

Energy from Waste – Energy Efficiency

The European Commission state waste is recovered if:

- Its combustion generates more energy than is consumed by the process itself;
- Most of the waste is consumed during the operation
- Most of the energy generated is recovered and used (either as heat or electricity)
- The waste replaces the use of a source of Primary Energy

The European Commission has produced a revised Waste Framework Directive (revised WFD) that comes into force in England in December 2010.

- This Framework seeks to clarify the distinction between recovery and disposal
- Make it clear that facilities whose principle purpose is the treatment of waste may be classified as Recovery.

But facilities dedicated to treating MSW have to meet specific requirements regarding energy efficiency as provided in the WFD in order to be classed as Recovery.

- To be regarded as “Recovery”, the revised WFD expects incineration facilities to achieve an energy efficiency factor of at least 0.65.
- Plants that do not achieve this factor are likely to be considered as “disposal” ie comparable to landfill and the option of last resort for waste management.

Some of the detail relevant to the calculation used to determine the energy efficiency factor set out in the revised WFD is yet to be agreed. However, a calculation procedure has been designated and these key principles have been used for the calculations set out below.

The principle is quite simple:

A designated calculation procedure takes the amount of useful electricity and heat DESIGNED to be produced by the facility and applies appropriate factors to determine the amount of energy necessary to produce this with modern plant. It then compares this energy requirement with the energy used by the facility.

This approach uses a complicated set of data including:

- Start-up oil,
- Standby power,
- Imported power,

- Energy required to run the plant and
- Energy required for dust removal and gas clean up.

If the factor produced is < 0.65 the facility is classed DISPOSAL.

If the factor produced is =>0.65 the facility is classed RECOVERY.

The definition of energy efficiency used in the revised WFD is:

$$\text{Energy Efficiency} = \frac{(E_p - (E_f + E_i))}{(0.97 \times (E_w + E_f))}$$

where:

E_p means annual energy produced as heat or electricity. It is calculated with energy in the form of electricity being multiplied by 2.6 and heat produced for commercial use multiplied by 1.1

E_f means annual energy input to the system from fuels contributing to the production of steam

E_w means annual energy contained in the treated waste calculated using the lower calorific value of the waste

E_i means annual energy imported excluding E_w and E_f

0.97 is a factor accounting for energy losses due to bottom ash and radiation.

Energy Efficiency (Factor) at Rookery South EfW

The Energy Efficiency Factor as calculated above = **0.7**

Under the terms of the revised WFD the EfW Facility at Rookery South is therefore classed as “Recovery”.

It should be noted that the energy efficiency figures provided above are Factors and not true cycle efficiencies. The true cycle efficiency of the EfW Facility is calculated in its very simplest form by dividing the energy (electricity) produced by the EfW Facility by the energy contained within the incoming fuel (waste).

The typical value for this cycle efficiency for an EfW is approximately 26%.

- This Efficiency takes into account the combustion efficiency (combustion on the grate)
- The boiler efficiency (heat transfer to boiler)
- Turbine/ generator efficiency
- Overall Operating efficiency (how well the boiler and associated plant are operated)

This level of cycle efficiency is better than most of the earlier existing EfW facilities, and is achieved through the use of modern advances in boiler technology and flue gas treatment etc.

Comparison With Other Generating Methods

- Coal Fired Power station: 37% efficient
- Gas Fired CCGT: 41% efficient
- Waste Fired Power Station (EfW) 26% Efficient

Definition of an Energy Generating Station

The Rookery South EfW Facility is an energy generating station by virtue of section 15 of the Planning Act 2008. This is because the facility is located on shore and will generate more than 50 MW. This is the same threshold as was previously used in the the Electricity Act 1989.

Through the use of the above calculations, the EfW Facility at Rookery South is classified as “Recovery.” Further, due to the amount of electricity that the facility is capable of generating, it is also an energy generating station that is recognised as a nationally significant infrastructure project.