2O) have been converted to CO_2 equivalent emissions according to their global warming potential.

The heat generated by the Facility would otherwise be generated from the combustion of natural gas. The net change in greenhouse gas emissions that will result from changing the combustion of fossil fuels with pre-processed waste wood biomass fuels to generate electricity has also been presented within this report.

It should be noted that this assessment methodology does not consider any emissions from any other alternative waste management options for waste wood biomass.

2 EXISTING EMISSIONS

As explained previously, the Installation currently combusts natural gas in a gas fired boiler to generate steam which is used within the tissue paper manufacturing process.

The paper manufacturing process uses approximately 56,000 MWh from the combustion of natural gas. Environment Agency guidance note H1 (Annex H), identifies the expected emissions of carbon dioxide from the combustion of natural gas. The guidance states that is 0.19 t of CO_2 is released from the combustion of each MWh of natural gas.

On this basis, the combustion of natural gas to provide heat to the tissue paper manufacturing process currently generated up to 10,600 tonnes of carbon dioxide per annum.

It is noted that this calculation does not take into consideration emissions from the power consumed to run the gas fired boiler. This is considered to be insignificant, at approximately 0.05 MW.

3 EMISSIONS FROM THE FACILITY

The operation of the Facility will cause the release of greenhouse gases. The following greenhouse gas emissions have been considered in this assessment.

(1) The greenhouse gases released from the combustion process. These include the carbon dioxide released from the combustion of materials that contain carbon derived from fossil fuels, as well as the nitrous oxide (N_2O) emitted by the Facility.

(2) The carbon dioxide released from the combustion of fuel oil in the auxiliary burners.

(3) The greenhouse gases released indirectly from importing electricity to the Facility.

Each of these sources is dealt with separately in this section.

3.1 Emissions from the Combustion of Biomass and Natural Gas

The following assumptions have been made regarding the design parameters of the Facility.

(1) At this design capacity and NCV and an annual utilisation of 8,200 hours, the Facility will process approximately 18,450 tonnes per annum (tpa) of fuel.

(2) All carbon contained in the fuel is biogenic. The fuel is considered to be a renewable resource, and, as stated in Environment Agency Guidance Note H1 (Annex H), the carbon dioxide released from its combustion has not been considered in the assessment.

(3) The gas fired boiler will be maintained in hot-standby to ensure that a back-up source of heat is available in case of unplanned shutdown of the biomass boiler. The gas fire boiler will operate at 10% load when in hot-standby.

On this basis, the gas fired boiler will release 1,060 tonnes of carbon dioxide per annum.

3.2 Emissions from Nitrous Oxide

The following assumptions have been made regarding the design parameters of the Facility.

(1) At the design capacity and NCV and an annual utilisation of 8,200 hours, the Facility will process approximately 18,450 tonnes per annum (tpa) of fuel.

(2) The Facility will export approximately 6.8 MW of heat to the paper manufacturing process and will not generate power.

(3) The volumetric flow 10,411 Nm^3/hr (dry @6% oxygen).

(4) Nitrous oxide is emitted at a concentration of 22.5 mg/Nm^3.[1]

(5) Nitrous oxide has a global warming potential which is 310 times greater than carbon dioxide.

On this basis, the total carbon dioxide equivalent emissions from emissions of nitrous oxide will be approximately 600 tpa.

3.3 Emissions from Auxiliary Firing

During start-up, auxiliary burners fired with natural gas will be used to raise the temperature within the boiler to 850°C before starting to feed fuel into the combustion chamber, as required by the Industrial Emissions Directive (IED). These burners will also be used to maintain the temperature within the boiler above 850°C when needed, as required by the IED. During shut-down, the auxiliary burners will be used to ensure complete burn-out of the waste. The combustion of the auxiliary fuel will release carbon dioxide.

[1] 22.5 mg/Nm^3 is the value related to urea based SNCR. If ammonia is used instead, the value will be 15 mg/Nm^3. This assumption is, therefore, conservative.

We have made the following assumptions regarding the start-up and shut-down procedures.

(1) The Facility will use natural gas as an auxiliary fuel.

(2) The Facility will have 10 start-ups and shut-downs per year. Each cold start-up will take 16 hours, and each shut-down will take 1 hour. On this basis, the auxiliary burners will operate for 170 hours per annum.

(3) The start-up burner capacity will be approximately 400 kWth and the auxiliary burner capacity will be 2,500 kWth. Therefore the total burner capacity will be 2.9 MWth. In assuming that both burners are used for start-up and shutdown this will provide a conservative assessment of carbon emissions during start-up and shutdown.

(4) The auxiliary burners will use approximately 500 MWh of auxiliary fuel per year.

(5) As stated in Environment Agency Guidance Note H1 (Annex h) the combustion of natural gas has emissions of 0.19 tonnes of carbon dioxide per MWh.

On this basis there will be a total of approximately 100 tonnes per year of carbon dioxide equivalent released from the combustion of natural gas for auxiliary firing.

3.4 Electricity Import

We have made the following assumptions regarding the electricity consumed by the Facility.

(1) The Facility will have a total parasitic load of 0.35 MWe and will not generate power.

(2) The Facility will be in operation for 8,200 hours per annum.

(3) The Facility will be in start-up and shut down for up to 170 hours per annum.

(4) During periods of non-availability, the parasitic load for the Facility's building services will be approximately 20% of the total parasitic load. The Facility will have a non-availability of 390 hours per year with a parasitic load of 0.07 MWh.

On this basis:

(1) During operation, the Facility will import approximately 2,870 MWh of electricity per year.

(2) During periods of start-up and shutdown, the Facility will import approximately 60 MWh of electricity per year.

(3) During periods of non-availability, the Facility will import approximately 30 MWh of electricity per year.

(4) Hence, the Facility will import a total of approximately 2,960 MWh of electricity per year from the grid.

As estimated in Environment Agency Guidance Note H1 (Annex H), importing electricity from public supply emits 0.398 tonnes of carbon dioxide per MWh.

On this basis, the Facility is expected to indirectly release approximately 1,180 tonnes of carbon dioxide equivalent per year from the imported electricity.

3.5 Summary

It is therefore estimated that the Facility will release a total of approximately 2,940 tonnes of carbon dioxide equivalent per year. In detail, the Installation will release the following emissions:

(1) Carbon emissions from the combustion of waste wood biomass fuel are carbon neutral;

(2) 1,060 tonnes per year of carbon dioxide equivalent from the combustion of natural gas as an auxiliary heat supply;

(3) 600 tonnes per year of carbon dioxide equivalent from nitrous oxide emitted from the process;

(4) 100 tonnes per year of carbon dioxide equivalent from the combustion of natural gas for auxiliary firing; and

(5) 1,180 tonnes per year of carbon dioxide equivalent from imported electricity.

4 CONCLUSIONS

The information detailed in the previous sections can be used to compare the potential carbon benefit or loss associated with changing the source of the heat used within the paper manufacturing process from natural gas to a biomass fuel. A comparison of the two scenarios is presented in Table 4.1.

Table 4.1 - Global Warming Potential (GWP)

Parameter	GWP (tonnes CO_2 equivalent)	
	Emissions from the gas fired boiler	Emissions from the biomass fired boiler
Total Emissions	10,600	2,940
Change in CO2 emissions	**- 7,660**	

Taking this into consideration, it is concluded that the proposed change to the Installation will result in a reduction of carbon dioxide emissions of approximately 7,660 tonnes per annum.

It should be noted that this assessment methodology does not consider any emissions from alternative waste management options for the management/treatment of waste wood biomass fuels or the emissions from the combustion of natural gas during periods when the biomass boiler is not available due to maintenance and the gas fired boiler is required to provide heat to the paper manufacturing process.

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