



## **Energy from Waste Combined Heat and Power Plant**



## **Advanced i8-1000 EFW Objectives are:**

- 1000Kg/Hr Continuous Combustion , Combined Heat & Power Plant
- Small Localised CHP Generation (to future proof your ever rising energy costs)
- Less complicated Local Authority Planning Permissions and Environmental Permitting (SWIP Permit)
- Off-Set electrical site loads and heating costs
- Save on waste disposal costs
- Compliant with Industrial Emissions Directive (IED) Regulations
- Low Maintenance costs
- Low running costs
- Viable Installation with less that four years payback
- Containerised and Modular Plants , Easier to fund
- No Specialist personnel required



## Typical Waste Streams that incur disposal costs or produced on site



### Some Examples:

- Poultry Litter
- Grade C/D Wood
- RDF
- Digestates
- International Catering Waste
- Food Waste (Digested)
- General Waste

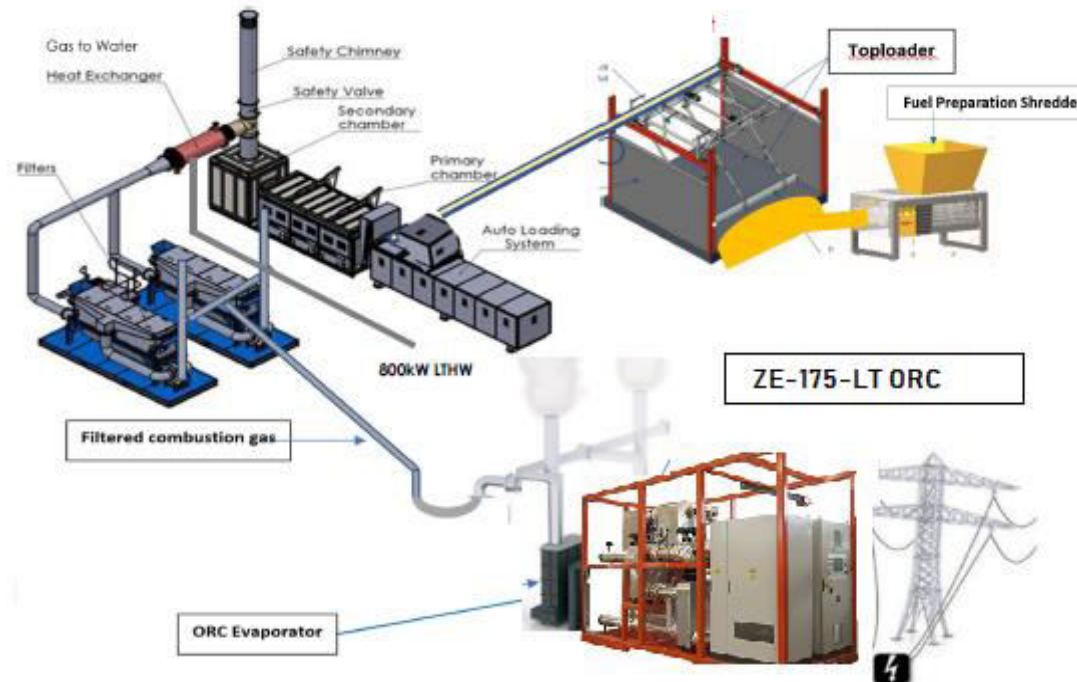


## **EFW – Equipment Installed**

- Waste preparation process
- Fuel delivery conveyors
- Advanced Inciner8 i8-1000 Combustor
- Pollution Control System
- Zuccato-Energia ZE-175-LT ORC Plant
- Emissions Monitoring



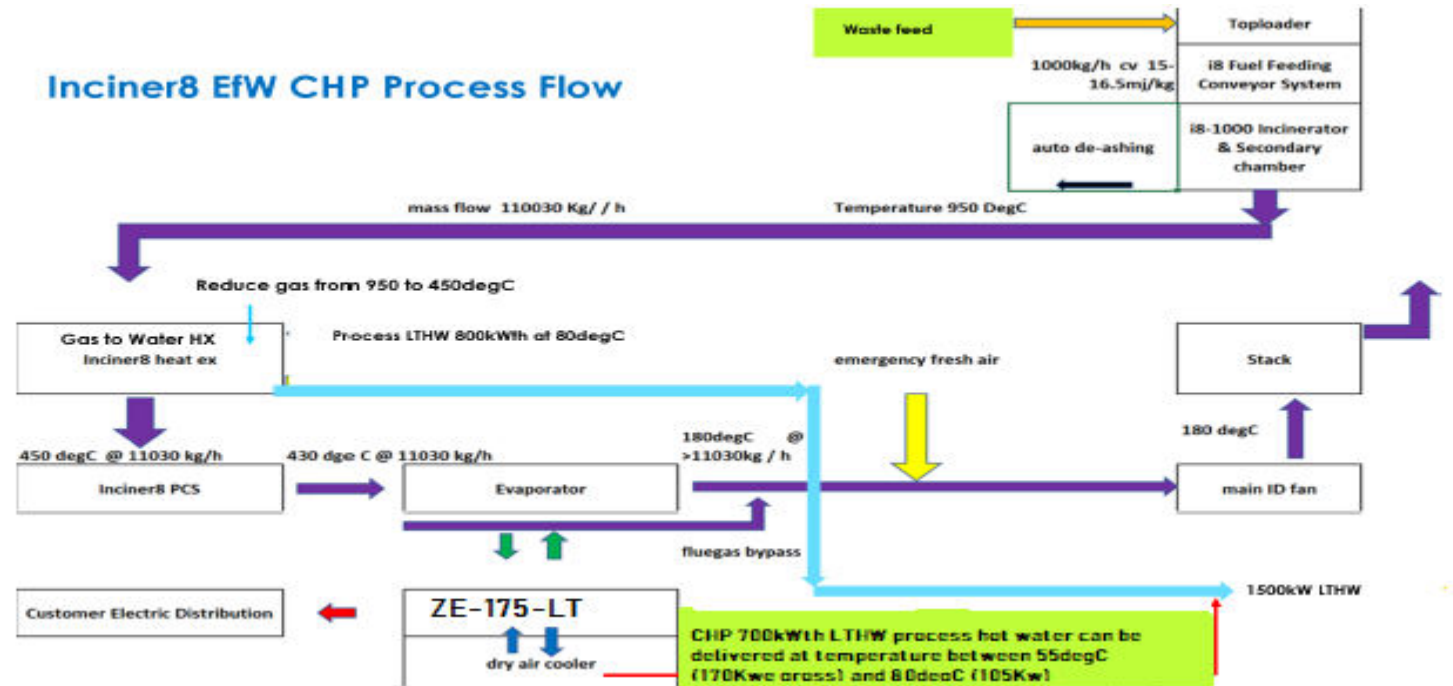
## EFW CHP – Process





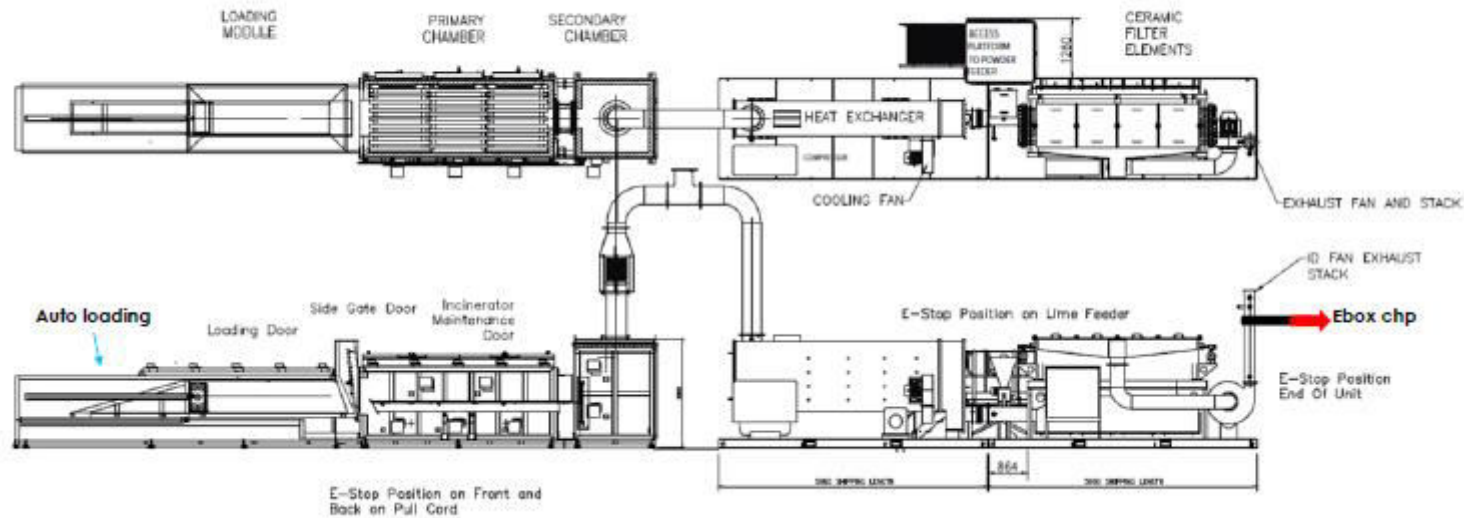
## EFW CHP – Process Flow

Inciner8 EfW CHP Process Flow





# The Advanced i8-1000 Continuous System





## EFW Combustor

### Main Features:

- Continuous 800-1000Kg Burn rates
- Variety of Wastes combusted
- Automatic continuous feed system
- Step grate for complete and efficient combustion
- Secondary burn that prolongs combustion and reduces the amount of unburned gases and dust (IED)
- Automatic Ash removal
- Advanced and Compliant Pollution Control System
- EFW Integrated CHP (ZE ORC)
- Advanced Safety Features
- 16,000°C Rated Combustor Lining
- Low/No fuel consumption (Auxiliary Burners)
- Marked Leading Insulation
- Remote Monitoring

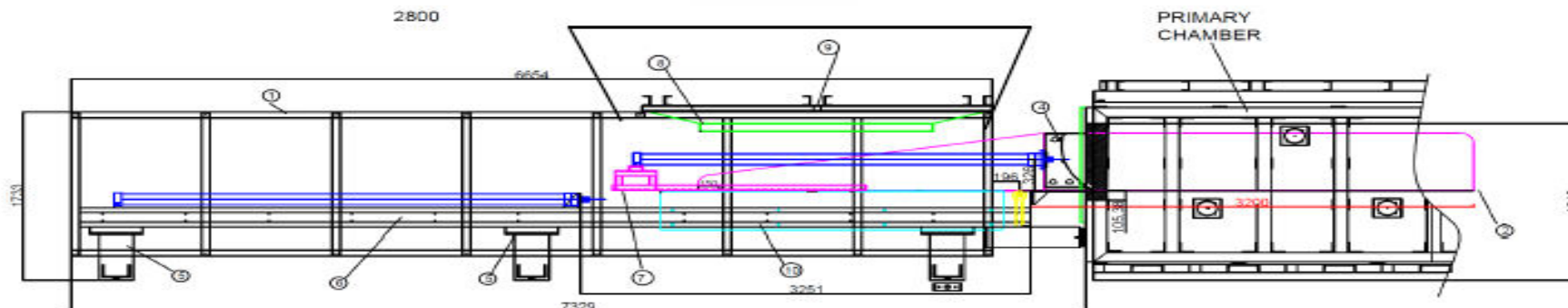




## Combustor – Auto Loading System

Main Features:

- Waste is fed into a feed hopper, 300Kg at a time ( Every 17Mins)
- Ram extends 3.2Mt into primary chamber
- Waste is dropped onto step grate for complete combustion
- No heat is lost during loading as the air-lock door system prevents this

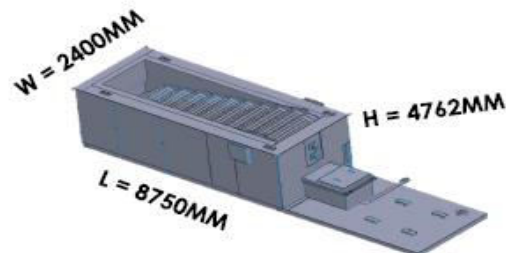
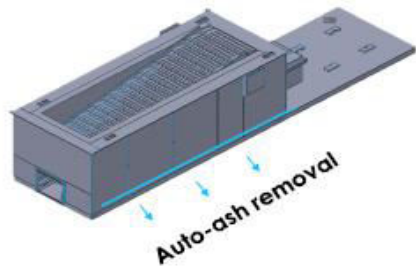




## Primary Combustor – Step Grate

Main Features:

- Continuous Operation
- Larger Capacity (1000Kg Per Hour)
- Improved Combustion (Step Grate)
- Integrated Auto-Ash removal





## Pollution Control System

The pollution control system takes the environmental performance to another level; in many cases this exceeds requirements. The purpose of the system is to allow compliance with EU regulation for hazardous waste. The pollution control system complies with best practice advice set out in the Directive 2000/76/EC on incineration and hazardous waste.

The controlled substances can be grouped according to their current best practice abatement/control technology

Dust	10	mg/Nm <sup>3</sup>
CO	50	mg/Nm <sup>3</sup>
NOx	200	mg/Nm <sup>3</sup>
Sox	50	mg/Nm <sup>3</sup>
HCl	10	mg/Nm <sup>3</sup>
HF	1	mg/Nm <sup>3</sup>
Heavy Metals	0.5	mg/Nm <sup>3</sup>
Cadmium & Thallium	0.05	mg/Nm <sup>3</sup>
Mercury	0.05	mg/Nm <sup>3</sup>





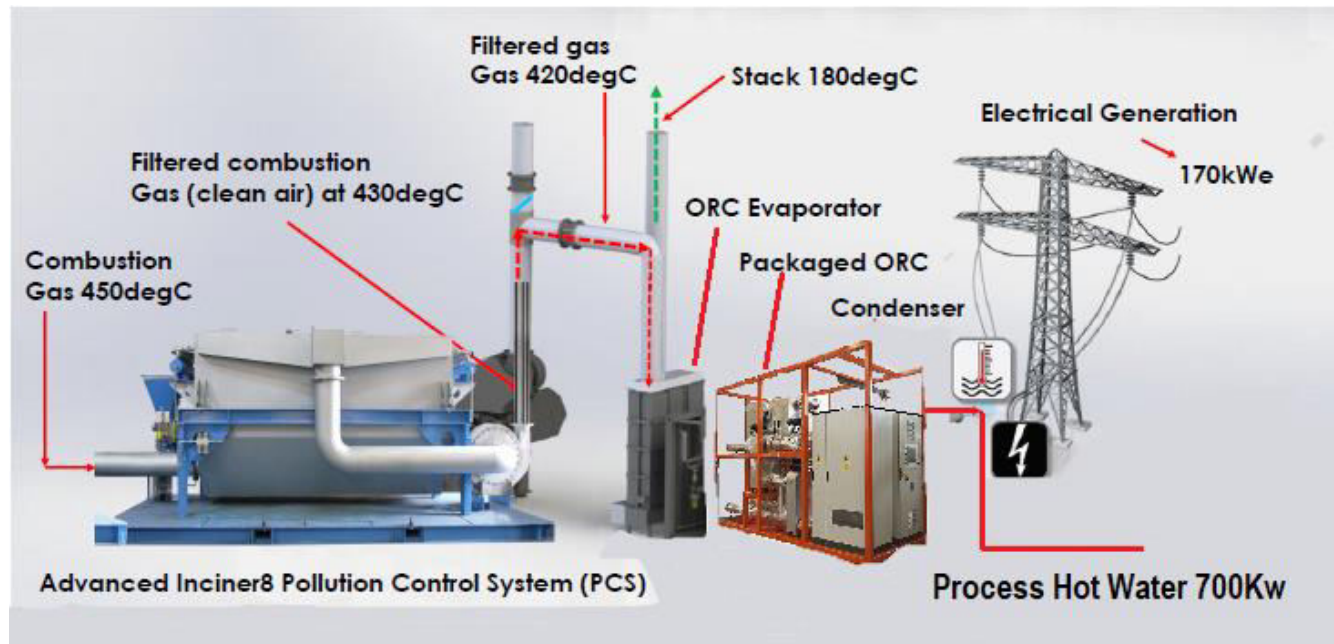
## Pollution Control System

Waste analysis dependant

- **Particulates** - removed by filtration
- **VOSs & CO** - removed by combustion in the secondary combustion chamber (The EC directive specifies that a secondary combustion chamber must be used)
- **Acid Gases;SO<sub>2</sub>,HCL and HF** – removed by reaction with a reagent
- **NO<sub>x</sub>** – controlled by combustion technology, removed by SCR or SNCR if required which involves reaction with ammonia/urea
- **Mercury,Hg**- Should be removed before waste is fed into the incinerator, otherwise gas must be cooled to low temperature and passed through activated carbon
- **Heavy Metals1**- Pb,As,Sb Etc are removed as solids via the filter
- **Heavy Metals2** – Cd,Tl – (Should not be any) , but will be filtered out if present
- **Ammonia** – This is not controlled in the EC, as far as we know, but will not be present unless it is added for NO<sub>x</sub> control – as above
- **Dioxins & Furans** – Will be destroyed in after burn. De Nova formation either avoided by high temperature filtration or removed by passing through activated carbon (or oxidation catalyst)



## EFW – Zuccato-Energia ORC Combined Heat and Power





## Zuccato-Energia (ZE-175-LT) Series ORC System

Waste combustion gas at +/- 1000°C is cooled to 460°C before being delivered to the PCS system (pollution control system) where the gas is filtered in compliance with IED regulation.

The clean filtered gas exits the PCS at 420°C, and is delivered to the ORC evaporator, where the heat is exchanged converting the liquid (working fluid) to a high pressure vapour, this high pressure vapour expands; driving the ORC turbine, producing electrical generation.

Based on combustion at 1000Kg/hr waste, there is sufficient heat to run 1 x ZE ORC at full load at full producing, 175kWe gross (net 155Kwe) to off-set electrical site loads or to export to the National Grid.

There is 700kWth in the condensing water that can be used as process heat.





## EFW – ZE 175 LT Plant Main features

### Automated Operation – Remotely monitored.

- Certified by Lloyds for unsupervised operation
- Monitored by central service Team

### Packaged in 20Ft Container

- Easy to ship
- Easy to connect
- Easy relocation

### 97% Annual Available

- Demonstration consistency since 2008

- Condensing Water at 80°C or 55°C
- Requires only 990Kwth up to 500°C air
- Rejects 700kWth as process heat
- Electrical Generation 135-170kWe tracts heat
- High Efficiency ORC





## EFW – Combined Heat and Power Plant

### Key Points in Summary

- Electrical generation to off-set electrical loads (Between 135kWe-175kWe)
- Process Hot water 700Wth at 80°C
- DNO – No costly upgrade to DNO network
- Packaged unit with a small footprint
- Certified for unsupervised operation
- Remote monitoring
- Woodfields – a UK company with field engineering experience for service and maintenance
- Low Maintenance costs
- Zero Emissions
- Future proof electricity and heating costs

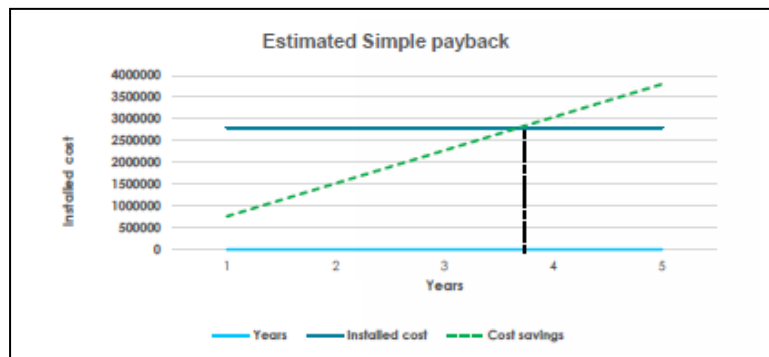




## Typical Cost Savings (RDF) – Zero Incentives

Savings are based on disposal costs estimated at £80p/t and electrical generation to off-set site loads at 10p/kWh

Waste	Quantity	Disposal cost	Electrical generation	Potential cost savings
	t/yr	£80p/t	155kWe net	p/yr
RDF	8000	£640,000	£124,000	£764,000





## Whats Next? – Step 1

Establish if the proposed installation meets the following criteria:

- ✓ District Network Operator (DNO) application
  - Grid export capacity and generator connection
- ✓ Pre-Application for planning approval
  - Process diagram
  - Equipment Layout
  - Equipment performance
  - Risk assessment
  - Chimney stack location
  - Roads and Access
  - Vehicle Movements
  - Noise
- ✓ Environmental Agency report
  - Emissions
  - Air dispersion modelling
  - Ground contamination
  - CEMS and live data reporting





**Thank you for your time today**

Any Questions?

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