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### Innovative Concepts of High-Efficiency EfW Plants

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Municipal waste has characteristics that make it particularly suitable for the generation of heat and power. Waste is generally available close to the location of heat and power consumption in towns and densely populated areas. The technology used in modern Energy-from-Waste (EfW) plants is such that the waste is transformed into a reusable ash and that the flue gases are no longer a significant source of emissions. These points have been assured by the European Waste Incineration directive since 2005.

The standard Energy-from-Waste technology in Europe consists of grate-based combustion systems. Typically, these sometimes quite old plants produce 546 kWh of electricity per ton of waste, which corresponds to a gross energy efficiency of 18% referred to the gross heat input from waste and additional fuels (Basis: heating value of 10.44 MJ/kg and electricity production only). Due to in-plant consumption of an average of 150 kWh per ton of waste, this results in an average exported electricity of 396 kWh (net efficiency of 13 %). Most recent Energy-from-Waste plants use steam parameters of 40 bar / 400°C. Typically, these plants produce 650 kWh of electricity per ton of waste, which corresponds to a gross energy efficiency of 22% (heating value of 10.44 MJ/kg). With an in-plant consumption of 150 kWh, this typically results in exported electricity of 500 kWh (net efficiency of 17%). These data refer to the Best Available Technology document on waste incineration by the EU IPPC directive (BREF).

In some of the more advanced European countries, landfilling of municipal waste is restricted and efforts are being concentrated on further improving the energy efficiency of Energy-from-Waste plants beyond the values mentioned above. The driving force behind the implementation of high-energy systems is usually a premium for renewable electricity from waste, for example:

Netherlands	14.5 €/MWh for 10 years if efficiency > 26% (2003)
Italy	170 €/MWh with the CHP6 program (no longer valid)
Italy	80 €/MWh (variable) on the "green market" for 8 years
Spain	23.4 €/MWh in (Directive 1998); Bilbao: 30% premium on the electricity price

There is a large potential for improving the use of the energy contained in municipal waste. On the one hand, waste can be diverted from landfilling and, on the other, the energy efficiency of Energy-from-Waste plants can be improved. In this respect the main topics apply to power generation: Steam parameters (pressure and temperature of superheated steam), flue gas heat losses (temperature at boiler outlet, excess air rate), steam condensation