Glossary

Biogenic: biodegradable substance, e.g. food, paper, garden trimmings, wood, natural textiles, manure, sewage sludge etc. These substances capture CO_2 from the atmosphere. When this CO_2 is released, it is not included in GHG Inventories.

Boiler: metal tubes filled with water or steam that collect the heat from incineration, to be further utilised.

Bottom ash: unburnable fraction of waste, e.g. sand, stones, glass, minerals etc, collected at the end of the grate

CHP: Combined Heat and Power plant, generating both heat and electricity

Corrosion: acids and salts in the flue gas make it corrosive. In order to have an acceptable boiler tube lifetime, steam temperatures are mostly limited to around 400°C. This limits the efficiency of electricity production

District Heating/Cooling: a network of pipes conveying hot (or cold) water for various applications in buildings or industrial processes

Flue gas: gas released from combustion. Carries pollutants contained in the waste and must therefore be treated in a flue gas treatment system before being released to the atmosphere

Fly ash: particulate residue conveyed with the flue gas. Taken out e.g. in the boiler, a fabric filter or an electrostatic precipitator

Grate: a series of moving/stationary metal bars on which the waste is incinerated and transported

Methane (CH_4): a gas created by anaerobic digestion of biological waste (e.g. in a landfill). It is a 25 times more dangerous greenhouse gas than CO_2

R1: a formula judging whether an Energy-from-Waste plant is considered to be a recovery operation or not. It examines how the energy is used, but is NOT an efficiency percentage

Recycling rates: the percentage of what is recycled or composted from the total waste generation (Eurostat 2008 – AT: 70%, DE: 65%, NL: 60%, BE: 59%)

Sewage sludge: solids carried by sewage water. Mainly minerals (sand) and organic material

Thermal Efficiency: percentage of energy recovered from total energy input. The higher this ratio, the more useable energy is recovered

Waste hierarchy: 5-step hierarchy, adopted in the EU Waste Framework Directive of 2008. Energy-from-Waste is on level 4 'other recovery', if it meets the R1 criteria

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Frequently Asked Questions about

Energy-from-Waste

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Energy-from-Waste: Why?

Bold words: *See Glossary at the back*

For unrecyclable waste

In the EU, waste must be managed according to the **Waste Hierarchy**. This is a mandatory instrument, promoting prevention, re-using and recycling, before allowing recovery (e.g. Energy-from-Waste) and finally disposal (landfill). When it's highly efficient **(R1 status)**, Energy-from-Waste is considered to be a recovery operation. It is a fact that countries with the highest **recycling rates** also rely most on Energy-from-Waste for treatment of their residual waste.

As a source of energy, partly renewable

Roughly 50% of the residual waste is of **biogenic** origin. This means that its incineration does not add to the global CO_2 balance, and therefore renewable. Concerning the non-biogenic part of the residual waste, it is preferable to recover its energy content rather than burying it. This offsets the use of other fossil fuels and has the added advantage that waste is a 'local' source of energy, lowering the dependency on imported supplies.

To fight Climate Change

Of course, burning the non-renewable fraction of waste generates CO_2 emissions. But when looking at the CO_2 avoided through the use of recovered materials and the offsetting of extraction, transport and use of fossil fuels, the overall CO_2 emissions are even negative! Waste can therefore be considered a resource and not a problem. Moreover, when diverting waste from landfill, the emission of **methane** is avoided, a much more potent greenhouse gas than CO_2.

All Energy-from-Waste plants in the Flanders region of Belgium combined emitted less dioxins than domestic fires (2007). The combined PM10 emissions of Energy-from-Waste plants in Germany amount to 0.003% of the national total (2007).

Energy-from-Waste: How?

How big?

In the EU, the average citizen generates 500 kg of waste per year. Assuming a recycling rate of 50% (today it is 40%), still 250 kg of residual waste per citizen per year need to be treated. Thus a city with 500,000 inhabitants will need an Energy-from-Waste plant capable of treating 125,000 tons of waste per year.

The minimum size, from an economic viewpoint, for an Energy-from-Waste plant is around 40,000 t/year.
The largest plants have capacities of more than 1 million t/year. Individual combustion lines can have capacities from around 2.5 – 50 t/hour (20,000t/year to 400,000t/year), whereby the more typical range is 5 – 30 t/hour (40,000 to 240,000t/year).
An Energy-from-Waste plant is expected to run for at least 8,000 hours per year, roughly 94% of the time.

How much?

Energy-from-Waste plants are most often tailor-made, depending on very specific local requirements. Construction costs hence vary widely, but a typical range in Europe is around 500 - 700 € per ton per year installed capacity, not including cost for the site and for project development.

What waste?

Energy-from Waste plants are designed to incinerate Municipal Solid Waste (MSW), but waste from industry and commerce can be treated as well. **Sewage sludge** and medical waste can be co-incinerated in certain percentages, but they need special storage and handling facilities. No pre-treatment is needed, except that very large pieces (more than around 1 m) and bulky items have to be shredded. Hazardous and radioactive waste is not permitted, it has to be treated in dedicated facilities.

And then?

What is the energy output?

The energy content of MSW in Europe is around 8-10 MJ/kg. 1 t of MSW has the same energy content as 200l of fuel oil. The energy contained in the waste is released during combustion into the **flue gas** and turned into steam in the **boiler**. The **Thermal Efficiency** of modern plants is over 80%. In order to limit **corrosion**, steam temperature and thus electrical efficiency is comparatively low. The best option is thus to use this energy directly in a **district heating/cooling network** or as process heat. The plant can also work in **CHP**-mode. This is the desired option to meet the **R1 criteria**.

What about Emissions?

The flue gas cleaning system, an important part of Energy-from-Waste technology, ensures that the pollutants contained in the waste and released during combustion are safely removed from the flue gas and the eco-cycle. The flue gases leaving the stack comply with the world's most stringent emission limits, making it the cleanest of all combustion industries. Remaining emissions are strictly monitored and negligible.

What to do with the residues?

The hygienised material remaining as **bottom ash** is 10 times less in volume and 75% less in weight compared to the initial MSW. After adequate treatment, including recovery of ferrous and non-ferrous metals, the bottom ash can be recycled as substitute to aggregates for road construction. **Fly ash** represents only 3-5% of the initial MSW in mass. This has to be disposed of and is thus taken out of the eco-cycle.