Debunking Efficient Recovery

The Performance of EU Incineration Facilities

Executive Summary
January 2023

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EU statistics reveal that 98% of municipal waste which is incinerated in the EU is incinerated in facilities classified as 'recovery' (R1). The R1 energy efficiency criterion, which was established to help draw a distinction between 'recovery' (R1) and 'disposal' (D10) incineration on the basis of 'energy efficiency', therefore fails to make a meaningful distinction between facilities that were deemed worthy of a permit (which would have to demonstrate recovery of heat 'as far as practicable') and facilities which achieved a relatively high performance in terms of energy efficiency.

The efficiency threshold set under R1 is one which is far too easily met. The effect of *Amending Directive 2015/1127* in introducing a climate correction made this easier still. Without the amendment, even the high threshold for newer facilities could be achieved by facilities generating electricity with a gross efficiency of around 23%, equivalent to a net efficiency of around 19%. Thus, climate correction factors allow for the R1 criterion to be met at even lower efficiencies (around 16.5% net).

Despite routinely meeting the R1 efficiency criterion, at the aggregate national level efficiencies of existing incineration facilities remain relatively low in those Member States where the focus is more on generation of electricity than heat. Table 15 summarises the figures for different Member States (based on assumed Net Calorific Values (NCVs) as shown in the Table), and these are generally low for electricity only facilities. At the aggregate level, they rarely sum to more than 40% gross, even if one assumes that heat and electricity should be given equivalent status (and there are reasonable arguments as to why heat should be considered inferior to electricity).[1]

Table 1: Summary of Efficiency of Energy generation from Incineration, National Level Figures [2]

		Elec only		Heat only		Cogen				Total			
	NCV assumption (GJ/tonne)					Elec		Heat		Elec		Heat	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net
Germany	(given)									14.3%	10.9%	34%	
France	10.4	16.5%	13.5%	48.7%	42.3%	10.1%	7.3%	28.3%	22.7%	10.3%	7.6%	26.1%	21.1%
	9.5	18.2%	14.8%	53.5%	46.5%	11.0%	8.4%	31.1%	23.2%	11.3%	8.4%	28.7%	23.2%
Italy	10.4	26.3%				23.7%		26.9%		25.0%		13.0%	
Netherlands	10.0									19.5%		21.2%	
Spain	10.0	24.1%											
UK	(given @9.4)										22.5%		5.0%
Sweden	MSW=10.0; C&I=12.0									11.9%		85.0%	
	13.9									9.8%		70.0%	

[1] It should be noted that the Member States shown in the Figure are six of the top seven Member States in terms of the amount of municipal waste incinerated, as well as the UK (which would lie between France and Italy in the Table if ranked by quantity). Sweden incinerated slightly more than Spain in the year of reporting, but is shown separately as the Member State which is a) incinerating a large quantity of waste, and b) focussed mainly on use of incineration for heat generation.

[2] Where there are two rows for a given Member State, this reflects discussion in the Main Report regarding the net calorific value (NCV) of waste used in estimations of the efficiency of generation in a given Member State. Where this has not been made clear, analysis has been undertaken using more than one figure for the NCV.

The weighting for electricity in the R1 energy efficiency calculation – of 2.6 – was justified in the underlying BREF document through reference to a 38% average efficiency of conversion into electricity (presumably from fossil fuels). [3] Conversion efficiencies have increased in the intervening period: in 2018, the European Environmental Agency noted '*Between 2005 and 2016, the efficiency of public conventional thermal power plants in the EU increased from 47 % to almost 50 %.*'[4] Efficiencies of electricity generation from waste, on the other hand, are in the mid-20's in the best cases. This compares with figures of around 35% for coal-fired generation, and 55% for combined cycle gas turbine (CCGT) plant.

Incineration is frequently considered a low carbon, sometimes even renewable (even if only partially), source of energy. It is neither. Especially when generating electricity only, typical efficiencies of generation compare poorly with those of coal fired electricity generating plant, and even worse when compared with combined cycle gas turbines. Even though (if one excludes the non-fossil CO_2 from the analysis) the greenhouse gas emissions per unit of energy content are relatively low for waste, the low generation efficiency of incineration leads to greenhouse gas emissions per unit of electricity being almost double those associated with natural gas generation. Comparatively, the situation is somewhat better as regards heat generation, but even here performance is no better than that of domestic gas fired boilers. The situation worsens when emissions of non-fossil CO_2 from waste incineration are considered, as the emissions effectively double, both for electricity and for gas.

These comparisons are somewhat backward looking. As we look forward, especially at new-build housing or commercial properties, the counterfactual source of heat is increasingly unlikely to be gas as urban planners seek lower carbon sources of space heating and hot water, such as heat pumps. Suitable use of building fabric will minimise demand for space heating, whilst heat pumps are likely to increase the extent to which they supply the balance.

In previous work, we indicated that there is a compelling logic for abandoning the distinction between D10 and R1 incineration.[5] We argued the point on the basis of the flawed rationale for making the distinction in the first place, and on the basis of the relative merits of 'landfill' and 'incineration' under current, and likely future, circumstances. We argued that sending leftover mixed waste directly either to incineration or landfill should no longer be considered acceptable in a world threatened by runaway climate change. With suitable changes in policy, designed to improve the performance of the most widely used 'way of getting rid of' leftover mixed waste, we argued that there was insufficient basis to prioritise incineration over landfill in the waste hierarchy.

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[3] European Commision, *BREF - Best Available Techniques (BAT) Reference Document for Waste Incineration (Industrial Emissions Directive 2010/75/EU)*, 2019. See: https://eippcb.jrc.ec.europa.eu/sites/default/files/2020-01/JRC118637_WI_Bref_2019_published_0.pdf

[4] European Environment Agency, "Efficiency of conventional thermal electricity generation". See: https://www.eea.europa.eu/data-and-maps/indicators/efficiency-of-conventional-thermal-electricity-generation-4/assessment-2 (accessed January 2023).

[5] Equanimator, *Rethinking the EU Landfill Target*, Zero Waste Europe, October 2021.

The analysis in this report strengthens the argument for abandoning the now meaningless distinction between D10 and R1 incineration. The R1 formula was badged as an 'energy efficiency' formula, but the formula has been amended in such a way that it no longer promotes this goal. It covers facilities whose efficiency of generation of power (when operating to generate only power) is around half the average efficiency of EU gas fired power generation, and which generate electricity at twice the carbon intensity of gas fired power stations, as well as facilities which, when generating heat only, deliver heat at roughly the same carbon intensity as a gas-fired boiler.

Zero Waste Europe is the European network of communities, local leaders, experts, and change agents working towards the elimination of waste in our society. We advocate for sustainable systems and the redesign of our relationship with resources, to accelerate a just transition towards zero waste for the benefit of people and the planet.

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