NESS Energy Project

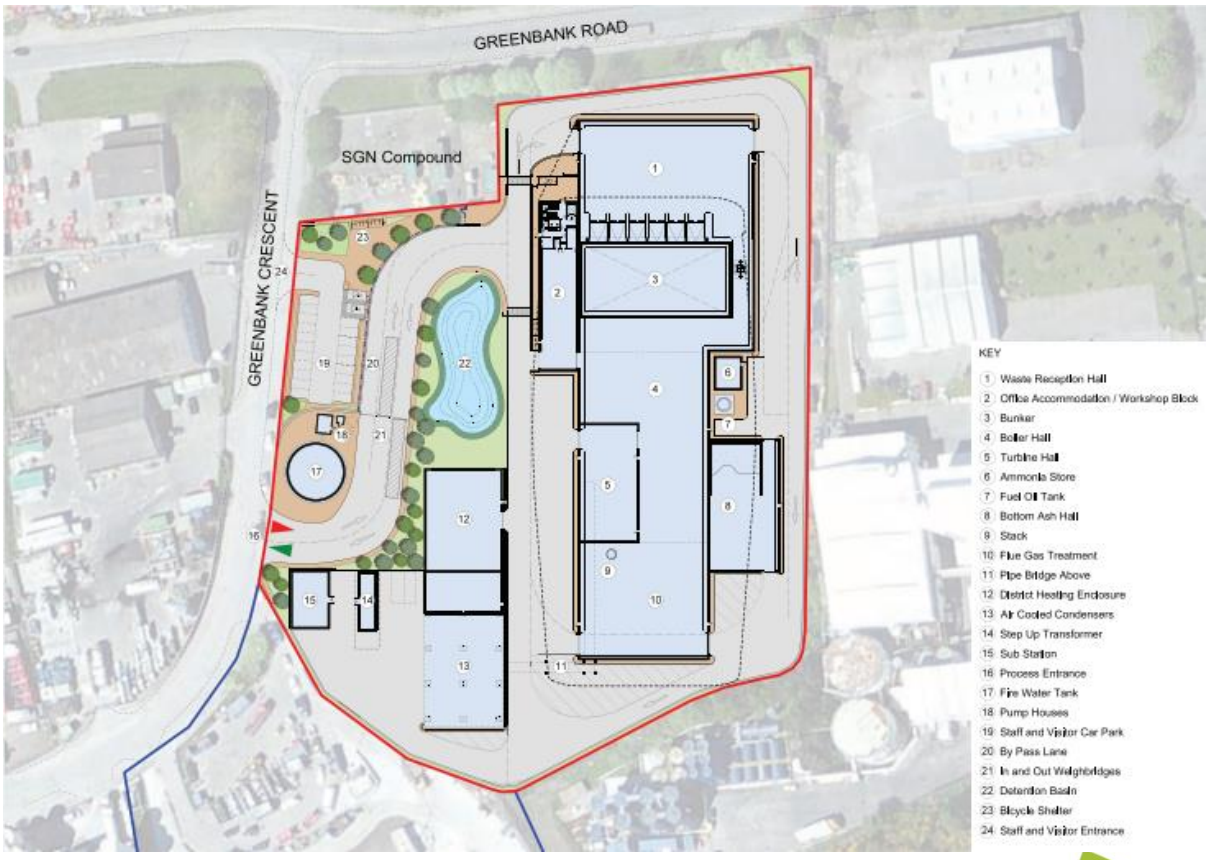
Aberdeen City Council | Aberdeenshire Council | Moray Council

The Facility

The East Tullos Facility will accept up to 150,000 tonnes of waste each year from the three Council areas in total. The Environmental Permit required to operate the plant will specify that the plant can only accept residual waste, or waste that remains following all efforts to recycle The facility will not accept any hazardous or clinical waste.

The proposed facility will comprise of the following main elements:

- A main building – this will house the majority of process plant and will have a flue stack. This building will also house the offices and welfare facilities;
- Air Cooled Condensers & Combined Heat and Power plant –
- Sub-station compound;
- Fire water tank;
- Operational vehicle site entrance, two automated weighbridges and circulation roads;
- Staff and visitor site entrance including parking and cycleparking; and
- Site drainage proposals and landscaping.



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Process Description

Vehicles delivering residual waste will be weighed when entering the Site at the dedicated weighbridge for incoming traffic and initial checks undertaken to ensure the waste being delivered is residual waste from one of the three Councils. If all is correct, the vehicles will then proceed to the waste reception area at the northern end of the building.

Tipping Hall

The vehicles enter an enclosed tipping hall, where the delivery vehicles manoeuvre to directly unload their material into the waste bunker.

Access to the tipping hall is with automatic access doors. The air is controlled within the tipping hall and bunker area by an extraction system. This operates at negative air pressure, drawing the air into the combustion process to help control odours.

The waste is then transferred from the waste bunker into the feed chute by overhead grab cranes which have three functions.
I), they manually remove large items that are unsuitable for processing, such as engine blocks or other hard items that would damage the plant,
II)they act to mix the waste to provide a more homogenous feedstock, and
II) they pick up the waste and deposit it via a dedicated feed chute into the combustion chamber.
The feed chute is fitted with an interlock that isolates the combustion chamber if conditions within it are not within the expected operating specification. This interlock stops waste entering the combustion chamber until conditions have been investigated and any anomalies rectified.

Combustion

The combustion chamber comprises of inclined fixed and moving bars that move the waste from the feed inlet to the ash discharger. The grate movement turns and mixes the waste along the surface of the grate to ensure that all waste is exposed to the combustion process. This ensures full combustion/burn out of the waste leaving an inert ash.

Air is fed into the chamber to assist the combustion process. Primary air is fed to the underside of the grates by inverter-driven fans. Secondary air is admitted above the grates to create turbulence and ensure complete combustion to ensure that the minimum levels of oxides of nitrogen (NOx) are produced. The volume of both primary and secondary air are regulated by a combustion control system described below.

Process Controls

The entire process and auxiliary systems are controlled and monitored by a complex telemetry system from a central control room which is manned during normal operating hours by skilled staff. This room contains computerised monitoring devices that measure and control conditions within the plant from many individual sensors located at key stages of the process. These include monitoring:

- The weighbridge;
- The vehicles within the tipping hall;
- The doors;
- The amount of waste within the bunker;
- The combustion temperature and rate of burning within the chamber;
- The air flow within the tipping hall and bunker and through the air system;
- The temperature, flow and composition of the gases within the primary and secondary chambers;
- The chemical dosing rates and flows within the flue gas treatment process;
- The efficiency of the heat exchanger;
- The power being generated by the turbine; and
- The amount of bottom ash and fly ash awaiting removal.

The telemetry system is programmed with the parameters for normal operation and this reacts to any sensor reporting data outwith these parameters. The system then signals a problem to the skilled staff within the control room who can then adjust the process to recover normal operating conditions, isolate parts of the process for investigation, or shut down the plant. As mentioned above, there are interlocks between the various plant items that prevent the waste, gas or steam from entering the next stage of the process where conditions are not as expected. The system would automatically induce shut down if no action was taken by the staff.

Conversion of Waste to Steam/Electricity and Heat

The facility recovers energy from the waste in the form of heat from the combustion processes. The hot gases rise from the waste and pass through a heat exchanger which heats up water in a sealed system which then transfers to a high efficiency boiler to produce steam.

The steam produced is then fed into a steam turbine which generates electricity. If all supplied steam was used to generate electricity, then the facility would be capable of generating approximately 13.5 MWe of electricity in total, of which 2.1 MWe would be used to run the plant systems themselves. The remaining 11.1 MWe could be fed to the local electricity network via an onsite substation

The facility is also designed to enable offtake of steam at the turbine in order to provide a source of hot water to deliver heat to a district heating network.

Flue Gas Treatment

The flue gas leaves the heat exchanger and enters the flue gas duct. Lime and activated carbon are pneumatically injected directly into the duct and react with the flue gas adsorbing and absorbing acid gases, sulphur dioxide, dioxins and heavy metals as solids that are then collected within bag filters. The amount of lime & activated carbon injected into the flue gas is automatically adjusted according to information from the emission monitoring system so that normal operating parameters are maintained.

The clean flue gas, is then emitted to the atmosphere via the flue gas fan and through the flue gas stack.

The build-up of solid particles on the filter bags is removed by pulses of air that dislodge the solids which then fall to the bottom of the filter house. The filter bags have a programmed sequence for pulsing to enable on-line cleaning and prevent spikes in emission readings. The timing of these pulses is based on the measured differential pressure. Clogging is prevented by a heater located near the bottom of the filter house.

The solid particles (or 'filter dust') that fall to the bottom of the filter house are then removed by a screw conveyor which transports this to the storage buffer; and then the dust is transported pneumatically to the filter dust silo. This process all takes place within the main building thus preventing the release of particles.

Waste Residues

Incinerator Bottom Ash (IBA)

IBA is generated from the grate combustion unit and can amount to 15-25% of input material (approximately 40,000 tonnes pa at the facility). This material is inert and can be used in the construction of concrete and concrete block construction, replacing up to 50% of the aggregate traditionally used after a process of hot asphalt stabilisation and mixing with cement or bitumen. It contains ferrous metals from the original waste and this is extracted using magnets and sold for reprocessing.

The IBA generated is stored and transferred to vehicles for onward transportation within the main building of the facility to prevent this material from being released.

Air Pollution Control Residues

Air pollution control residue (fly ash) is the residue from the flue gas treatment process prior to release of the cleaned flue gas into the atmosphere. This ash consists of lime, carbon dust and the captured pollutants, organic compounds and heavy metals. These

are removed from the flue gases to ensure that the cleaned emissions from the facility are safe prior to release, preventing pollution to the environment. Air pollution control residue represents about 3% - 4% by mass of the waste feedstock (approximately 4,500 tonnes per annum at the facility), and is disposed of safely by enclosed tanker to a designated hazardous waste landfill. The air pollution control residue is designated hazardous due to the high alkalinity (caustic nature) of the material caused by the addition of lime.

The market is growing for further treatment of the Fly Ash to render it inert so that it can also be used within construction materials ensuring even less material will be sent to landfill in the future.