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The European position

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Where is waste-to-energy, and where is it going?

A WTE plant in Mallorca, Spain. European plants operate under stringent emission limits.

PHOTO: TIRME S.A.

Europe currently treats 50 million tonnes of wastes at waste-to-energy plants each year, generating an amount of energy that can supply electricity for 27 million people or heat for 13 million people. Forthcoming changes to EU legislation will have a profound impact on how much further the technology will help achieve environmental protection goals.

Despite EU policy to divert biodegradable waste from landfill, landfilling remains the dominant method used in Europe – approximately 50% of the 243 million tonnes of municipal solid waste (MSW) generated in the 25 Member States of the EU (EU-25) each year is still landfilled.

One of the reasons for this continuing dominance could be public reluctance to accept waste-to-energy (WTE) plants as a safe treatment option. Approximately 50 million tonnes of waste is currently thermally treated each year in about 400 WTE plants in Europe. The distribution of these plants is shown in Table 1.

TABLE 1. Waste-to-energy plants in Europe operating in 2003. SOURCE: CEWEP

	Number of WTE plants	Treated waste (million tonnes)
France	123	11.25
Spain	11	1.86
Portugal	3	1
UK	15	3.17
Belgium	17	1.64
Netherlands	12	5.18
Luxembourg	1	0.12
Switzerland	29	2.97
Italy	49	3.47
Austria	5	0.88
Germany	58	13.18
Czech Republic	3	0.4
Poland	1	0.04
Hungary	1	0.19
Denmark	31	3.28
Norway	21	0.79
Sweden	28	3.13
Finland	1	0.15

WTE AND THE ENVIRONMENT

Low emissions

In September 2005, a report[1] by the German Environment Ministry (BMU) stated:

'...because of stringent regulations waste incineration plants are no longer significant in terms of emissions of dioxins, dust and heavy metals. And this still applies even though waste incineration capacity has almost doubled since 1985.' 'Total dioxin emissions from all 66 waste incineration plants in Germany has dropped to approx. one thousandth as a consequence of the installation of filter units stipulated by statutory law: from 400 grams to less than 0.5 grams'.

Referring to other industries, the report says:

'The decline, however, has nowhere been as drastic as in the incineration of household waste. The consequence is that whereas in 1990 one third of all dioxin emissions in Germany came from waste incineration plants, for the year 2000 the figure was less than 1%'.

These comments and the data in Tables 2 and 3 reflect the improvements that have occurred in reducing emissions in Germany as a result of strict national legislation and significant investment in efficient flue gas cleaning systems.

TABLE 2. Annual dioxin emissions in Germany by source. SOURCE: BMU[1]

	Emissions per year in gram per toxicity unit (g TU)		
	1990	1994	2000 [a]
Metal extraction and processing	740	220	40
Waste incineration	**400**	**32**	**0.5**
Power stations	5	3	3
Industrial incineration plants	20	15	< 10
Domestic firing installations	20	15	< 10
Traffic	10	4	< 1
Crematoria	4	2	< 2
Total emissions, air	1200	330	<< 70

[a] Data for the year 2000 are estimates by the Federal Environment Agency

TABLE 3. Annual emissions from WTE plants in Germany. SOURCE: BMU[1]

	1990	**2001**
Lead	57,900 kg	130.5 kg (= 0.2% of initial emissions)
Mercury	347 kg	4.5 kg (= 1.3% of initial emissions)
Dust (particulate matter)	25,000 tonnes (= a maximum of 30 mg/m3 of exhaust air)	< 3000 tonnes

On a European level, the Waste Incineration Directive 2000/76/EC introduced strict emission limit values – much more stringent than for any other industrial activity. The Directive covers both waste incineration plants and industrial plants that co-incinerate waste, but with exceptions for co-incinerators with respect to dust and nitrogen oxide (NOx) emissions.

More information on emissions from WTE plants can be found in the recently adopted Best Available Techniques Reference (BREF) document for waste incineration.[2]

Climate protection and renewable energy

Waste-to-energy has the potential to have a significant impact on carbon dioxide (CO_2) emissions by supplying energy that would otherwise be supplied by conventional power plants using fossil fuels. Each year in Europe, 7778 million cubic metres of natural gas or 7428 million litres of oil are substituted by treating 50 million tonnes of waste in WTE plants (Figure 1).

At this level, some 27 million MWh of electricity or 63 million MWh of heat can be generated, supplying 27 million inhabitants with electricity or 13 million inhabitants with heat. This is equivalent to supplying the entire population of the Netherlands, Denmark and Finland with electricity, or nearly the entire population of Austria, Ireland and Estonia with heat throughout the year.

According to the European directive on the promotion of electricity produced from renewable energy sources 2001/77/EC (RES Electricity Directive), the biodegradable fraction of waste is considered biomass and thus a renewable energy source. The biodegradable fraction in MSW is more than 50%; according to a study by the Öko-Institut, it is 62%.[3]

The Commission is seeking to clarify the definition of recovery and disposal

In practice, Member States differ in how electricity from waste is supported and how the RES Electricity Directive is implemented. While a number of Member States recognize waste as a renewable energy source, only some are really supporting it. Thus, the price that WTE plant operators receive for selling their electricity ranges from the market price of around 3 Eurocents/kWh in Germany to the 9 Eurocents/kWh, which can be achieved with green certificates in Italy. In Hungary and Portugal, operators get about 7 Eurocents/kWh. In the Flemish part of Belgium, only 40% of waste is recognized as renewable, but WTE plant operators achieve approximately 10 Eurocents/kWh for selling their electricity via green certificates. Support for electricity from waste also exists in the Netherlands and Denmark.

There is considerable potential for WTE plants to contribute to climate protection through generating energy. But while the RES Electricity Directive applies this idea with regard to electricity, the biomass heat sector is not covered within EU legislation. This could be considered by the Commission, which plans to draft a biomass action plan by the end of 2005. Actions to promote the biomass–bioenergy sector could include:

- a stronger consideration that waste is biomass
- a declaration of the energy produced from the biogenic waste as sustainable energy (with appropriate labelling)
- stronger support for heat from biomass/waste.

IMPACT OF FORTHCOMING EU LEGISLATION

The following are likely to have a major impact on waste-toenergy plants:

- amendments to the Waste Framework Directive 75/442/EEC based on:
    - Thematic Strategy on Waste Prevention and Recycling
    - Thematic Strategy on Natural Resources
- revision of the Waste Shipment Regulation 259/93/EC
- concentration limits for dioxins/furans according to the Regulation 850/2004/EC on persistent organic pollutants (POPs)
- revision of the Emissions Trading Directive 2003/87/EC.

Waste Framework Directive

The European Commission is planning thematic strategies on waste and resources, which are supposed to be delivered as a package together with the amendments to the Waste Framework Directive in autumn 2005. These strategies will give (together with five others, such as on air quality) a 20- to 25-year timeframe for European environment policy and should contribute to better legislation.

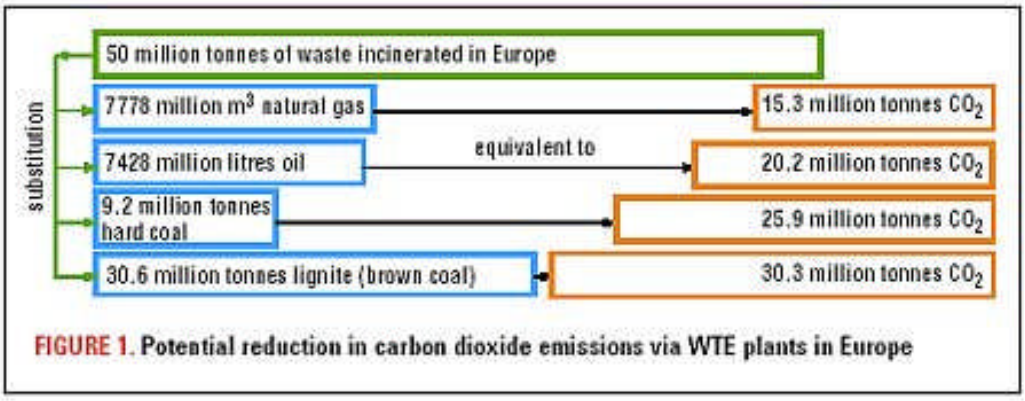


FIGURE 1. **Potential reduction in carbon dioxide emissions via WTE plants in Europe**

The Commission is seeking to clarify the definition of recovery and disposal. It intends to propose that the principal of 'substitution of resources' is used to clarify the definition of recovery. Substitution will be assessed from an economic perspective rather than the approach taken by the European Court of Justice, which only considered the boundaries of the plant itself.

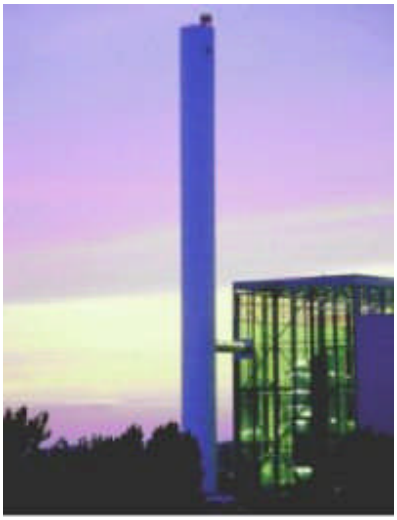
Two corrective mechanisms could be added to this principle:

- Operations will be classified as disposal, even if substitution of resources takes place, when they have a negative effect on the environment.
- Operations, such as waste incineration plants, will establish energy-efficiency thresholds.

The Confederation of European Waste-to-Energy Plants (CEWEP) has provided the Commission with energy-efficiency criteria for the classification of energy recovery in WTE plants.[4] This should help the WTE sector, which has been stigmatized as a waste disposal operation (instead of energy recovery) by the interpretation of European Court of Justice ruling from 13 February 2003 in Case C-458/00.[5]

The Commission will also address the definition of waste and when a waste ceases to be a waste. This will be clarified for several waste streams. Candidates for the end of waste discussion are compost, scrap metal and paper, but lobbying is intensive to get other waste streams on the list.

A waste-to-energy facility in Malmö in 2004 used 400,000 tonnes of waste to generate 140,000 MWh of electricity and 1 million MWh of heat. The heat fulfils about 45% of the district heating requirements for the cities of Malmö and Burlöv with 300,000 inhabitants. PHOTO: SYSAV



An important question for the WTE sector will be whether fuel from waste (solid-recovered fuel or refuse-derived fuel, which is co-incinerated in industrial plants such as cement kilns and power plants) can be classified as a non-waste. If related lobbying is successful, then plants co-incinerating this material will not have to comply with the strict emission limit values of the Waste Incineration Directive. In addition, the Waste Shipment Regulation, which demands the notification of waste shipments to other countries, applies only to waste. Should fuel from waste be classified as a product and thus a non-waste, there would be no traceability.

Waste Shipment Regulation

The Waste Shipment Regulation is currently under revision. Once again, the question of whether a waste is shipped to be recovered or to be disposed of is of tremendous importance. The discussions in the European Parliament are likely to be highly controversial during the second reading (starting in mid September 2005).

Just to mention one example. The Commission disagrees with a Council amendment adopted in June 2005, which allows Member States to block waste shipments destined for recovery abroad on the grounds that the waste will be processed to 'lower treatment standards' in the country of destination. According to the Commission, this would create barriers in the European waste recycling and recovery market, without improving environmental standards. The European Parliament however, was even more restrictive on trade during the first reading than the Council and is likely to maintain this position for environmental reasons.

Concentration limits on POPs

The POP Regulation came into force on 20 May 2004 and POP concentration limits have to be specified by 31 December 2005. The most important concentration limit for WTE plants is the so-called low POP concentration limit regarding dioxins/furans. This is because it can affect the treatment of residues, such as the use of bottom ash in road construction and the storage or recovery of filter dust in hazardous landfills or underground in salt mines.

Italy is the only Member State that has integrated WTE plants into the EU-ETS

Greenhouse gas emissions trading

At present, no Member State apart from Italy has integrated WTE plants into the EU Emissions Trading Scheme (EU-ETS). A review of the ETS Directive, which came into force on 21 October 2003, is foreseen for 2006 and discussions are underway about which sectors should be included in its scope.

A waste-to-energy facility at Halmstad, Sweden. WTE capacity in Europe looks set to increase. PHOTO: RAMBØLL

CEWEP's first investigation on whether WTE plants should be integrated in the EU-ETS in the future resulted in the following.

Given today's systematic approach and criteria for the EU-ETS, an integration of WTE plants in it does not seem to be suitable. This is because WTE plants only reduce CO_2 emissions indirectly (when they substitute for fossil fuels), whereas the approach taken by the EU-ETS today recognizes only direct reductions of CO_2 emissions. Moreover, the reduction in methane emissions (by diverting waste from landfill) is not considered by the current scheme.

In addition, monitoring WTE plants is extremely difficult due to the very heterogeneous waste inputs and it will be impossible to avoid inaccuracies in emission factors of at least 10%. It will not make sense to integrate plants with uncertainties in monitoring of more than 10% into a system with emission reduction targets of under 10%, as the true emission reduction achieved by a plant might be within the range of the uncertainty.

On the other hand, the utilization of the project-based mechanisms – Joint Implementation (JI) and Clean Development Mechanism (CDM) – marks a potential opportunity to reduce emissions in the waste sector. As projects are to be evaluated on a case-by-case-basis, these project-based mechanisms are considered as systematically much more suitable for the very varied waste sector as a whole than the integration of WTE plants or other parts of the waste sector into the EU-ETS.

OUTLOOK

Waste incineration with energy recovery and recycling are complementary options to fulfil the goal of European environment policy to divert waste away from landfills.

European legislation aims to divert waste from landfill

According to the Landfill Directive (1999/31/EC), the amount of biodegradable waste going to landfill has to be reduced to 35% of the total amount (by weight, compared with the amount in 1995) by 2016. As a result, implementing the Landfill Directive will reduce greenhouse gas emissions by around 74 million tonnes CO_2 equivalents[6] (methane being a significantly [21 times] more potent greenhouse gas than CO_2).

In order to approach this goal, additional capacity of WTE plants is needed. An investigation undertaken by CEWEP concluded that at least 10 million tonnes of additional WTE capacity will be constructed during the next few years.

WTE plants have the potential to make a huge contribution to climate protection. They are an essential part of both the waste management and the energy supply network. There is no reason for concerns about this environmentally sound energy recovery operation, which will help divert waste from landfill.

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NOTES

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