Bridge Farm

Holme Fen Drove

Huntingdon

Cambridgeshire

PE28 3RE

RE: Biomass Combined Heat and Power plant located Bridge Farm, PE28 3RE

Project Summary.

The 1.65MWt Biomass plant located at Bridge Farm will be located within the existing farm buildings, the new facility will provide heat and power to the existing farm via a new District heating network. The heat will also be used to dry agricultural derived materials within the existing drying sheds. The low carbon heat and power generation will offset the use of existing fossil fuels and will significantly improve the efficiency and green credentials of the farming operations.

The Biomass CHP Plant will be of 1.65MW in thermal output, with an electrical output of 175kW and will operate on Grade A, B and C recycled waste wood.

The plant will be operated continuously with shutdowns only expected for routine maintenance each month. Each routine maintenance will take no more than 24 hours.

Start-up Procedure

The Biomass plant utilises an auxiliary heater that operates using heating oil, the auxiliary heater is used to get the boiler up to 850°C temperature before the biomass fuel is introduced. This ensures that the plant does not exceed the emissions limits during the start-up process imposed by the IED standards.

Shutdown Process.

When the boiler goes into shutdown mode it will stop feeding biomass fuel into the combustion chamber until the fuel burn off. During this process, the levels of emissions will reduce.

Breakdown/abnormal operation.

If the boiler detects a fault within the system it will automatically enter into the shutdown sequence. This sequence will stop all fuel feed systems and shut down the boiler safely without any increase in emission levels.

The plant is monitored using continuous emissions monitoring equipment. The system will identify any increase beyond set thresholds to notify the operator of the plant via audible and telecommunication / email fault reports so the operator has sufficient time to investigate. If the set parameters are exceeding the plant CEM system will automatically shut down the boiler.

Continuous Emissions controls.

The plant will be monitored using continuous emissions monitoring equipment. The system will ensure that the plant is operating within the IED standards imposed the local authority.

Continuous Monitoring equipment.

The equipment will be Codel or similar monitoring NOx, SO2, CO2, H2O, Temperature, Pressure, Particulates and O2.

Herz Industrial (Binder) WID Biomass Plant details

Combustion chamber:

Combustion chamber fit for combustion of solid fuels with high moisture content and maintains the combustion temperature of 900-1.000°C (except during the transitory regimes).

The high temperature smoke, after a long stay in the combustion chamber, still slows down in the post-combustion chamber (gasification) by depositing the majority of the volatile ashes.

In the high temperature and abrasion areas are installed bricks type SIC (silicate carbide bricks) to temperature (till 1600°C), wear, thermal deformation, combustion of wet fuels containing silica. SIC bricks; over to be cemented on the steel supports of the wall – are jointed with tongue e groove.

Combustion chamber walls are fitted with an inter-space and the entire walls are cooled by water. The water passage through the walls permits (in case of over temperature) to absorb immediately part of the warm produced from the combustion an use it as air preheating of the combustion chamber.

Combustion air:

Combustion chamber and moving grate are equipped with distribution system of the oxidizing air:

Primary airs blown under the combustion grid. The regulation of primary airs are automatic controlled by the lambda sensor. All motors are equipped with inverters, also the primary airs are pre-heated recovering the heat produced by the walls cooling system.

Secondary airs blown into the combustion chamber into the different flame zone: Secondary airs are managed by the oxygen sensor with automatic adjustment through inverters.

Important note: The combustion technology uses the concept of "STEP COMBUSTION " by the secondary combustion air, in order to reduce drastically emissions of CO and NOx.

Horizontal heat exchanger:

Above the combustion chamber is installed the 2 pass smoke tube heat exchanger . The steel heat exchanger allows an efficient thermal exchanges between smoke at high temperature and water .

The construction geometry helps to ensure maximum heat exchange and performance. Design and constructive system of the heat exchanger, in addition to having a large efficiency, allows a strong reduction of the flue gas outlet temperature, recovering the major part of the latent heat of smoke.

HiLoVe© system :

The HiLoVe is a device to be coupled with a HV cleaning system present into the Binder boilers in order to guarantee a successful functioning of the boiler at very low fuel rate without the main effects of a partial load into a solid fuel burner. This device has the purpose to by-pass the second turn of flue gas passing avoiding the possible condensation at very low thermal load regimes.

Automatic cleaning system of heat exchanger (HV System):

-High speed smoke recirculation. This system (designed by Binder) is relative simple: Instead of ID fan with the right power, we install a bigger ID fan controlled by inverter.

when necessary we increase drastically the speed of the fan and a portion of the smoke is fed back into the smoke tube at high speed. in our opinion, this system has some advantages: no thermal stress, no compressor, pipes etc, moreover during the cleaning phases the heat exchange is higher.

Multi cyclone particle separator:

Multi-cyclone separators consist of a number of small-diameter cyclones, place into a steel container with walls 3 mm thick, covered with insulating material. Under the multi cyclone is positioned a rotary valve to discharging automatically the ash directly into the intermediate ash bin of the centralized ash discharge system, maintaining always the correct depression in the system.

- Flow gas recirculation system (Low DeNOx):

The flow gas recirculation introduces part of the exhaust gases into the combustion chamber by mixing with combustion air. The flue gas recirculation, reducing the quantity of O2 in the combustion air, avoids reaching very high temperatures in the combustion chamber end increasing the melting point of ash .

Furthermore, by keeping constant the temperature of smoke, it reduces the formation of nitrogen oxides (NOx). Recirculation is necessary in the case of fuels with a high calorific value, low melting point of the ash and high risk of the formation of NOx.

- ID fan

Centrifugal smoke extract fan with high efficiency suitable for the automatic cleaning of the heat exchanger HV, fan and fan casing with inspection door cleaning, 3 mm thick. Inverter control speed.

Flue gas ducts:

Flue gas ducts designed for high temperature in carbon steel, not insulated, for connection between heat exchanger, multi-cyclone. HV system.

Urea Injection

The SNCR Process is a urea-based Selective Non-Catalytic Reduction (SNCR) process for reduction of oxides of nitrogen (NO_x) from stationary combustion sources. The process requires precisely engineered injection of stabilized urea.

Ceramic Filtration.

The ceramic filters are highly efficient. They have the ability to remove submicron particles as small as a nanogram. In operation, they do not flex which prevents submicron particles from entering the substrate.

Polluted waste gases enter the housing on the dirty side and are drawn through the special, hollow "ceramic" filter elements into the clean side. The filter element structure is so fine that particles cannot pass through it. Instead, they lay on the outer surface of the element, while the filtered, clean gases are discharged to atmosphere. In time, on the surface of the filter elements collected particulates increase in thickness, this creates a higher differential pressure across the filter elements. The pressure is recovered by reverse pulse cleaning, at a pre-set time compressed air is automatically blown back through the filter elements to discharge the collected particles as a filter cake. The removed material falls to the bottom of the filtration housing and is removed either manually via a collecting tray or automatically using a screw conveyor.

Sodium Bicarbonate Injection

Sodium bicarbonate remains fully active with no variation in consumption between 140 and 450°C. To ensure optimum efficiency and the fullest use of the sodium bicarbonate, each filter unit has been carefully modelled using computational fluid dynamics(CFD) to plot the pattern of particulate retention positions. CFD design also helps to ensure that pollutants are uniformly presented over the whole of each filter element and that the absorbent is drawn onto the elements where the reaction takes place.

Flue

The Flue System will be designed to provide the correct flue gas velocity and height to comply with the emissions standards set by the local authority.

The Dispersal modelling will determine the required height of the flue and will be detailed within the Air Quality assessment for the proposed plant.

Fuel Handling System

The fuel will be delivered by HGV's using walking floor trailers with a capacity typically between 90-100m³. The lorries will reverse into the existing agricultural building that will contain a concrete fuel storage bunker. The concrete storage bunker is 6m wide x 15m long x 5m high with a capacity of 400 m³.

The wood chip transfer from the fuel storage bunker into the fuel store is fully automated, the walking floor within the bunker pulls the fuel onto an enclosed auger transfer system and it is then transferred into the boiler.

Noise.

The noise generated by the Biomass CHP plant is minimal and will be contained within the existing building. Given the nature of the existing farm activity's operating drying stores, grading machinery and other plant and equipment, it is very unlikely that the boiler will be noticeable. There are no receptors in close proximity that could be affected.

The noise produced by the biomass plant is detailed in the table below.

	RRK 1650 SRF, walking floor extraction SBA, ash auger	Unit
Environmental noise	58	dB
Measurements in the boiler room, measured 1 m distance		
Primary air fan	78	dB at max rpm
Secondary air fan	63	dB at max rpm
Exhaust gas fan	64	dB at max rpm
Stoker auger	72	dB
Dosing auger	70	dB
Measurements during operation with 100% capacity in the boiler		
From boiler feed from 1 m distance	75	dB
From side of fans from 1 m distance	74	dB
Measurements outside from 1 m distance		
Environmental noise	62	dB
at open boiler room door	62	dB
at closed boiler room door	60	dB
Noise at chimney outlet		
when boiler in operation	not measured	
when boiler not in operation	not measured	