ZERO WASTE EUROPE

Landfill emission reductions only tell half the story as GHG emissions from Waste-to-Energy incineration double

Policy Briefing

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In the framework of discussions on the climate impact of waste sector activities, it is often mentioned, by a number of stakeholders, that Waste-to-Energy (WTE) incineration is a way to reduce overall greenhouse gas emissions (GHG) from the waste sector, and in particular, from landfilling. While the GHG emissions from landfills (and therefore the waste sector overall) are seemingly reducing, **the actual emissions from waste activities are shifting to the energy sector - as more waste is being incinerated in WTE plants across Europe**. Since GHG emissions from WTE plants are not reported under the waste sector but the energy sector, it **gives the false impression that we are reducing overall emissions in the waste sector, hiding important climate emissions and pushing waste policy in a troubling direction**.

This briefing helps to identify the ways in which **GHG emissions from waste are being shifted from one sector to another**, uncovering the true GHG emission impact of WTE.

Data Disclaimer

The report is based on the analysis of annual inventory submissions to the UNFCCC consisting of the national inventory report (NIR) and common reporting format (CRF).[1] The NIRs contain detailed descriptive and numerical information and the CRF tables contain all GHG emissions and removals, implied emission factors, and activity data. Relevant figures for this briefing are found in the CRF documents, per year, in the tab "Table1.A(a)s4" for WTE emissions under the energy sector, and the tab "Table5" for landfill emissions under waste sector emissions (see Annex I for extracted data from these UNFCCC reports). The analysis refers to data on CO_2 emissions from WTE incineration and CO_2eq of CH_4 (methane) emissions from landfills. The multiplier for calculating CO_2eq of CH_4 emissions of landfills is 25, in line with the UNFCCC recommendations.[2]

As some of the countries did not report on the emissions of WTE incineration this data was complemented with data received directly from those Member States through access to information requests.

[1] The full list of National Inventory Submissions to the UNFCCC can be found here: https://unfccc.int/ghg-inventories-annex-i-parties/2020
[2] This was confirmed via a personal communication with a UNFCCC expert.
https://www.ghgprotocol.org/sites/default/files/ghgp/Global-Warming-Potential-Values%20%28Feb%2016%202016%29_1.pdf

Non-transparent reporting of GHG emissions from WTE facilities

The GHG emissions from WTE plants are reported by countries to the UNFCCC under the National Inventory Submissions[3] where the biomass and fossil fraction of waste incinerated in WTE plants is reported separately (see Annex I for extracted data from these UNFCCC reports). However, **numerous EU countries did not report any data on WTE emissions** (Austria, France, Germany, Lithuania, Netherlands, Poland and Slovakia) **or reported only the fossil part of the emissions** (Portugal and the United Kingdom).[4] The data, therefore, had to be complemented through access to information requests. Yet, despite incomplete inconsistencies in EU reporting (when it comes to the number of EU countries being reported), **the trends seem to point in the same direction.**

An increasing trend in waste incineration

In 2018, over 131 million tonnes of (non-hazardous) waste was incinerated in the EU-27 in WTE incinerators.[5] This marks a substantial increase in the burning of municipal waste which has risen from 29 million tonnes in 1995 by an increase of 101% to 58 million tonnes in 2018.[6] This is a rise from 34kg per capita in 1995 to 131kg per capita in 2018 (Table 1). **These trends show a significant increase in WTE capacity across the EU.**

Municipal waste landfilled, incinerated, recycled and composted, EU-27, 1995-2018

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change 2018/1995 (%)
												million tonnes													
Landfill	121	117	117	114	113	112	107	104	99	93	88	88	87	83	82	79	74	67	63	59	57	54	53	52	-57
Incineration	29	30	33	33	34	36	37	39	39	41	45	48	49	51	52	53	55	54	55	56	56	58	59	58	101
Material Recycling	23	26	30	32	37	38	40	43	43	43	46	47	52	53	54	55	56	58	56	59	63	65	66	67	190
Composting	14	16	17	18	19	23	23	24	24	26	26	27	28	30	30	29	29	30	31	33	33	36	37	37	163
Other	10	13	12	11	12	11	12	12	12	13	16	13	11	10	7	6	6	6	5	5	5	5	5	5	-51
												kg per capita													
Landfill	286	276	276	266	263	262	250	241	229	215	202	202	199	190	186	178	167	153	142	134	127	121	118	117	-59
Incineration	34	36	39	39	79	84	87	90	90	95	103	111	112	116	117	121	125	122	125	126	127	130	132	131	285
Material Recycling	54	62	69	75	85	87	92	100	100	100	105	109	119	120	123	125	128	130	128	134	141	145	147	150	178
Composting	33	38	41	42	45	53	54	57	57	59	59	61	64	69	67	66	66	69	71	73	75	81	83	83	152
Other	60	66	66	65	28	27	26	27	26	31	37	30	23	23	17	13	13	14	12	11	10	11	11	11	-82

Note: estimated by Eurostat.
Source: Eurostat (online data code: env_wasmun)

Table 1: Municipal waste landfilled, incinerated, recycled and composted. EU-27, 1995-2018, Eurostat

Depending on the waste composition, **incineration of waste emits between 250–600 fossil CO_2kg per tonne of incinerated waste, which is comparable to the carbon intensity of emissions from coal combustion**[7] – making it a significant source of GHG emissions. Plus, when biogenic emissions are included, direct CO_2 emissions are approximately 1,000–1,100kg per tonne of waste.[8]

Therefore, with trends showing significantly increased WTE incineration capacity across the EU over the last decade, it should be expected that GHG data will show an increased source of emissions coming from WTE under the energy sector.

[3] https://unfccc.int/ghg-inventories-annex-i-parties/2020.
[4] https://unfccc.int/ghg-inventories-annex-i-parties/2020
[5] https://ec.europa.eu/eurostat/databrowser/view/env_wastrt/default/table?lang=en
[6] https://ec.europa.eu/eurostat/statistics-explained/index.php/Municipal_waste_statistics
[7] http://wedocs.unep.org/bitstream/handle/20.500.11822/28413/WTEfull.pdf?sequence=1&isAllowed=y
[8] Idid.

Waste sector emissions shifting to the energy sector

The waste sector is the fourth largest GHG emitting sector in the EU-28, after energy, agriculture and industrial processes, contributing 3% to total GHG emissions in 2017.[9] GHG emissions in the waste sector are generated from different treatment and disposal routes that can be categorised as emissions from:

- 5.A Solid waste disposal;
- 5.B Biological treatment of solid waste;
- 5.C Incineration[10] and open burning of waste; and
- 5.D Wastewater treatment and discharge.

The first three mainly relate to the treatment and disposal of solid waste.

The latest European Environment Agency report[11] notes that emissions from the waste sector have been continuously decreasing in recent years, standing at 139Mt of CO_2eq in 2017 (Figure 1). A decrease in emissions that is mainly driven by the development of different waste treatment and disposal routes which especially cut emissions from landfills. In fact, 87% of *waste sector* emission reductions were due to a reduction in emissions from landfilling as a result of more diversion through separate collection, composting and recycling, and the increased application of other waste treatment methods.

The latest UNFCCC inventory showed that emissions from landfilling in the EU 27+UK were at 99,429kt CO_2eq in 2018.[12]

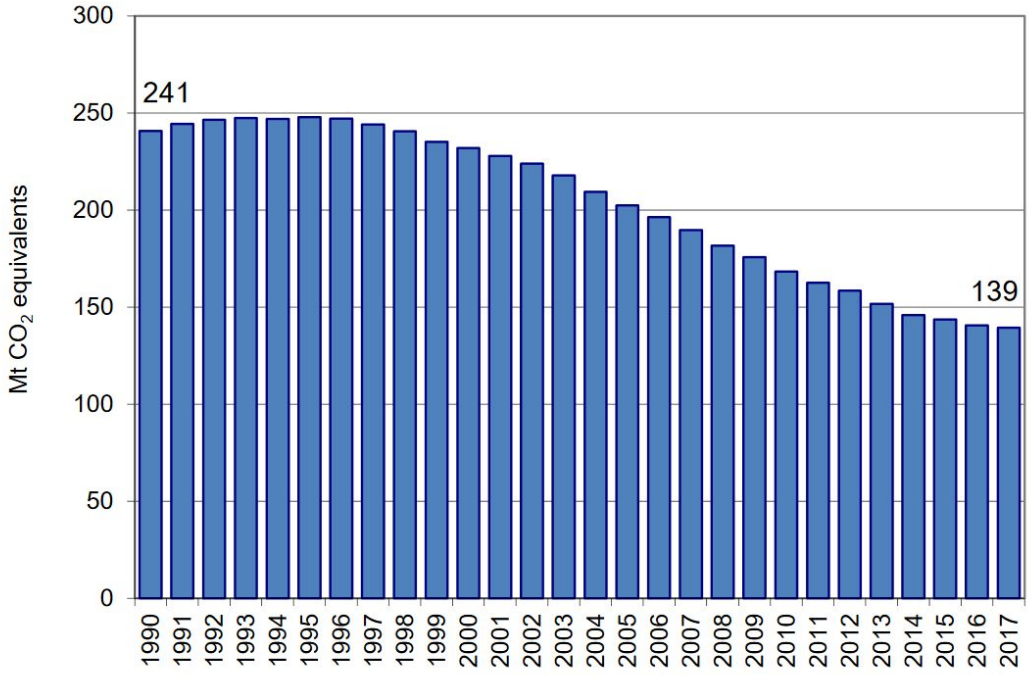

Figure 1: Sector 5 Waste: EU-28+ISL GHG emissions, 1990-2017, European Environment Agency

[9] https://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2019/european-union-greenhouse-gas-inventory-2019/viewfile
[10] This includes only waste incineration without energy recovery.
[11] https://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2019/european-union-greenhouse-gas-inventory-2019/viewfile
[12] This data includes only CH4 emissions from landfills.

While landfilling emissions may appear to be decreasing, emissions from WTE plants have been doubling, according to the latest available data, reaching 52,102kt fossil CO_2 in 2018 (Table 2). Yet, these figures only include the emissions resulting from the fossil fraction of waste incinerated (typically, plastics and synthetic textiles). In addition to the fossil CO_2 emissions, WTE incineration also generates significant emissions from the biogenic part of the waste incinerated (as noted previously).[13] In 2018 this biogenic waste accounted for an additional 43,526kt CO_2 from waste incineration in the EU (Table 2). Therefore, **the total CO_2 emissions from burning waste in WTE plants in 2018 was around 95,425kt CO_2, which is almost the same as the CO_2eq emissions from landfills**, 99,429kt CO_2eq in 2018 in the EU27+UK[14] (Figure 2).

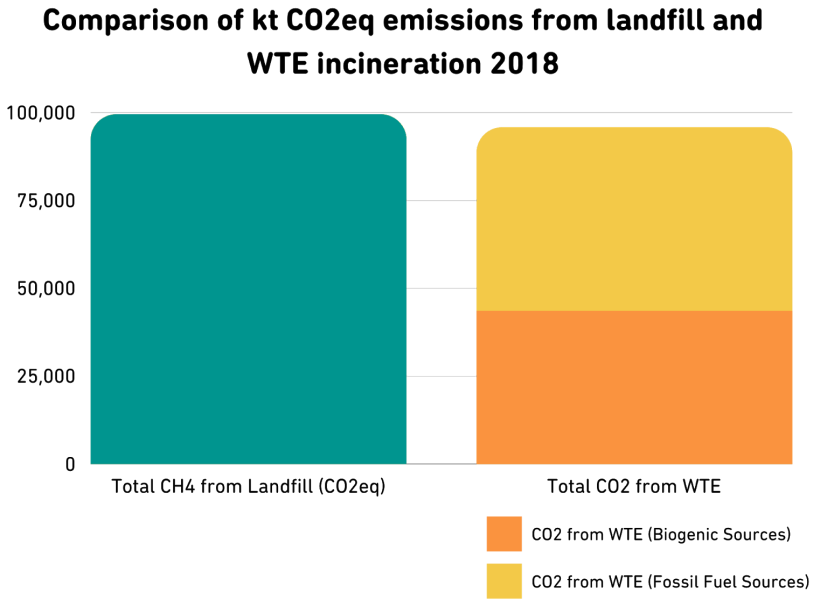

Figure 2: Comparison of kt CO_2 emissions from Landfill and WTE Incineration

The data shows that **since EU countries are sending more of their waste to WTE plants, a significant part of emissions from the waste sector are being shifted to the energy sector where the emissions from burning waste in WTE plants are reported**. This means that emissions from the management of waste are not in fact decreasing but simply being reported under a different sector as the reductions in landfill emissions are replaced with WTE emissions.

Date	Data area	CO_2 from WTE (Biogenic sources)	CO_2 from WTE (Fossil Fuel Sources)	Total CO_2 WTE (Biogenic sources + Fossil fuel sources)	Total CH4 from Landfill (CO_2eq)
1990	EU27+UK	2,659	2,714[15]	**5,373**	189,512
2018	EU27+UK	43,526	52,102	**95,628**	99,425

Table 2: Comparison of kt CO_2eq emissions from landfill and WTE incineration

[13] Although biogenic CO_2 is directly released into the atmosphere making a significant contribution to climate change, only the CO_2 emissions from fossil sources are generally considered – an important loophole in GHG emissions accountability.
[14] This data includes only CH4 emissions from landfills.
[15] This figure excludes data on emissions from Austria, France, Germany and Netherlands that did not report the data in 1990.

Impact of the new Landfill Directive

One of the key policies impacting future landfilling is the revised Landfill Directive.[16] A key new element brought about by this Directive is the landfill minimisation target which obliges Member States to limit the amount of municipal waste due to be landfilled to 10% or less by 2035, from the total municipal waste generated. Although the landfill minimisation target seems to be aligned with the strategic goals of the Waste Framework Directive such as the maximisation of preparation for recycling and reuse, and separate collection obligations for specific waste types, **the new obligation, if not accompanied by targets to limit WTE incineration, may facilitate the continued increase of CO_2 emissions from WTE plants..**

Moreover, since both incinerator and landfill climate impacts are very sensitive to the composition of the waste input, any change in the residual waste composition could further exacerbate the climate change impact of WTE facilities. For example, knowing that the average climate impacts of WTE are similar to those of landfills, small changes in the composition of plastic (for example) in the residual waste could push WTE impacts above landfilling - actually exacerbating the emissions from waste management rather than reducing them.[17] This is very likely to happen, on account of the so-called "concentration effect" in residual waste, for materials not targeted by separate collection, as it is the case for non-packaging plastics.

Conclusions

Waste-to-Energy is not a low-carbon solution for limiting the climate impacts of landfills, as some stakeholders claim. In fact, the emissions from WTE have been intensifying over the past decades due to policies encouraging WTE incineration.

The way that this data is currently being reported risks perpetuating the false notion that WTE incinerators have been successful in reducing the climate impacts of landfills. In reality, the WTE emissions are being moved from one sector to another, hiding the real climate impacts, and creating a net burden in ongoing efforts to decarbonise Europe.

Due to the global climate urgency we live in, it's clear that decarbonisation must happen across all sectors. Since WTE infrastructures are meant to last for 20-25 years, continued promotions of WTE incineration is delaying a much needed, and urgent, transition to genuinely low-carbon solutions.

Zero Waste Europe calls for **increased transparency and improved reporting on GHG emissions from WTE** that would include an addendum to the waste section of the UNFCCC inventory showing the estimated emissions from WTE that are currently only included under the energy sector. Once this reporting is achieved, **policy should reflect these findings to prioritise genuinely climate positive technologies for managing residual waste: such as Material Recovery and Biological Treatment (MRBT) instead.**

➔ For more information on MRBT read our paper: "Building a bridge strategy for residual waste. Material Recovery and Biological Treatment to manage residual waste within a circular economy"

[16] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L0850&from=EN
[17] https://www.zerowastescotland.org.uk/sites/default/files/ZWS%20%282020%29%20CC%20impacts%20of%20incineration%20TECHNICAL%20REPORT.pdf

Annex

CO_2 emissions in kt CO_2 from WTE incinerators and kt CO_2eq from Landfills in EU27+UK as reported in National Inventory Submissions to the UNFCCC, 2018.

Country	WTE Biomass CO_2	WTE Fossil CO_2	Landfill CO_2eq
Austria	748.75	1,963.60	1045
Belgium	1,586.63	1,767.29	772
Bulgaria	121.85	135.94	2741
Croatia	NA	NA	1772
Cyprus	NA	NA	505
Czechia	405.94	248.17	3743
Denmark	2,438.69	1,779.37	561
Estonia	68.95	68.95	200
Finland	1,087.98	837.21	1468
France	8,689.00	6,937.40	12,198
Germany	10,631.02	13,077.07	7579
Greece	NA	NA	3328
Hungary	262.91	630.28	2923
Ireland	584.62	317.68	693
Italy	2,157.40	5,819.98	13704
Latvia	104.26	130.95	382
Lithuania	89.10	96.10	662
Luxembourg	74.09	96.20	48
Malta	NA	NA	154
Netherlands	4,933.63	2,856.87	2480
Poland	411.68	5,212.92	8577
Portugal	606.20	473.10	3562
Romania	NA	NA	3639
Slovakia	85.21	154.49	1140
Slovenia	19.61	12.83	234
Spain	1,934.88	1,397.47	9931
Sweden	3,835.81	2,376.72	782
United Kingdom	2,753.40	5,785.90	14606

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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 planet.

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