THE ROLE OF WASTE DERIVED FUEL IN THE EU'S ENERGY AND RESOURCES TRANSITION

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RDF INDUSTRY GROUP

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EXECUTIVE SUMMARY

The Waste Derived Fuel supply chain plays an important role in helping to solve three major challenges the EU and wider Europe faces: reducing levels of methane and CO2 emissions to limit the rate of climate change; ensuring resources are used in a circular (rather than a linear) way, so their full value is realised; and reducing fossil energy consumption and supporting energy security. Current and future waste and energy-related policies must be designed to support the Waste Derived Fuel industry to maximise its potential towards these three global challenges. A summary of key messages relating to landfill policy, carbon taxation and carbon policies, and joined-up policy making are presented below.

Landfill Policy

- Methane is responsible for 30% of global warming. A significant source of methane in Europe is landfill, which is responsible for emitting ~80Mt CO_2e annually. The greatest potential for methane reduction in Europe is better solid waste management, with landfill diversion into energy from waste and recycling as the priority. Although small amounts of landfill capacity will always be needed for some specific waste streams (such as contaminated soils), progress towards the Landfill Directive targets is extremely patchy across Europe. Effective enforcement of existing policy must be prioritised to ensure the Landfill Directive meets its aims and objectives, before effort is spent designing new policies. Failure to do so risks new policies having a limited impact due to inadequate enforcement.

- All Member States must have sufficient landfill taxes and/or restrictions in place to reduce waste sent to landfill. Landfill tax increases should be linked to carbon tax liabilities, so that landfill and energy from waste price increases rise in line with each other and support the waste hierarchy. In simple terms, landfilling should always be taxed more heavily than any applicable energy from waste taxation.

- Landfill exemptions for specific waste streams should be removed, unless those specific waste streams have no other means of treatment. This will encourage these waste types to move up the waste hierarchy.

- All waste that can be recycled or sent to energy from waste must not be landfilled, including commercial and industrial waste, not just municipal solid waste. It is vital to reduce existing and future methane emissions from landfill through:
  - Communicating to the market an annually increasing landfill tax that is sufficiently high to move waste up the waste hierarchy into recycling and EfW facilities across Europe. This should eventually lead to a clearly scheduled landfill ban on combustible municipal solid waste and commercial and industrial waste.
  - Making the capture of methane from existing landfills mandatory.
  - Incentivising or mandating organic waste collections, to divert organic waste away from the residual waste stream.

Carbon Taxation Policy

- Policymakers must take a life cycle analysis approach when looking at greenhouse gas impacts. For energy from waste, this means considering avoided emissions (landfill diversion), and emissions substitutions (energy generated, recycling increases), as well as direct emissions (stack emissions).

- Energy from waste is well-placed to support the energy transition and contribute towards energy security. To support this, the import of fossil-intensive fuels such as coal, oil and gas must be taxed at higher rates than more sustainable fuels like waste derived fuels.

- Carbon taxation is fragmented across Europe. There are national trading schemes alongside the central EU Emissions Trading System, as well as many different types of carbon taxes that apply to energy from waste. These taxes all have different designs and in some countries are combined with incineration taxes as well. The fragmented nature of these taxes introduces an unlevel playing field across Europe. Fragmented carbon policy creates a barrier to effective and shared energy from waste utilisation. As such, policymakers need to ensure that all available energy from waste capacity is utilised in Europe, to avoid landfilling and reduce overall greenhouse gas emissions. This is especially important given Europe's commitment to the Global Methane Pledge, which is best served by reducing landfill. Energy from waste capacity in countries with national 'overcapacity' must not be artificially reduced, but utilised by countries with insufficient energy from waste capacity until all combustible waste is diverted from landfill across Europe. When energy from waste falls within scope of the EU's central Emissions Trading System in 2028, all other forms of carbon taxation must be removed to simplify the carbon taxation landscape.

- Carbon taxes should only be applied to the fossil carbon content of waste. This will maximise the reduction in fossil carbon in waste derived fuel to slow climate change and achieve a net-zero economy. Release of biogenic carbon to the atmosphere should not be covered by carbon taxes.

- There are several different methods for how fossil carbon can be measured and monitored, in order for energy from waste facilities to report this to carbon tax scheme operators. As each of these methods has its own pros and cons, individual operators will take commercial decisions into account when choosing which method is most advantageous for them. The carbon calculation methods open to energy from waste operators in carbon taxation schemes should be practical, affordable, and robust. Enough flexibility should be built into scheme design to allow for a choice between calculation and measurement approaches.

- Policymakers should consider whether fixed carbon rates are more suitable for carbon taxes affecting energy from waste facilities. This will provide greater certainty for energy from waste facilities determining how to pass through the costs of carbon taxes to waste producers, in line with the polluter pays principle, and provides local governments with more budgeting certainty. Fixed carbon rates could be replaced with market-based mechanisms using a phased approach.

- Pre-treatment of waste to reduce fossil carbon before energy from waste is feasible and should be incentivised, however, the presence of plastics particularly in residual waste is a wider problem which must be addressed by policymakers. Policies (such as Extended Producer Responsibility) around reduction, re-use and recycling of plastics must also be progressed to reduce this challenge for the whole waste sector.

- Recycled plastics can struggle to compete with cheap virgin plastics. Mandatory levels of recycled content in new plastics products should be used to support market demand, with further support from governments through good practice public procurement policies. Energy from waste also provides an affordable sustainable treatment route for sorting and recycling residues, an essential service to support a circular economy. Taxation of residue treatment through energy from waste taxation is therefore counterproductive and leads to an unlevel playing field compared with virgin materials.

- Given the significant contribution energy from waste makes to district heating and thus to reducing greenhouse gas emissions from heat, heat offtake from energy from waste facilities should be exempt from carbon taxation or provided with free allowances to incentivise and support the expansion of these sustainable heat sources.

- Carbon capture and storage will not be suitable for all facilities and energy from waste operators. However, carbon taxes must allow energy from waste operators to reduce their liabilities by exempting carbon that is permanently stored. If carbon capture and storage is to succeed, governments will need to ringfence a portion of carbon tax revenue for this purpose. Negative emissions from carbon capture and storage should also result in tradeable allowances.

Joined-Up Policies

- When waste-related policies are developed, especially those affecting waste derived fuel, the impact on related policies should be carefully assessed, for example: Fit for 55; Global Methane Pledge; REPowerEU; Circular Economy Action Plan; Waste Framework Directive; Landfill Directive and the EU Emissions Trading System.

- Resource efficiency policies should be prioritised in the same way as carbon taxes.

- With a move towards including energy from waste within scope of the UK and EU Emissions Trading System later this decade, it is vital that parts of the waste sector not subject to carbon taxes, i.e. landfill, are not inadvertently incentivised. Increasing the cost of energy from waste but not landfill will reduce the cost gap between these two treatment methods. Any policies which jeopardise landfill diversion contradict the waste hierarchy and risk leading to an increase in greenhouse gas emissions, exactly the opposite of what carbon taxes are aiming to do. Improvements to landfill diversion policies need to be introduced at the same time as the financial burden of carbon taxes kicks in, to prevent diversion to landfill.

- The EU (both as a whole political entity, and every individual Member State) has committed to carbon reduction targets under the Paris Agreement, while all EU Member States signed the Global Methane Pledge. Achieving these targets require European and global commitment, demanding a collaborative approach. To ensure there is cross border coordination on energy from waste capacity, all national carbon taxes and incineration taxes that apply to energy from waste should be removed when the scope of the EU Emissions Trading System includes this sector. This will ensure there is no double or even triple taxation on the industry and will allow a European-wide level playing field.

- A more holistic and consistent view is needed to make the transition to a more circular, climate-neutral economy that runs on sustainable energy. Policy must be designed in such a way that all available energy from waste capacity in Europe can be reached economically and technically in an easy way to achieve landfill diversion, methane reduction, energy-self-reliance and low-carbon district heating.

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ACRONYMS

ADEME	French Environment Agency (Agence de l'Environnement et de la Maîtrise de L'Energie)
AMS	Accelerator Mass Spectrometry
C&I	Commercial and Industrial
C14	Carbon-14 method
CCAC	Climate and Clean Air Coalition
CCS	Carbon Capture and Storage
CCU	Carbon Capture and Utilisation
CCUS	Carbon Capture Utilisation and Storage
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CV	Calorific Value
DESNZ	UK Department for Energy Security and Net Zero
ECJ	European Court of Justice
EEA	European Environment Agency
EfW	Energy from Waste
EPR	Extended Producer Responsibility
ETS	Emissions Trading Scheme
GHG	Greenhouse Gas
IBA	Incinerator Bottom Ash
IPCC	Intergovernmental Panel on Climate Change
LCA	Life Cycle Assessment
LNG	Liquid Natural Gas
LSC	Liquid Scintillation Counting
Mt	Million Tonnes
MSW	Municipal Solid Waste
RDF	Refuse Derived Fuel
SRF	Solid Recovered Fuel
UNEP	United Nations Environment Programme
WDF	Waste Derived Fuel
WFD	Waste Framework Directive

1 INTRODUCTION

1.1 The Waste-Derived Fuel Sector

Waste-derived fuel (WDF) is a generic term used to describe waste from municipal or commercial sources that is residual (i.e. non-recyclable mixed waste) and has undergone some processing that allows it to be burnt as a fuel to produce energy, diverting it from landfill. WDF is commonly classified into two main categories: RDF (Refuse Derived Fuel); and SRF (Solid Recovered Fuel); both of which undergo a treatment process to meet specific requirements for their end uses. The exact specification of the fuel depends on the facility utilising it, but the treatment process typically involves the removal of inert materials and recyclables such as metals and plastics, as well as additional processes such as drying, shredding to a uniform size, and reducing moisture content. RDF is commonly recovered in energy from waste (EfW) facilities to generate heat and power, whereas SRF is increasingly used as a secondary fuel for co-incineration for cement production.

Residual waste will always be left over from the separation of material for recycling, and incineration with EfW moves this non-recyclable residual material out of landfill. Many Member States do not have sufficient non-landfill residual waste treatment capacity, and as such transport waste to other Member States with excess capacity for EfW. Indeed, this practice is fully supported by the European Commission in its communication on Waste-to-Energy and the circular economy.[1] Studies have shown that exporting waste for EfW, and keeping it out of landfill, even over distances up to 9,000 km, helps to reduce net greenhouse gas (GHG) emissions.[2] For example, for every tonne of waste that is landfilled in the UK instead of incinerated for electricity and heat in Dutch facilities, an additional 261kg CO_2e is emitted.[3]

EfW is therefore not only providing an essential sanitary service to society, but contributing to an overall decrease in emissions when the whole waste management sector is considered.

Moreover, in light of energy security concerns resulting from the war in Ukraine and a subsequent move towards European self-sufficiency, it is paramount that all renewable energy capacity available in Europe is used. EfW is well placed to aid this transition and reduce reliance on natural gas from countries such as Russia and Qatar. EfW can also support carbon removals: the Intergovernmental Panel on Climate Change (IPCC) highlights the potential for EfW facilities equipped with carbon capture to provide energy with negative GHG emissions.[4]

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[1] European Commission, 'Communication from the Commission to the European Parliament, the Council, European Economic and Social Committee and the Committee of the Regions. The Role of Waste-to Energy in the Circular Economy.'

[2] Prognos and CE Delft (2022) CO_2 reduction potential in European Waste Management https://www.rdfindustrygroup.org.uk/resources/report-co2-reduction-potential-in-european-wastemanagement/

[3] RDF Industry Group (2019) Impacts of the Proposed Dutch Waste Import tax. August 2019. Available at: https://www.rdfindustrygroup.org.uk/resources/impacts-of-the-proposed-dutch-waste-import-tax/

[4] IPCC (2022) Climate Change 2022: Mitigation of Climate Change. Available at: https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_FullReport.pdf

1.2 Towards a Circular and Net-Zero Economy

The EfW sector straddles both the waste and resources fields of legislation and policy, as well as that of the energy sector. It therefore interacts with societal aims such as progressing towards a circular economy (i.e. changing models of production and consumption), as well as achieving a net-zero economy (i.e. cutting GHG emissions to as close to zero as possible and moving away from the exploitation of fossil resources). Both these aims need to be achieved to create a sustainable environment for life to thrive, but policies need to be well-designed so as not to hinder progress in one area for the sake of another. All countries in Europe, whether an EU Member State or not (as well as the EU as a whole political entity), have signed the Paris Agreement, committing to reduce GHG emissions by 45% from 2010 levels by 2030, in order to limit global warming to 1.5°C above pre-industrial levels.[5] The EU has also committed to net-zero by 2050, with its Green Deal transformation aiming to achieve this alongside the decoupling of economic growth from resource use and ensuring a fair and just transition. The more recent 'Fit for 55' package outlines progress towards these aims by 2030 (by reducing GHG emissions by at least 55% by 2030, compared to 1990 levels).[6]

Given the severe negative implications of failing to limit global warming to 1.5°C, the transition to a climate neutral society is urgent. It is a global problem, and not one any single nation can solve. GHGs pay no attention to borders and continental-scale solutions at a minimum are essential to address this challenge. Nevertheless, it is an opportunity to build a better future.
The Group fully supports this mission, and this document outlines key policy recommendations for the EfW and adjacent sectors which will help to achieve these goals.

[4] UN Climate Change Conference UK 2021. COP26 Outcomes. Available at: https://ukcop26.org/the-conference/cop26-outcomes/
[5] European Commission (2023) A European Green Deal. Available at: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

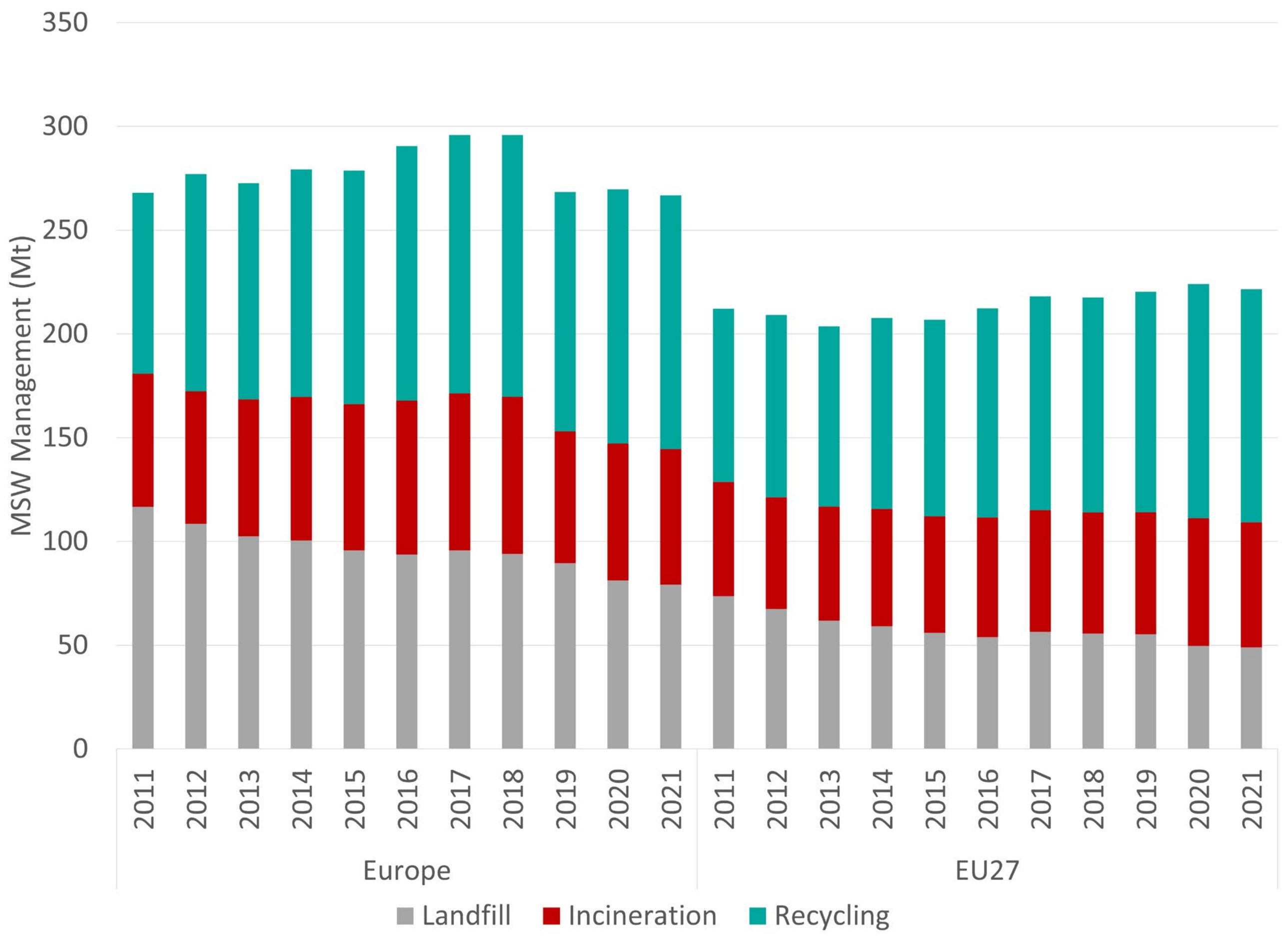
2 LANDFILL REDUCTION

2.1 Landfilling in Europe – An Overview

Landfill has historically been the dominant method of waste management in Europe, despite advances in recycling technologies and an increase in EfW capacity. In 2021 (the latest comprehensive dataset available on Eurostat), 32% and 27% of all municipal solid waste (MSW) was sent to landfill in Europe and the EU27, respectively. This equates to 49 million tonnes (Mt) and 79.1Mt (Figure 1).

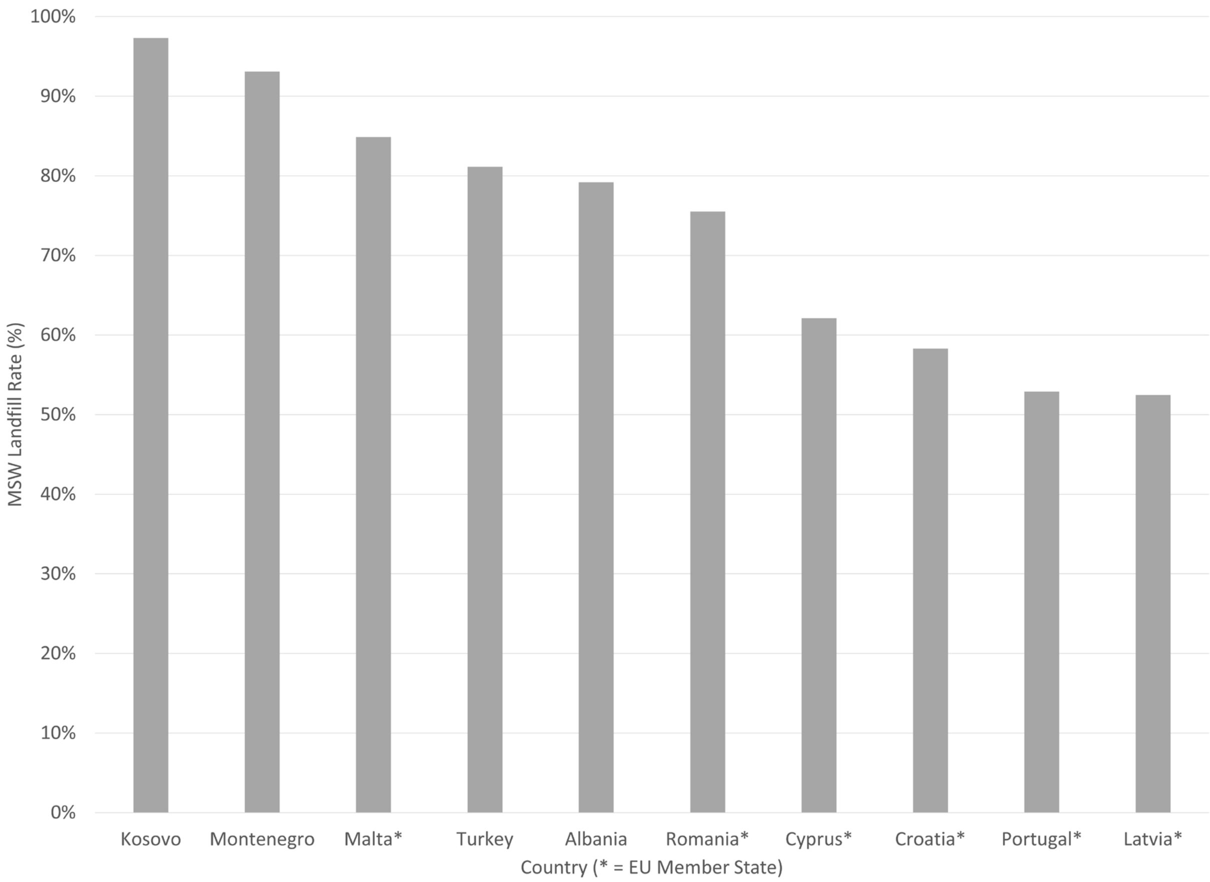
Many countries have successfully transitioned away from landfill through the use of landfill restriction policies – combined with the provision of EfW capacity and high recycling rates (see case study in Section 3.1). However, many are still lagging in this transition, with countries such as Kosovo, Montenegro, Malta and Turkey landfilling over 80% of their MSW. Figure 2 shows the European countries with the highest MSW landfill rates, some of which are EU Member States.

FIGURE 1: EUROPEAN TRENDS IN MSW MANAGEMENT, 2021[7]



[7] Eurostat (2024) Municipal waste by waste management operations. Available at: https://ec.europa.eu/eurostat/databrowser/view/env_wasmun/default/table?lang=en

FIGURE 2: EUROPEAN COUNTRIES WITH THE HIGHEST LANDFILL RATES, 2021[8]



Even in larger Member States such as Spain, France and Italy, large percentages of MSW are being landfilled annually (respectively 11.6Mt (52%), 8.9Mt (23%) and 5.6Mt (19%)). Landfill sits at the bottom of the waste management hierarchy and is the most environmentally damaging method of waste management due to its uncontrolled emissions of a range of GHGs, including methane. The European Defence Fund has stated that to date, methane emissions account for 30% of global warming.[9] It is recognised by the Climate and Clean Air Coalition (CCAC), United Nations Environment Programme (UNEP) and United Nations Global Methane Pledge that the greatest potential for methane emission reduction in Europe is in the waste sector.[10] Data shows that 70% of the European waste sector's emissions are caused by landfill (80Mt of CO_2e.).[11]

Waste (both MSW and also commercial and industrial (C&I) waste) which cannot be recycled can be diverted from landfill, in the form of EfW and co-incineration. EfW therefore moves waste up the hierarchy, providing a sanitary disposal of waste, whilst recovering energy and reducing the GHG impact of treatment and mainstream energy production. With some Member States having excess EfW capacity, and some not having enough, the European wide movement of residual waste is essential to maximise landfill diversion across the bloc.[12]

The following sections outline: landfill reduction policies in the EU to date; progress towards these targets; and the importance of reducing GHG emissions, particularly methane, from landfill.

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[8] Eurostat (2024) Municipal waste by waste management operations. Available at: https://ec.europa.eu/eurostat/databrowser/view/env_wasmun/default/table?lang=en

[9] Environmental Defence Fund (2024) Methane: A crucial opportunity in the climate fight. Available at: https://www.edf.org/climate/methane-crucial-opportunity-climate-fight

[10] United Nations Environment Programme (2021) Global Methane Assessment: Benefits and Cost of Mitigating Methane Emissions. https://www.unep.org/resources/report/global-methane-assessment-benefits-and-costs-mitigating-methane-emissions

[11] European Environment Agency (2024) Capturing the climate change mitigation benefits of circular economy and waste sector policies and measures. Available at: https://www.eea.europa.eu/publications/capturing-the-climate-change-mitigation

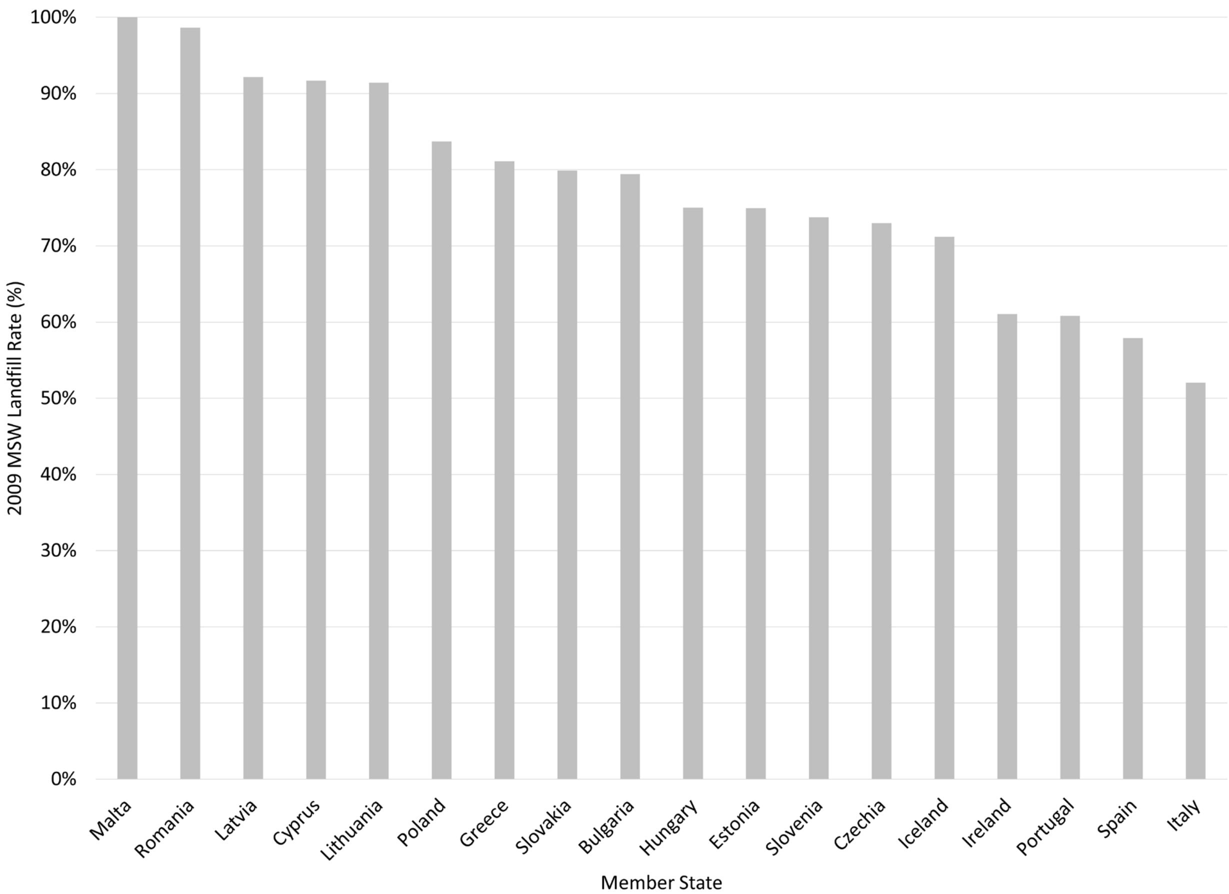
[12] This practice is fully supported by the Commission in its communication on Waste-to-Energy and the circular economy. Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions: The role of waste-to-energy in the circular economy. European Commission, 26/01/2017 COM (2017) 34 final

2.2 EU Landfill Policy – Targets and Progress

The EU Landfill Directive was first introduced in 1999, after decades of mounting concern over the environmental impact of landfill sites. The Landfill Directive required all Member States to reduce the amount of biodegradable waste going to landfill to 75% of their 1995 waste generation baseline by 2006. This target evolved to 50% by 2009, and 35% by 2020. Since then, the EU Landfill Directive has been updated several times, most recently in 2018 as part of an update to the Waste Framework Directive (WFD), setting a new target to limit the landfill rate to a maximum of 10% by 2035 (compared to 2019 levels, a target which previously was meant to be met by 2030).

Implementation and enforcement of the Landfill Directive has varied hugely across EU Member States, with some clearly struggling to meet the targets. In fact, many EU Member States did not even meet the 2009 landfill diversion target (see Figure 3). Others (Bulgaria, Cyprus, Greece, Latvia, Malta, and Romania) have been found to be non-compliant with elements of the Landfill Directive. Despite these historical non-compliances, no official derogations to the latest Landfill Directive target have been awarded to date.

FIGURE 3: EU MEMBER STATES THAT MISSED THE 2009 50% LANDFILL DIVERSION TARGET



Landfill Directive Compliance Timeline

Although landfill capacity will always be needed for some specific waste streams (such as contaminated soils), progress towards the Landfill Directive targets is extremely patchy across Europe.

2009 targets

Greece was given until 2013 to make the necessary steps to meet the target. Secondary action was taken by the European Court of Justice (ECJ) when this deadline was also missed. The ECJ imposed a penalty of €10 million and a daily fine of €30,000 until Greece fully complied with the Directive.[13]

2020 targets

The Commission is taking legal action against **Romania**, **Bulgaria**, **Croatia**, and **Slovakia** for non-compliance with regards to appropriate pre-treatment before landfill. Similar infringement procedures are taking place in relation to **Romania**, **Bulgaria**, **Cyprus**, **Italy** and **Slovenia** around closure and rehabilitation of non-compliant landfills. In 2018 **Greece** was granted a one-year extension to the target due to delays in the construction of necessary waste treatment facilities. In 2019, Malta and Romania were given three and four-year extensions respectively, predominantly due to the need for new waste management infrastructure and current lack of investment in the area. In total, 15 Member States were not fully meeting the obligation in the Landfill Directive to treat waste before landfilling.[14]

2035 targets

As of 2021 only nine Member States had reached the 10% landfill target set for 2035 (Austria, Belgium, Denmark, Finland, Germany, Luxembourg, Netherlands, Slovenia and Sweden, see Figure 4). Many of these low-landfill countries have high levels of EfW capacity, which enable them to divert residual waste from landfill. The EU's own early warning report highlighted the "serious gaps, delays and challenges" in reaching waste management targets, and stressed that derogations to the targets would delay environmental benefits of the circular economy.[15] It also stated that Member States are not using the full spectrum of economic measures to reduce landfilling. Bulgaria, Croatia, Cyprus, Czechia, Greece, Hungary, Latvia, Malta, Poland, Portugal, Romania, Slovakia and Spain are still far from the 2035 target.[16] Clearly more needs to be done to ensure the whole of the EU is meeting not just the future 2035 targets, but also meeting missed or postponed 2020 targets.

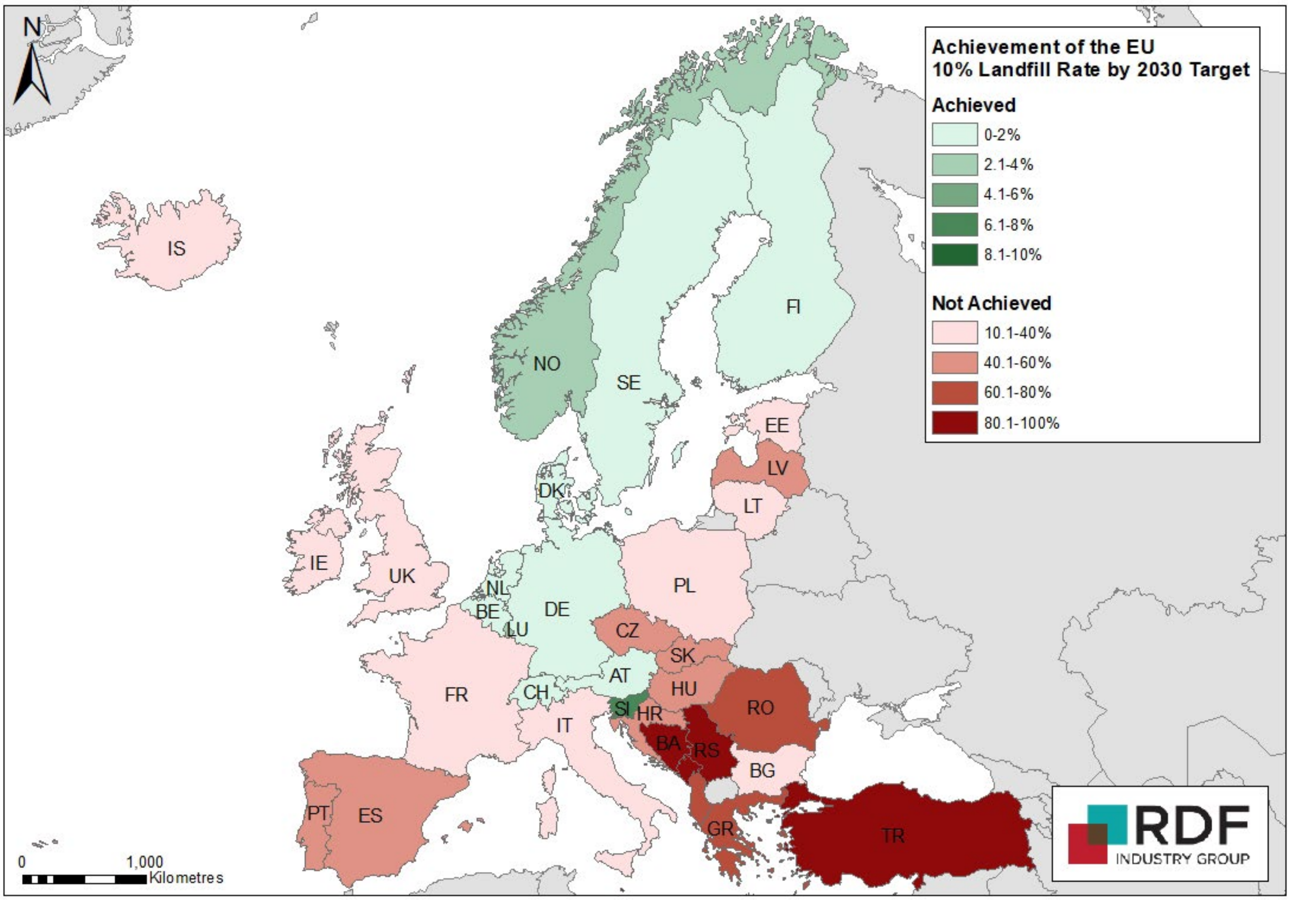
[13] BBC News (2016) Greece fined €10m for breaking EU waste rules. Available at: https://www.bbc.co.uk/news/world-europe-37296789

[14] Milieu (2017), 'Study to assess the implementation by the EU Member States of certain provisions of Directive 1999/31/EC on the landfill of waste'.

[15] European Commission (2023) Waste Early Warning Report. Available at: https://environment.ec.europa.eu/publications/waste-early-warning-report_en

[16] European Commission (2023) Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committees of the Regions. Identifying Member States at risk of not meeting the 2025 preparing for re-use and recycling target for municipal waste, the 2025 recycling target for packaging waste and the 2035 municipal waste landfilling reduction target. Available at: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023DC0304

FIGURE 4: EUROPEAN LANDFILL RATES, 2021[17]



Methane is responsible for 30% of global warming. A significant source of methane in Europe is landfill, which is responsible for emitting ~80Mt CO_2e annually. The greatest potential for methane reduction in Europe is better solid waste management, with landfill diversion into EfW and recycling as the priority. Although small amounts of landfill capacity will always be needed for some specific waste streams (such as contaminated soils), progress towards the Landfill Directive targets is extremely patchy across Europe. Effective enforcement of existing policy must be prioritised to ensure the Landfill Directive meets its aims and objectives, before effort is spent designing new policies. Failure to do so risks new policies having a limited impact due to inadequate enforcement.

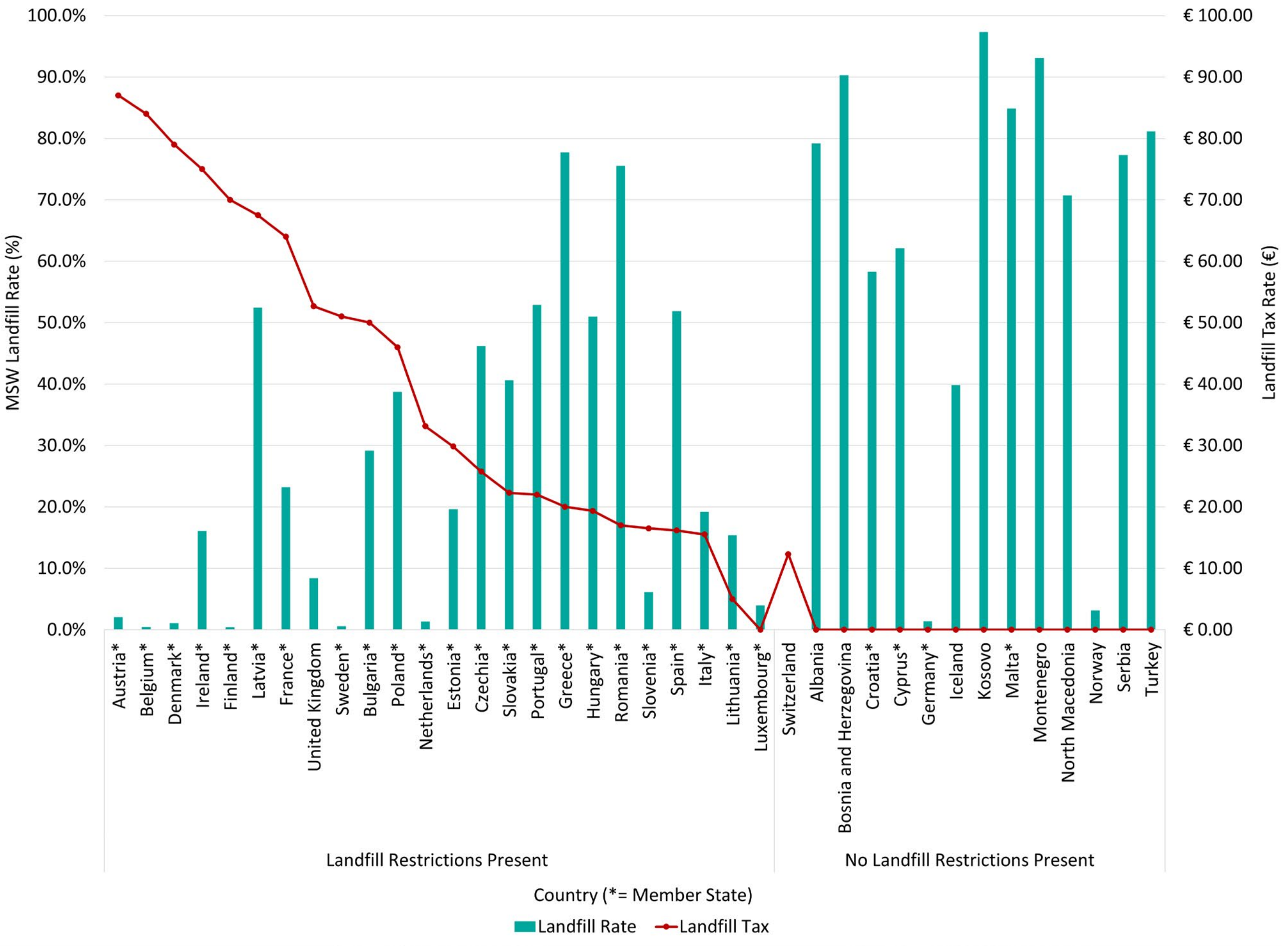
[17] Eurostat (2023) Municipal waste by waste management operations. Disposal – landfill and other (D1-D7, D12), Thousand Tonnes). Available at: https://ec.europa.eu/eurostat/databrowser/view/env_wasmun/default/table?lang=en

2.2.1 National Landfill Restrictions

To meet the Landfill Directive targets, Member States use a range of mechanisms to discourage landfill use. Examples include taxes, restrictions on the type of waste allowed into landfill (including pre-treatment requirements), and blanket bans.

Landfill taxes are usually charged as a tax per tonne of waste sent to landfill. This seeks to disincentivise its use by making landfill disproportionately expensive compared to other waste treatment options. 23 EU countries have landfill taxes in place, ranging from €5 per tonne (/t) in Lithuania to €120.52/t in the Wallonia region of Belgium. Figure 5 details the landfill tax per tonne in each country, compared to percentage of MSW landfilled in 2021 (the latest year of comprehensive data available on Eurostat). As can be seen in the graph, those nations with higher landfill taxes generally have lower landfill rates, and many of the nations with the highest rates of landfilling have no landfill tax in place.

FIGURE 5: 2021 EUROPEAN LANDFILL TAX RATES (€/TONNE) AND 2021 MSW LANDFILL RATE (%)*[18,19]



[18] CEWEP (2021) Landfill taxes and restrictions overview. Available at: https://www.cewep.eu/wp-content/uploads/2021/10/Landfill-taxes-and-restrictions-overview.pdf
[19] Eurostat (2024) Municipal waste by waste management operations. Disposal – landfill and other (D1-D7, D12), Thousand Tonnes). Available at: https://ec.europa.eu/eurostat/databrowser/view/env_wasmun/default/table?lang=en
[20] CEWEP (2021) Landfill Taxes and Restrictions. Available at: https://www.cewep.eu/landfill-taxes-and-restrictions/

Some countries also use restrictions on the type of material that is allowed to be landfilled to control landfill tonnages. In some countries, these restrictions are in place of landfill taxes, and in others, they are in addition to landfill taxes, as presented in Table 1.[20]

TABLE 1: EUROPEAN COUNTRIES WITH NO LANDFILL TAXES AND/ OR RESTRICTIONS INSTEAD OF TAXES[21]

Country	Landfill Tax in €/ Tonne	Landfill Tax Planned	Landfill Restrictions Implemented	Landfill Restrictions Planned
Albania	No known landfill tax	No known planned landfill tax	No known landfill restrictions	No known planned landfill restrictions
Bosnia	No known landfill tax	No known planned landfill tax	No known landfill restrictions	No known planned landfill restrictions
Bulgaria	According to a policy from 2011: 57 BGN/t in 2019 (30€) 95 BGN/t in 2020 and following years (50€) Note: Because of delay in waste treatment facilities, it has been discussed to increase the rate from 57 BGN to 95 BGN in three steps until 2022. Unclear what decision was made.	95 BGN/t.	No known landfill restrictions	No known planned landfill restrictions
Croatia	No tax.12.00 HRK/t (1.60 €) for municipal and non-hazardous technological waste	A fee is foreseen in the law on sustainable waste management, but the implementing act has not been adopted yet.	Limit on amount of biodegradable waste that can be deposited in the landfill (50% of amount deposited in landfill from 1st January 2017, 35% by 31st December 2020)	No known planned landfill restrictions
Cyprus	No known landfill tax	No known planned landfill tax	No known landfill restrictions	No known planned landfill restrictions

[20] CEWEP (2021) Landfill Taxes and Restrictions. Available at: https://www.cewep.eu/landfill-taxes-and-restrictions/
[21] CEWEP (2021) Landfill taxes and restrictions overview. Available at: https://www.cewep.eu/wp-content/uploads/2021/10/Landfill-taxes-and-restrictions-overview.pdf

Country	Landfill Tax in €/ Tonne	Landfill Tax Planned	Landfill Restrictions Implemented	Landfill Restrictions Planned
Germany	No known landfill tax	No known planned landfill tax	Administrative regulation (TASi) introduced in 1993 on untreated waste with TOC > 3 %, full implementation since 1.6.2005. There are exceptions for: - mechanical-biological treatment waste with a calorific value > 6600 kJ/kg dry substance - mechanically treated waste with a calorific value > 6600 kJ/kg dry substance and TOC > 8%	No known planned landfill restrictions
Iceland	The Icelandic Government has opted not to introduce taxes on landfill and incineration at present and has instead implemented a system of recycling fees through legislation passed in 2002.	No known planned landfill tax	No known landfill restrictions	No known planned landfill restrictions
Ireland	Landfill tax since 1.6.2002. 75 €/t since 1.7.2013.	No known planned landfill tax	No restrictions. Ireland aims to reduce to 0% direct disposal of unprocessed residual waste to landfills from 2016 onwards, and to achieve the Landfill Directive target on biodegradable waste by 2020.	No known planned landfill restrictions
Kosovo	No known landfill tax	No known planned landfill tax	No known landfill restrictions	No known planned landfill restrictions

Country	Landfill Tax in €/ Tonne	Landfill Tax Planned	Landfill Restrictions Implemented	Landfill Restrictions Planned
Luxembourg	No national tax. A fee of 8 €/t is applied by the municipality who owns the only landfill in Luxembourg open for municipal waste	No known planned landfill tax	No untreated MSW and organic waste (TOC > 5%).	No known planned landfill restrictions
Malta	No known landfill tax	No known planned landfill tax	No known landfill restrictions	No known planned landfill restrictions
Montenegro	No known landfill tax	No known planned landfill tax	No known landfill restrictions	No known planned landfill restrictions
North Macedonia	No known landfill tax	No known planned landfill tax	No known landfill restrictions	No known planned landfill restrictions
Norway	Introduced in 1999, repealed on 1.1.2015	No known planned landfill tax	No biodegradable waste and waste with TOC > 10% and LOI > 20%, introduced on 1.7.2009	No known planned landfill restrictions
Serbia	No known landfill tax	No known planned landfill tax	No known landfill restrictions	No known planned landfill restrictions
Turkey	No known landfill tax	No known planned landfill tax	No known landfill restrictions	No known planned landfill restrictions

Member States should communicate a clear escalator of landfill taxes for the coming decade. An annually climbing landfill tax should make it economically preferential to utilise all available recycling and EfW capacity across Europe. It is also important to link landfill tax rates to carbon tax liabilities, so waste management methods lower down the waste hierarchy are more heavily taxed than those above. Landfill tax escalators should culminate in a clearly communicated landfill ban on all combustible waste, which should be in place at the latest by 2035. Some nations offer exemptions to landfill restrictions for certain types of waste: in Ireland street sweepings are exempt from the landfill levy for example. These exemptions should be reviewed and only allowed where such materials cannot be treated in any other way.

All Member States must have sufficient landfill taxes and/or restrictions in place to reduce waste sent to landfill. Landfill tax increases should be linked to carbon tax liabilities, so that landfill and EfW price increases rise in line with each other and support the waste hierarchy. In simple terms, landfilling should always be taxed more heavily than any applicable EfW taxation.

Landfill exemptions for specific waste streams should be removed, unless those specific waste streams have no other means of treatment. This will encourage these waste types to move up the waste hierarchy.

2.3 Climate Change Impact of Landfills

When MSW is deposited in landfills, the organic material present decomposes to produce methane, CO_2 and other trace compounds. Landfills are therefore a significant source of methane, a GHG 86 times more potent than CO_2 over a twenty-year period. Methane is additionally a primary contributor to the formation of ground level ozone, which causes one million premature deaths annually around the world.[22] The largest sources of methane in the waste sector in Europe are solid waste disposal (70%), domestic and industrial wastewater treatment and discharge (21%) and to a lesser extent, biological treatment of solid waste (6%). These three sources represent almost all the 109Mt CO_2e of methane emissions in the waste sector (data from 2021).[23] Of this, landfilling in Europe is responsible for approximately 80Mt CO_2e of methane emissions.[24]

As aforementioned the CCAC and UNEP state that the largest potential for methane emission reduction in Europe is in the waste sector.[25] Based on this, the Global Methane Pledge was signed at COP26 in Glasgow by countries across Europe. The Pledge set a global target to reduce methane emissions by 30% by 2030. As the Pledge is specifically a global and not a national goal, it demands a collaborative approach between countries. Given that the EU is also subject to international climate change agreements such as the Paris Agreement and has a goal of reaching climate neutrality by 2050, addressing the contribution of landfill to methane emissions is paramount.

It is possible to capture part of the methane emissions from landfills and use the resulting gas to generate electricity, although many landfills currently do not do this. Policymakers should focus on simultaneously expanding the capture of methane gases from current landfills and reducing the amount of biodegradable waste going into landfills in the future. Biodegradable waste refers to any waste that can be broken down through anaerobic or aerobic decomposition, mainly consisting of organic materials. The environmental effects of depositing biodegradable waste in landfills are widely recognised. When biodegradable waste decomposes in landfill, it generates landfill gas, primarily composed of methane and CO_2. In contrast, polymers in other types of waste, like plastics, typically do not breakdown. Since methane is a significant contributor to climate change and GHG emissions, reducing the amount of biodegradable waste to landfill is a major environmental priority. This can

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22 United Nations Environment Programme (2023) Methane emissions are driving climate change. Here's now to reduce them. Available at: https://www.unep.org/news-and-stories/story/methane-emissions-are-driving-climate-change-heres-how-reduce-them
23 European Environment Agency (2024) Historical and projected greenhouse gas emissions for the waste sector, MtCO_2e, EU-27. Available at: https://www.eea.europa.eu/data-and-maps/figures/historical-and-projected-greenhouse-gas
24 European Environment Agency (2022) Methane emissions
25 United Nations Environment Programme and Climate and Clean Air Coalition (2021) Global methane assessment: Benefits and costs of mitigating methane emissions. Available at: https://www.unep.org/resources/report/global-methane-assessment-benefits-and-costs-mitigating-methane-emissions

be done either through incentivising or mandating organic waste collections (to stop organic waste from entering the residual waste stream in the first place); or prohibiting biodegradable municipal waste from being sent to landfills. Although landfill bans have begun to be implemented across Europe, these have focused on MSW. It is pivotal that governments consider extending landfill bans to non-municipal biodegradable waste as well. Whether the waste is municipal or not in origin does not alter the resulting environmental and climate impacts of landfill, nor does it mean the waste hierarchy does not apply to the waste, therefore non-municipal biodegradable waste should not be treated any differently. There is also a risk of incentivising the misclassification of waste if the ban applies to municipal waste only.

All waste that can be recycled or sent to EfW must not be landfilled, including C&I waste, not just MSW. It is vital to reduce existing and future methane emissions from landfill through:

- **Communicating to the market an annually increasing landfill tax that is sufficiently high to move waste up the waste hierarchy into recycling and EfW facilities across Europe. This should eventually lead to a clearly scheduled landfill ban on combustible municipal solid waste and commercial and industrial waste.**
- **Making the capture of methane from existing landfills mandatory.**
- **Incentivising or mandating organic waste collections, to divert organic waste away from the residual waste stream.**

3 TRANSITIONING FROM LANDFILL TO EFW – CASE STUDIES

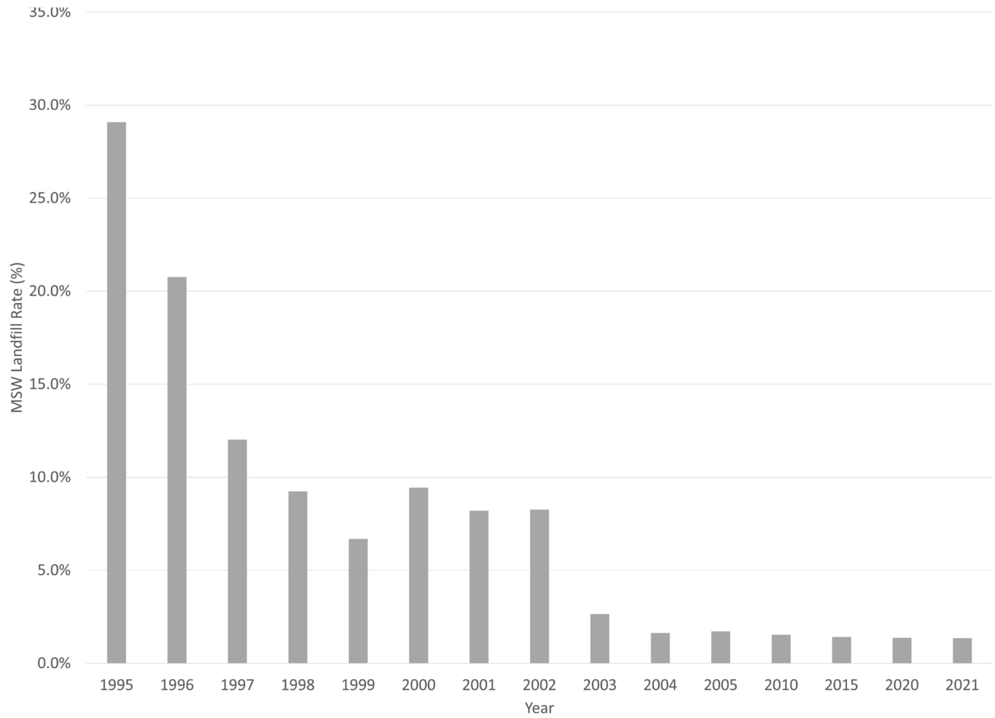
3.1 The Netherlands – EfW Case Study

The Netherlands is at the forefront of sustainable waste management in the EU. In the 1980s a lack of both landfill and EfW capacity were identified as critical waste management issues. A fundamental shift occurred away from landfill towards recycling and EfW, with landfill only allowed in certain circumstances. Further increases in recycling rates have led to spare EfW capacity which is shared more widely amongst European countries, allowing the diversion of European waste from landfill. This utilises existing infrastructure and has a net GHG benefit that helps to reduce emissions across the continent. Other countries with a comparable waste management profile can also help to achieve European-wide climate goals in a similar way.

Landfill Diversion

A substantial reduction in landfilled waste was successfully achieved through a comprehensive introduction of both landfill bans and taxes. A landfill ban was introduced in the Netherlands in 1995 and initially covered 35 waste categories. By 2023 this had expanded to 64 categories. At the same time a landfill tax of €13/t on waste not covered by the ban, provided an economic disincentive for landfill use. The tax increased sharply in 2002 and reached the highest level in Europe by 2010, standing at €38.58/t as of 2023. The impact of these measures is evident in the significant decrease in the landfill rate from 29% in 1995 to 1.4% in 2021.[26] (Figure 7). Alongside this, there was a reduction in landfill sites from 80 in 1992 to 19 in 2019.[27]

FIGURE 6: DUTCH LANDFILL RATE



DECREASE IN THE LANDFILL RATE FROM **29%** IN **1995** TO **1.4%** IN **2021**

REDUCTION IN LANDFILL SITES FROM **80** IN **1992** TO **19** IN **2019**

As a consequence, landfill-related methane emissions declined from 13.7Mt CO_2eq in 1990 to 2.2Mt by 2020, equating to 79% of national methane emission reductions from all industrial sectors.[28] The remaining landfill emissions are from historically landfilled waste.

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[26] Calculated from latest MSW generated and landfilled figures available on Eurostat. Eurostat (2024) Municipal waste by waste management operations. Available at: https://ec.europa.eu/eurostat/databrowser/view/env_wasmun/default/table?lang=en

[27] European Union European Regional Development Fund (2019) Landfill management in the Netherlands. Dutch policy regarding landfill mining. Available at: https://vb.nweurope.eu/media/8189/7-rawfill-workshop-leppe-2019_dutch-policy-regarding-landfill-mining-fons-van-de-sande.pdf

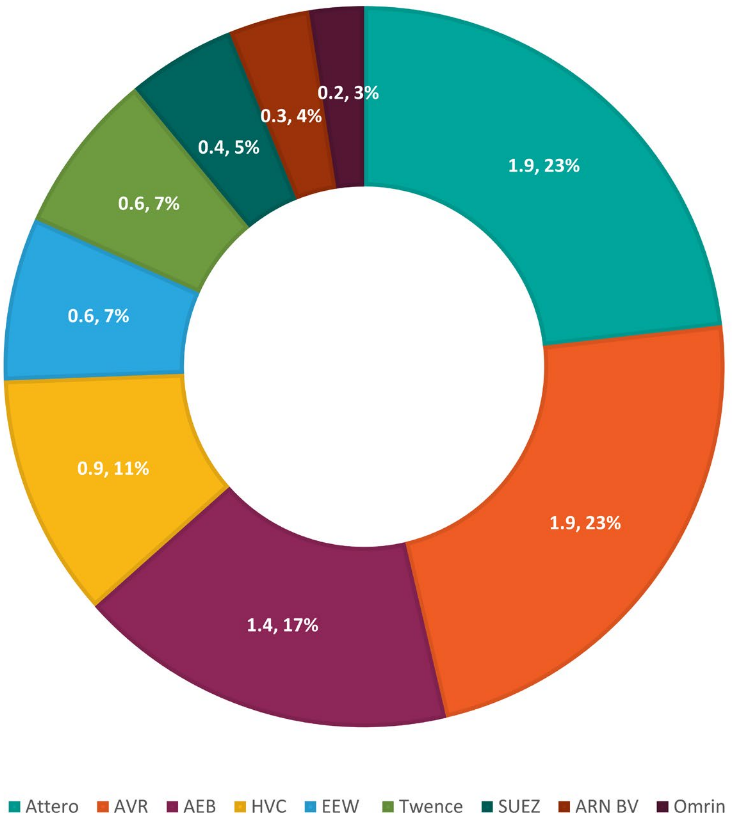
[28] United Nations Climate Change (2022) Netherlands. 2022 National Inventory Report (NIR). Page 245. Available at: https://unfccc.int/documents/461906?gad_source=1&gclid=Cj0KCQjwzZmwBhD8ARIsAH4v1gUrz1i-R3WPO-SASVIB9yAi5hUuPuqYnvneZI2wkFTligu8C50Y3XYaAoHPEALw_wcB

EfW Capacity Sharing

As landfill rates reduced, EfW capacity in the Netherlands grew. By 2011 the success of domestic recycling initiatives led to a reduction in domestic waste and to effectively utilise EfW capacity, the Netherlands began importing WDF. The Netherlands imported 1.1Mt of WDF in 2021. For most of the 2010s the majority of this was from the UK, but this share decreased from 91% in 2016 to 44% in 2021.[29] The Netherlands now also imports WDF from countries such as Italy, Iceland and France. The reduction in imports from the UK has been primarily driven by the expansion of the Dutch waste disposal tax in 2020, to include imported waste destined for EfW, which currently stands at €39.23/t.[30]

There are currently 13 Dutch EfW facilities with an annual capacity of 8Mt. Three major operators (Attero, AVR and AEB), hold the majority of the country's total capacity (63%) (Figure 7). Given this well-established capacity, gate fees[31] (the price the facility charges for taking the waste) are generally competitive.[32]

FIGURE 7: DUTCH EFW CAPACITY (MT/PA, %)



[29] Eurostat (2024) Waste Shipments Across Borders. Available at: https://ec.europa.eu/eurostat/web/waste/data
[30] Data provided by Dutch RDF Industry Group Member.
[31] A "gate fee" is the charge levied by treatment facilities to dispose of waste.
[32] RDF Industry Group (2022) The future of RDF export market in Europe. Available at: https://www.rdfindustrygroup.org.uk/resources/the-future-of-rdf-export-market-in-europe/

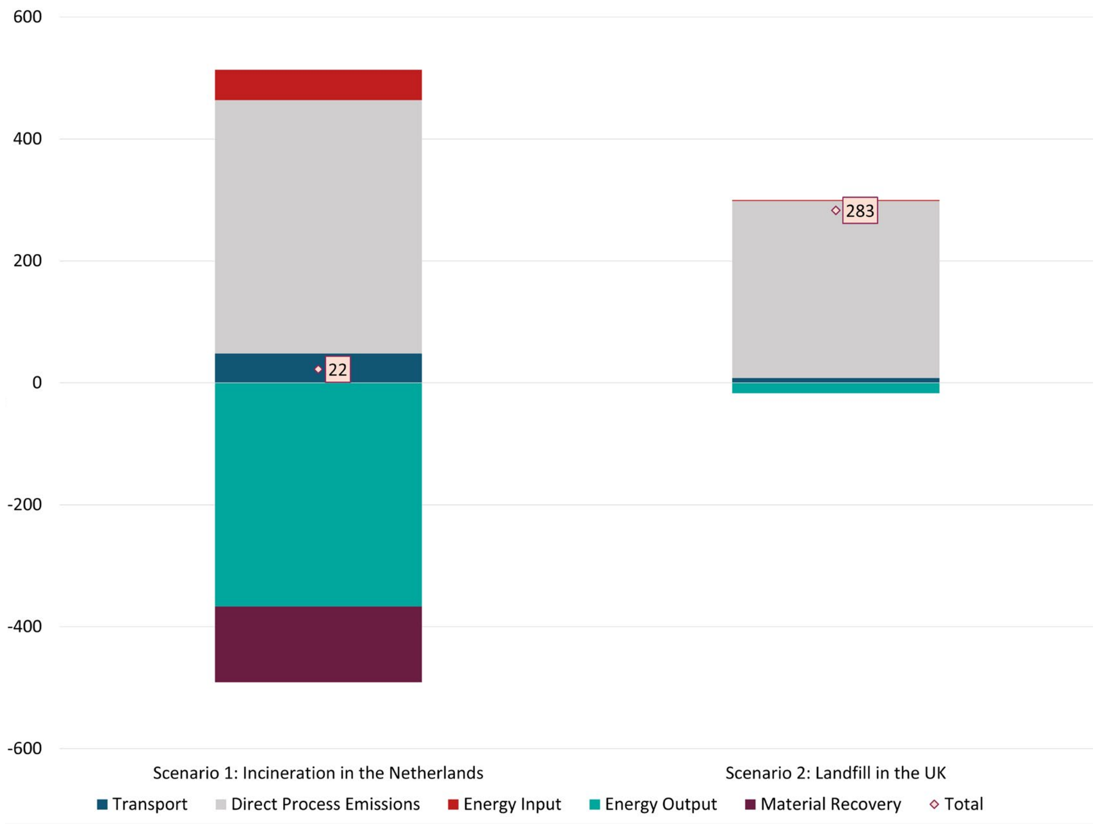
EU-Wide Emissions Reduction

The Dutch success story goes beyond landfill diversion: total emissions from the waste sector reduced by 81% between 1990 and 2019.[33] This was partly driven by landfill diversion, and partly due to higher recycling rates.[34,35]

To further drive decarbonisation of the waste sector, an EfW-specific carbon tax was introduced in 2021. The tax is currently set at €63.49/t of fossil carbon emitted past an agreed ceiling, with the agreed ceiling decreasing and the carbon cost increasing over time. This tax acts as an added cost on top of the incineration tax which currently stands at €39.23/t of waste, leading to an increasingly unlevel playing field within Europe.

Dutch EfW facilities are providing capacity to countries such as the UK which are still landfilling residual waste. As shown in Figure 9, there is a net GHG benefit for every tonne of waste diverted from landfill in this way. As the Netherlands has decided to stop its national land-based gas exploration due to earthquakes, the country has become dependent on importing 20 billion m^3 of Liquid Natural Gas (LNG) from countries such as the United States and Qatar. The Government realises that EfW plants that produce district heating and industrial steam from imported WDF, replace the import of fossil LNG are environmentally beneficial. With the implementation of both an import tax on WDF and a carbon tax on EfW, ongoing discussions are focused on eliminating the import tax. This would allow the Netherlands to utilise its spare capacity more effectively, whilst still incentivising the reduction in GHG emissions from the EfW industry.

FIGURE 8: DUTCH EFW VS UK LANDFILL EMISSIONS PER TONNE OF WASTE



[33] CO_2e, The Netherlands Ministry of Economic Affairs and Climate Policy (2019) The Netherlands fourth biennial report under the United Nations Framework Convention on Climate Change. Available at: https://unfccc.int/sites/default/files/resource/NLD%20 4th%20Biennial%20Report%20Final%20version%2018dec19.pdf

[34] The decomposition of organic components in landfill releases methane, a significant contributor to climate change and 86 times more potent than CO_2 over a 20-year period European Commission (2024) Methane Emissions. Available at: https://energy.ec.europa.eu/topics/oil-gas-and-coal/methane-emissions_en#:~:text=On%20a%20100%2Dyear%20timescale,on%20a%20 20%2Dyear%20timescale.

[35] European Union European Regional Development Fund (2018) Landfill Management in the Netherlands. Available at: https://www.eea.europa.eu/publications/managing-municipal-solid-waste/netherlands-municipal-waste-management

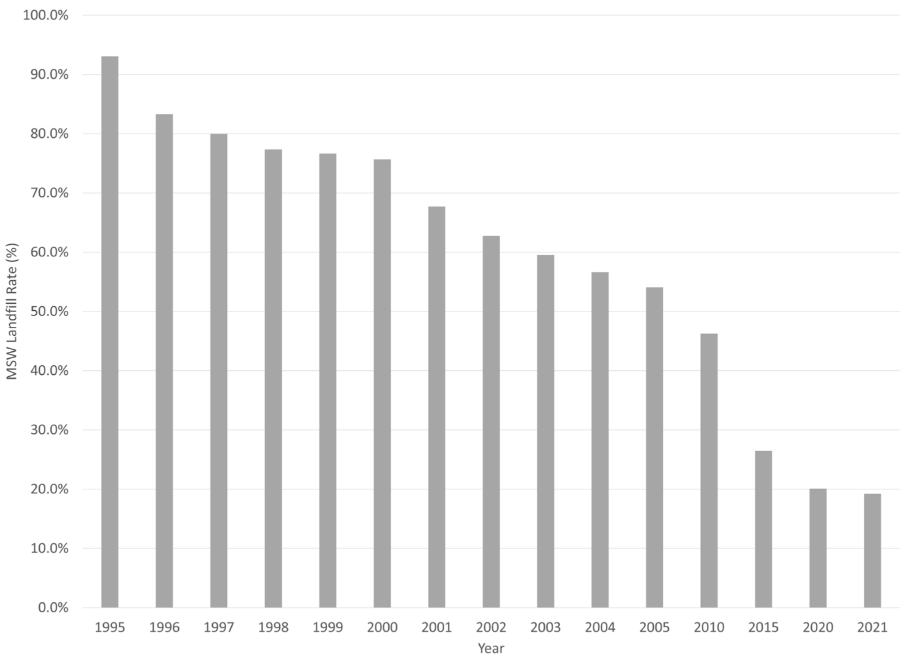
3.2 Italian WDF Case Study

Italy is a prime example of an EU nation that is in the process of transitioning from being reliant on landfill but does not yet have the non-landfill capacity in place to treat all its residual waste. Complicated tendering and management processes around landfill and EfW contribute to uncertainty around national infrastructure. To help bridge this gap, WDF production is being used to take advantage of excess EfW capacity in northern Europe. This contributes to landfill diversion and its associated GHG savings, to reduce the climate impact of the Italian waste sector.

In the 1990s Italy had a high number of illegal landfill sites. This had a significant negative impact on the environment and human health.[36] In 1996 Italy introduced a landfill tax alongside wider waste legislation, prompting a shift towards compliant treatment routes and away from landfill.[37] The landfill tax currently ranges from €5.20/t to €25.82/t depending on the region.[38] Regional fixed separate collection objectives also play a crucial role in driving landfill diversion, by imposing a cumulative 20% addition to the landfill tax for municipalities failing to meet collection goals.[39] Further attempts at restricting landfill through a planned ban on waste with a calorific value (CV) greater than 13MJ/kg, faced delays and eventual cancellation in 2016/17. The landfill rate has declined from 93% in 1995 to 19% in 2021 (Figure 10).[40] The number of active landfill sites has also slightly reduced from 180 in the early 2000s to 117 currently.

The capacity and cost of landfilling is also complex. Despite the relatively low landfill tax, landfill is general is expensive due to high gate fees caused by limited capacities in certain regions. Regardless of the fact Italy is on track to just meet the 2035 10% landfill target, further diversion of waste from landfill is hampered by a lack of alternative treatment routes. Alongside this, there is a greater amount of landfilling in the South of the country than the North, as access to alternatives is more limited in the South.

FIGURE 9: ITALIAN LANDFILL RATE

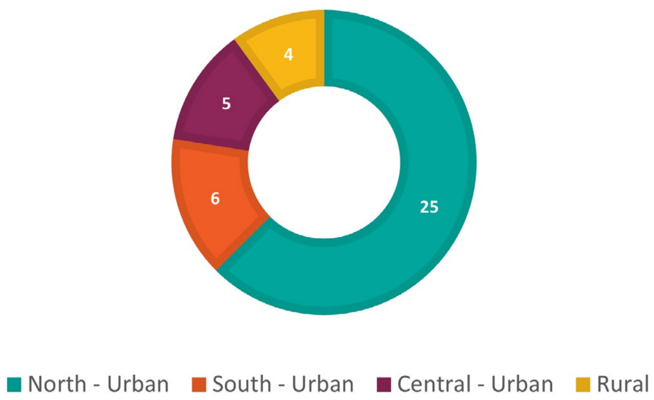


[36] Senior, K. and Mazza, A. (2004) 'Italian "Triangle of death" linked to waste crisis', The Lancet Oncology, 5(9), pp. 525–527. doi:10.1016/s1470-2045(04)01561-x.
[37] European Environment Agency (2013) Municipal Waste Management in Italy. Available at: https://www.eea.europa.eu/publications/managing-municipal-solid-waste/italy-municipal-waste-management#:~:text=In%20Italy%20the%20landfill%20tax,the%20regions%20by%20landfill%20operators
[38] CEWEP (2021) Landfill taxes and restrictions. Available at: https://www.cewep.eu/landfill-taxes-and-restrictions/
[39] European Environment Agency (2022) Early warning assessment related to the 2025 targets for municipal waste and packaging waste. Available at: https://www.eea.europa.eu/publications/many-eu-member-states/italy
[40] Calculated from latest MSW generated and landfilled figures available on Eurostat. Eurostat (2024) Municipal waste by waste management operations. Available at: https://ec.europa.eu/eurostat/databrowser/view/env_wasmun/default/table?lang=en

Alternative Residual Waste Treatment Capacity

As landfill rates have reduced, EfW capacity in Italy has increased and in 2021 a near-equal amount of MSW was landfilled as was incinerated. There are currently 37 Italian EfW facilities, with an annual authorised capacity of 7.1Mt, 90% of which are located in urban areas (Figure 10).

FIGURE 10: NUMBER OF ITALIAN EFW FACILITIES BY GEOGRAPHY



EfW plants have very few operators (mostly private), with Hera SPA and A2A SPA holding a combined quarter of all capacity.[43] Gate fees range on a regional basis from €64/t in Campania to €112/t in Veneto.[44] The EfW sector in Italy is highly politicised, and this has impacted on future capacity development. Tendering processes can be complicated, with unfavorable contract terms for developers. A proposed EfW facility in Rome is currently out to tender, after many years of political battles surrounding its development.[45] Sicily has chosen to extend the life of its landfills until two proposed EfW plants come online. There are other facilities in the pipeline in Northern and Central Italy. Although Italy had an overall recycling rate of ~52% in 2021, rates are lower in the South where reliance on landfill is greater, and so further solutions are needed.[46] Analysis has shown that Central and Southern Italy will still not have sufficient EfW capacity by 2035 to accommodate national waste arisings, with Northern Italy also slightly short.[47]

Exports of WDF have allowed Italy to access surplus EfW capacity, particularly in Northern Europe. Italy began exporting WDF in 2011, and although it began importing small amounts of WDF in 2019, it remains a net exporter with latest figures noting 969,000 tonnes were exported in 2021 (Figure 11). Austria has traditionally been the main off-taker with an average of 23% (ranging from highs of 46% in 2014, to lows of 7% in 2011). In the last two years, imports from Italy into Sweden and the Netherlands have grown. The high domestic landfill gate fees mean that even with the additional costs of production and transport distances, export of WDF from Italy is financially very competitive.

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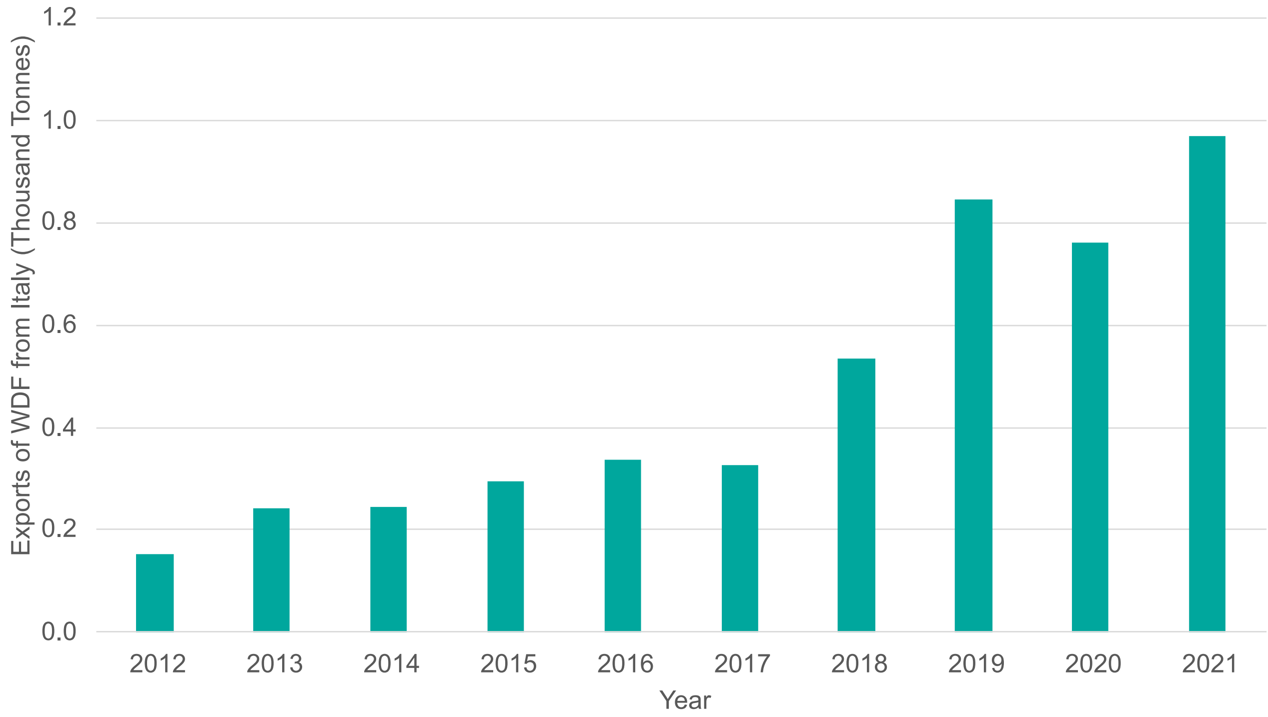
[43] Footprint Services (2021) EU EfW Facilities. Available at: https://footprintservices.co/wp-content/uploads/2021/08/EU-Energy-from-Waste-Facilities-Italy.pdf
[44] Massarutto, A., Moretto, A., and Favot, A.(2019) Incinerators in Italy: an overview in light of the Circular Economy Model. Economica Pubblica, The Italian Journal of Public Economics. Italy, CIRIEC.69-88.
[45] https://www.endswasteandbioenergy.com/article/1848360/rome-launches-tender-process-efw-plant
[46] Calculated from latest Municipal Waste by Waste Management Operations figures available on Eurostat. at: https://ec.europa.eu/eurostat/databrowser/view/env_wasmun/default/table?lang=en
[47] Data provided by Herambiente, 2021 data, Utilitalia internal report
[48] Eurostat (2024) Waste Shipments Across Borders. Available at: https://ec.europa.eu/eurostat/web/waste/data

FIGURE 11: ITALIAN WDF EXPORT VOLUMES[48]

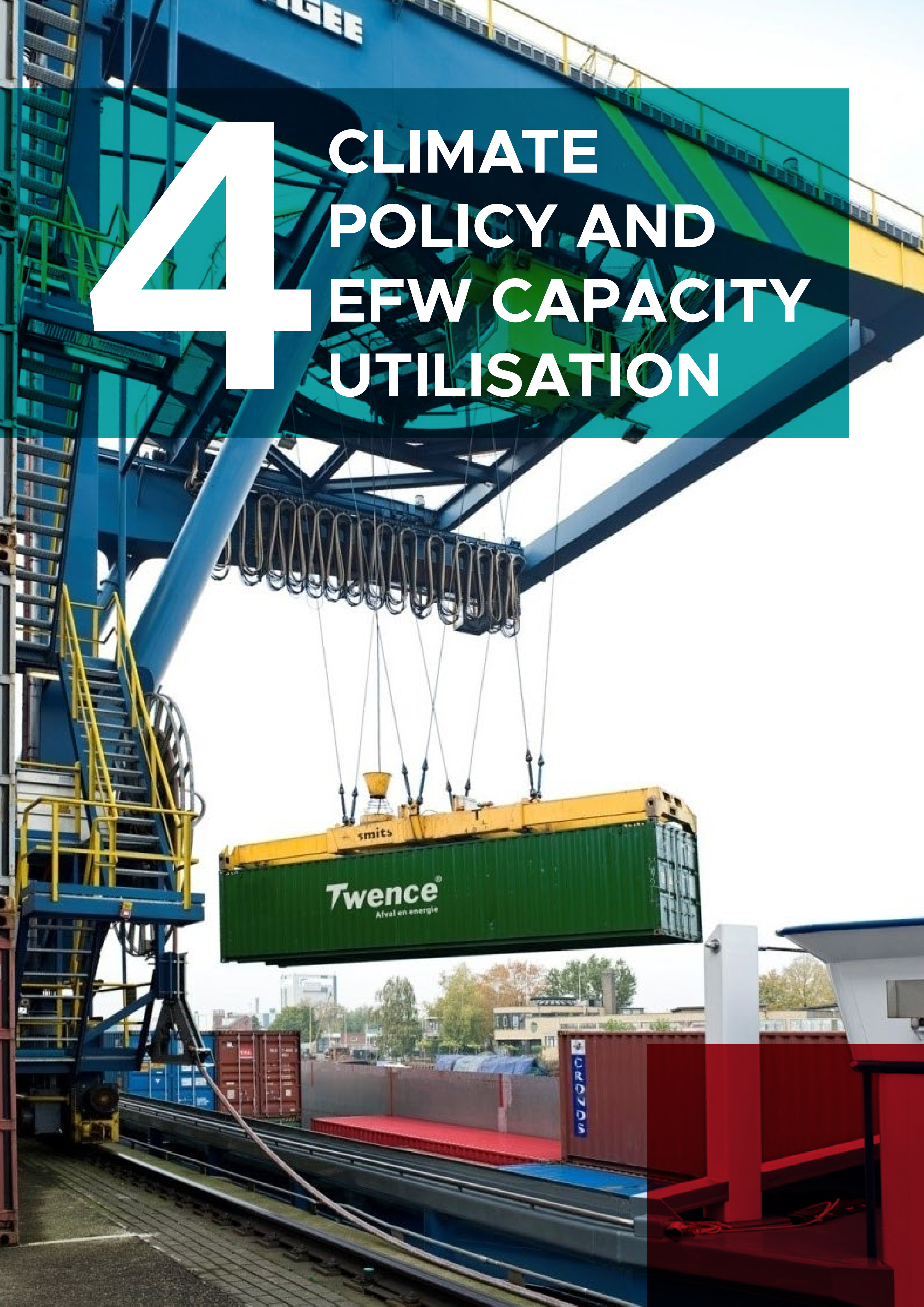


EU-Wide Emissions Reduction

Currently the waste sector in Italy accounts for 4.8% of the country's overall GHG emissions. Emissions from the waste sector have fluctuated, but there has been an overall increase of 6.3% from 1990 to 2021, predominantly driven by the disposal of solid waste, which accounts for 77.6% of sectoral emissions.[49] A country such as Italy, with more to do on landfill diversion and a complicated EfW environment, would significantly benefit from investing further in WDF production. This will allow domestic capacity to develop, whilst utilising capacity elsewhere and allowing landfill diversion and its associated GHG savings to reduce the climate impact of the Italian waste sector soon rather than later. This in turn would provide an economic benefit to the Italian economy through a reduction in fines for non-compliance with EU Directives. It would also help Northern European countries with colder climates replace the heat in their district heating networks with that from more sustainable low-carbon sources such as EfW.

[48] Eurostat (2024) Waste Shipments Across Borders. Available at: https://ec.europa.eu/eurostat/web/waste/data
[49] ISPRA (2023) Italian Greenhouse Gas Inventory 1990-2021 National Inventory Report 2023. Available at: https://www.isprambiente.gov.it/files2023/pubblicazioni/rapporti/rapporto_383_2023.pdf

4 CLIMATE POLICY AND EFW CAPACITY UTILISATION



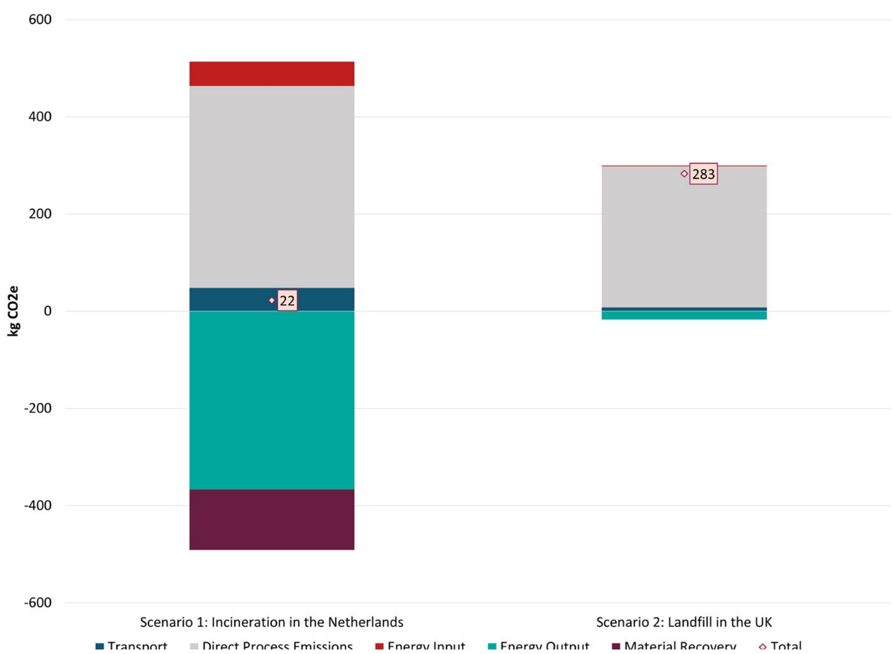
4.1 Climate Impact of EfW

Residual waste will always be left over from the separation of material for recycling, as by definition, it should be solely composed of waste that cannot be reused or recycled. Life Cycle Assessment (LCA) is an evaluation process that allows the environmental impacts and benefits of providing and using goods and services to be determined.[50] Generally, the results of a range of waste management LCAs show the benefits of material recycling, and that a well-operated EfW facility has distinct environmental advantages over landfill. The negative impacts of EfW come from the emissions produced during its processes: through the use of energy in the facility itself and direct stack (chimney) emissions to the air.

The environmental benefits of EfW come from a range of different areas. EfW facilities produce energy in the form of electricity and for many facilities, also in the form of heat. This creates a GHG benefit as it displaces carbon-intensive sources of energy production such as coal or gas. In recent years, improvements have also been made in the thermal efficiency of EfW. Some facilities also undertake pre-treatment of the waste before it enters the EfW process, diverting plastics and metals from the residual stream into recycling and shifting this material up the waste hierarchy. The recycling of this material also has a GHG benefit, as it reduces the demand for virgin materials and subsequently the energy needed to create new products. Manufacturing materials from recyclate is often far less energy intensive than manufacturing that begins with raw, generally non-renewable materials. Metals are also recovered and recycled from the incinerator bottom ash (IBA). IBA is the material left once the EfW process is complete, and IBA itself can also be used in the construction industry.

However, this is not the whole story. EfW provides an essential sanitary treatment route for residual waste which otherwise would be landfilled. It is therefore important to consider an LCA approach which not only looks at the overall net benefit of GHG emissions from an EfW facility, but also to compare this to what would otherwise happen to the waste. Studies have shown that exporting waste for EfW and keeping it out of landfill, even over distances up to 9,000 km, has a net GHG benefit. For example, for every tonne of waste exported for efficient incineration for electricity and heat in Dutch facilities, rather than being landfilled in the UK, 261kg of CO_2e emissions are avoided (Figure 12).

FIGURE 12: DUTCH EFW VS UK LANDFILL EMISSIONS PER TONNE OF WASTE



[50] Burnley, Stephen John (2019). A life cycle assessment of energy from waste and recycling in a post-carbon future.Detritus,05pp. 150–162.

For every tonne of waste exported for efficient incineration for electricity and heat in Dutch facilities, rather than being landfilled in the UK, 261kg CO_2e emissions are avoided.

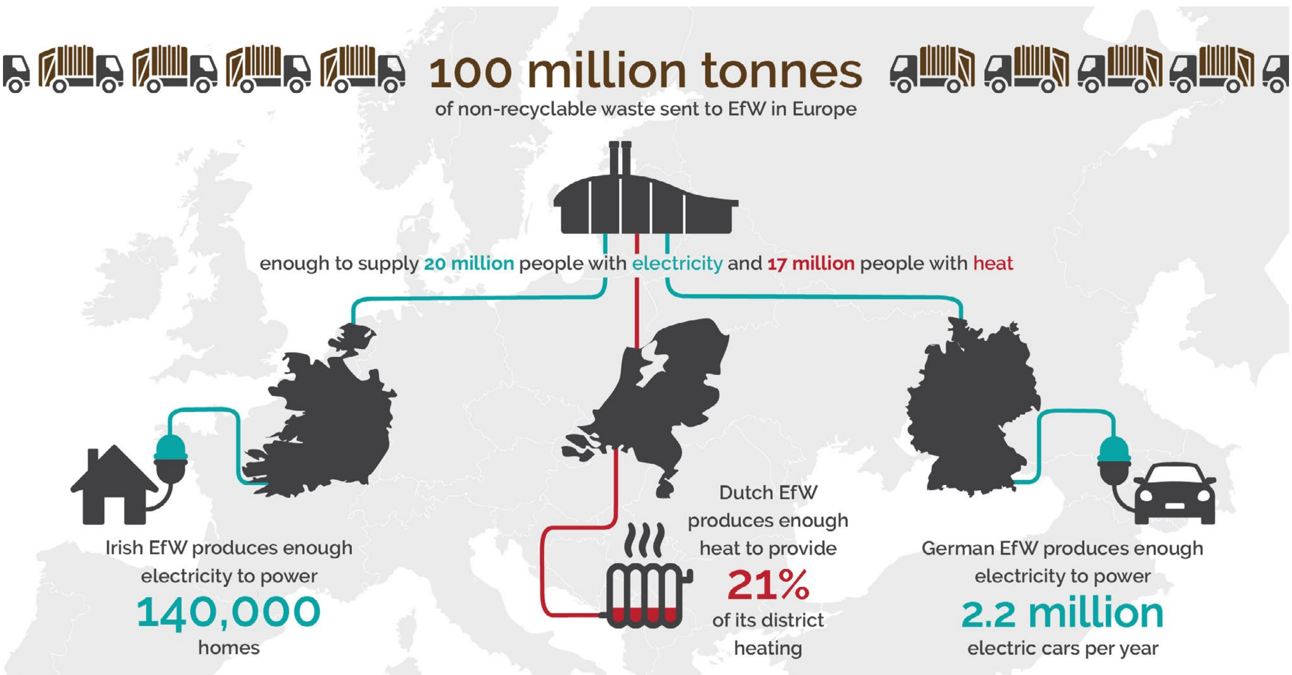
This is equivalent to the carbon sequestered by over 4 tree seedlings grown for 10 years.

Policymakers must take an LCA approach when looking at GHG impacts. For EfW, this means considering avoided emissions (landfill diversion), and emissions substitutions (energy generated, recycling increases), as well as direct emissions (stack emissions).

4.2 Energy Security

An energy transition in Europe is essential for achieving the dual goals of decarbonising energy production and reducing or eliminating reliance on countries such as Russia, as a source of fossil fuels to increase energy security. Natural gas, LNG, coal and biomass (sourced from long distances) are commonly still imported for energy production across Europe. It is therefore paramount that all renewable energy capacity available in Europe is used. EfW is well placed to aid this transition, as shown in Figure 13.

FIGURE 13: ENERGY PRODUCTION POTENTIAL OF EUROPEAN EFW



Source: Data from CEWEP Waste-to Energy Climate Roadmap, country-specific calculations based upon internal calculations

However, in countries like the Netherlands fossil fuels are often imported without a significant tax burden. This is in contrast to WDF imports which do have a significant tax burden (the WDF import tax is €39.23/t), despite contributing to landfill diversion and despite serving as a fuel to provide district heating, industrial steam, and renewable energy. Such disparities hinder progress to achieving targets such as net zero, high recycling, and ultimately energy transition targets. The presence of national carbon taxes in Germany, Sweden and Denmark have resulted in uneven competition with fossil energy sources and create an unlevel playing field in Europe.

EfW is well-placed to support the energy transition and contribute towards energy security. To support, this the import of fossil-intensive fuels such as coal, oil and gas must be taxed at higher rates than more sustainable fuels like WDF.

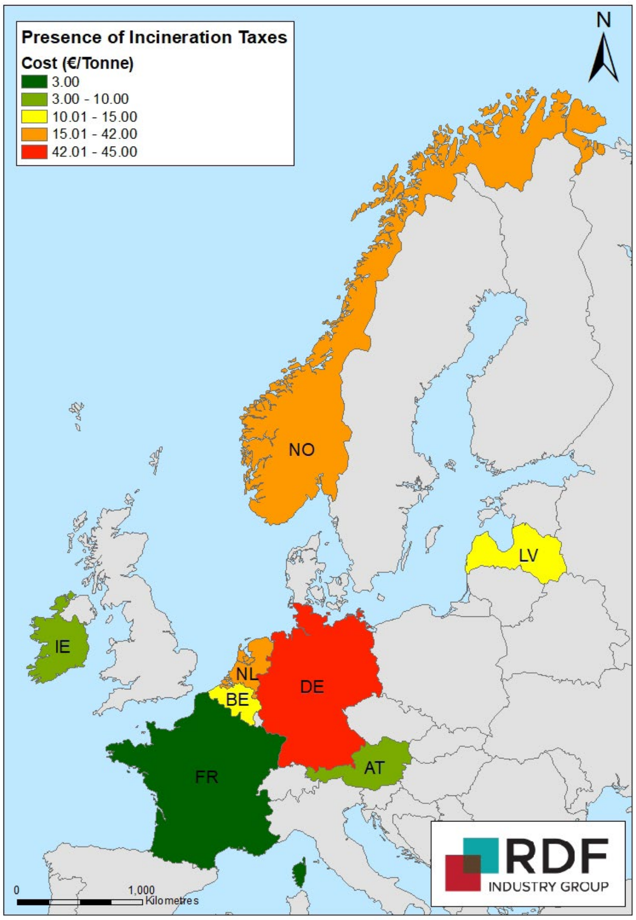
4.3 EU Carbon Taxation: A Level Playing Field?

As the EU and its Member States transition from the traditional linear model of 'take, make, waste' to a more circular one, both waste and energy policies are being re-designed to expedite this change. Fiscal measures are being used as interventions: taxes and levies can discourage certain behaviours or activities whilst incentivising others. The landscape of WDF related carbon taxation has grown exponentially more complex in recent years, with the implementation of both national and international policies. Many different types of taxation have been, or are now, in place across Europe. These taxes all have subtle differences in their design, including:

- Import taxes covering WDF;
- Tonnage-based EfW taxes;
- Carbon-based EfW taxes; and
- National emissions trading systems (ETS) with EfW within scope.

While some countries have no such tax in place, others are already taxed, as evidenced in Figure 14. Examples of each of these types of taxes, as implemented in different European countries, are set out below. In line with these differing tax rates, a whole system reform is taking place which seeks to bring EfW within the scope of the ETS by 2028, with a contingency until 2030 which will be applicable to all Member States.

FIGURE 14: PRESENCE OF EFW TAXATION EUROPE



WDF Import Tax (plus a carbon-based EfW tax)

THE NETHERLANDS	
Tax	WDF Import Tax and Carbon-Based EfW Tax
Summary	Import tax of ~ €39/t of waste for WDF going to EfW in the Netherlands; A tax per tonne of fossil carbon from EfW emissions above a ceiling

Since 2014 there has been a tax in place in the Netherlands for domestic waste going to disposal (landfill) or to EfW. In 2020, the scope of this tax was extended to also cover imported waste and is set at a rate of €39.23/t for 2024. As the Netherlands has been very successful at separating and recycling waste, its residual arisings have reduced, resulting in excess EfW capacity. It imports WDF from countries with insufficient non-landfill residual waste capacity, diverting this waste from landfill into efficient combined heat and power facilities. The import tax has led to a decrease in imports to the Netherlands from Europe from 1.5Mt in 2019 to 1.1Mt in 2021. The reasoning behind the tax was the reduction of Dutch GHG emissions by disincentivising use of its excess EfW capacity. However, this only serves to at best displace GHG emissions elsewhere, and at worst increase overall GHG emissions by jeopardising landfill diversion.[51] In fact, applying the waste tax as an import levy is estimated to result in an additional 0.9Mt of CO_2 emissions annually at the European level.[52] Furthermore, for over a decade the Netherlands has been in the top 5 exporting nations of hazardous waste in Europe (1Mt exported annually), resulting in the emissions from this hazardous waste treatment also being exported. If receiving nations also tried to hinder the emissions from Dutch waste with similar taxes, European countries would negate the optimal utilisation of treatment capacity for the lowest overall GHG emissions.

In addition to the import tax, the Netherlands also has a carbon tax which applies to the EfW industry (amongst others). Introduced in 2021 by the Dutch Emissions Authority, the tax is specifically aimed at achieving a 49% reduction in CO_2 emissions by 2030 and 95% by 2050 compared to 1990 levels.[53] It is calculated as follows:

- Only fossil (non-organic) GHG emissions are taxed.
- Each EfW plant is given a benchmark based on historic emissions, which acts as a ceiling for emissions.
- This ceiling is reduced linearly over time using a National Reduction Factor. This factor was 1.2 in 2021 and will be 0.69 by 2030.
- For each tonne of fossil carbon emitted above the ceiling a carbon tax is paid.
- The tax rate will increase over time, it was €30/t of carbon in 2021 and will be €125/t of carbon by 2030.

By implementing both an import and carbon tax on the EfW industry, the Dutch Government is subjecting the waste to double taxation.

[51] RDF Industry Group (2019) Impacts of the Proposed Dutch Waste Import Tax. Available at: https://www.rdfindustrygroup.org.uk/wp-content/uploads/2019/09/RDF-Industry-Group-Impacts-of-the-Proposed-Dutch-Waste-Import-Tax.pdf
[52] TNO (2020) The contribution of incineration of imported waste to Dutch and European CO_2 emissions. Available at: https://fnvsawebprd.blob.core.windows.net/fnvmediacontainer/fnv/attachments/fnv/e2/e26accb0-0869-43b2-916d-d3cd68783bd5.pdf
[53] Government of the Netherlands (2024) Climate Policy. Available at: https://www.government.nl/topics/climate-change/climate-policy#:~:text=To%20combat%20climate%20change%2C%20the,a%2095%25%20reduction%20by%202050.

Tonnage-Based EfW Tax

IRELAND	
Tax	Tonnage-Based EfW Tax
Summary	A tax of €10/t of waste exported for EfW

In 2023 the Irish Waste Recovery Levy was introduced at a rate of €10/t of waste. This applies to both domestic EfW and the export of WDF for EfW abroad.[54] The legislation that introduced this levy allows for the rate to go as high as €120/t of waste without legislative change.

Carbon-Based EfW Tax

NORWAY	
Tax	Carbon-Based EfW Tax
Summary	A tax of NOK 882/t (~€78) of fossil carbon on all waste going to EfW facilities

In 2022 a tax of NOK192/t (€20) of fossil carbon was introduced on all waste sent to EfW in Norway. It is calculated by multiplying the tonnage of waste that is delivered to EfW by a default pre-determined national factor of 0.5498 to calculate the fossil carbon amount.[55] A facility can choose whether to calculate and submit a facility-specific fossil carbon factor and if approved by the Norwegian Environment Agency, this can be used instead of the default national factor.

In 2024 two different tax rates were introduced: one for emissions subject to the EU Emissions Trading Scheme (EU ETS) (NOK 176/t fossil carbon/~€15.50) and one for emissions not subject to the EU ETS (NOK 882/t fossil carbon /~€78). As EfW is currently not subject to the EU ETS, the latter rate applies. The tax can be refunded if operators can prove the carbon produced is captured and stored.

[54] Lets Recycle (2023) Irish Government to introduce €10 per tonne 'waste recovery levy'. Available at: https://www.letsrecycle.com/news/irish-government-levy/#:~:text=Legislation-,Irish%20Government%20to%20introduce%20%E2%82%AC10%20per%20tonne%20'waste%20recovery,waste%20from%201%20September%202023.

[55] Skatteetaten (2024) Tax on incineration of waste. Available at: https://www.skatteetaten.no/rettskilder/emne/saravgifter/avfall/

National Emissions Trading Systems with EfW Within Scope

SWEDEN	
Tax	National Emissions Trading Systems with EfW Within Scope
Summary	EfW within scope of national ETS. Previous incineration taxes introduced and removed within a number of years.

Though the EU-wide ETS currently does not include EfW within scope, individual Member States can include additional areas within their national ETS, as long the EU scope is treated as a minimum. To this effect, EfW has been within scope of the Swedish ETS since 2010, following the withdrawal of its incineration tax. The carbon price in 2023 was €122/t.[56]

Sweden previously had an incineration tax on household waste between 2006 and 2010. This was based on a measure of the fossil carbon within residual waste. However, this was withdrawn after it was concluded by the Swedish Tax Agency to have had no effect on GHG emissions nor on the amount of waste material recycled. Additionally, it was not possible to pass on the cost of the tax to those who had control over the generation of the waste to influence change.

Another incineration tax was also introduced in April 2020. The tax was removed as of 1st January 2023 when it was €11.50/tCO_2, as part of decisions on Sweden's 2023 budget.[57] The argument centred around ensuring the production of more energy at cheaper prices given the situation with sanctions on energy imports from Russia.[58] Half of all households in Sweden are connected to district heating and the 33 EfW plants in Sweden are considered an important heat source.

The example of Sweden is interesting given two taxes on incineration were introduced and removed in a very short period, even when EfW is covered by the national ETS.

Carbon taxation is fragmented across Europe. There are national trading schemes alongside the central EU ETS, as well as many different types of carbon taxes that apply to EfW. These taxes all have different designs and in some countries are combined with incineration taxes as well. The fragmented nature of these taxes introduces an unlevel playing field across Europe. Fragmented carbon policy creates a barrier to effective and shared EfW utilisation. As such, policymakers need to ensure that all available energy from waste capacity is utilised in Europe, to avoid landfilling and reduce overall greenhouse gas emissions. This is especially important given Europe's commitment to the Global Methane Pledge, which is best served by reducing landfill. EfW capacity in countries with national 'overcapacity' must not be artificially reduced, but utilised by countries with insufficient EfW capacity until all combustible waste is diverted from landfill across Europe. When EfW falls within scope of the EU's central ETS in 2028, all other forms of carbon taxation must be removed to simplify the carbon taxation landscape.

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56 Government Offices of Sweden (2024) Sweden's carbon tax. Available at: https://www.government.se/government-policy/swedens-carbon-tax/swedens-carbon-tax/

57 Euwid (2023) Sweden scraps waste incineration tax. Available at: https://www.euwid-recycling.com/news/policy/sweden-scraps-waste-incineration-tax-110123/

58 Geminor (2022) Scandinavian tax relief on waste incineration will reduce landfilling in Europe. Available at: https://www.geminor.no/news/scandinavian-tax-relief-on-waste-incineration-will-reduce-landfilling-in-europe#:~:text=Less%20taxes%20for%20more%20efficient%20combustion&text=In%20the%20longer%20term%2C%20it,efficient%20plants%2C%20rather%20than%20landfilling.

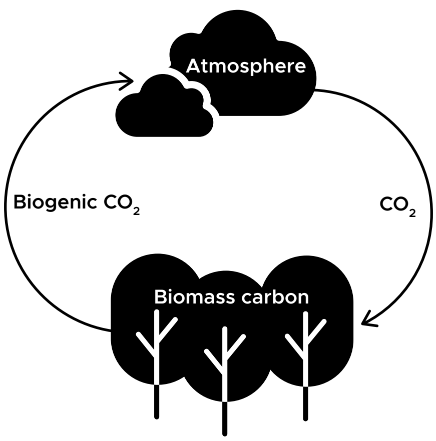
4.4 EU Carbon Taxation: Key Policy Design Questions and Considerations

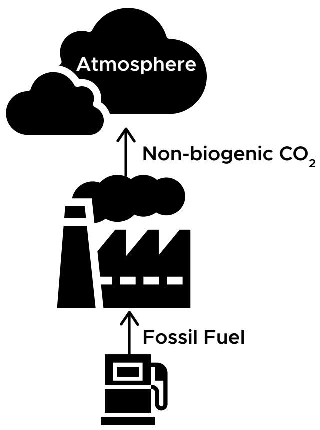
As illustrated in the previous section, current European incineration and carbon related taxes have many different designs. Tax design is an important factor in determining its impact. This section assesses important features of carbon tax design: which types of carbon should be taxed; the quantification of fossil carbon emissions; carbon pricing; how EfW facilities can reduce their carbon emissions; and the prevention of waste displacement.

As part of a whole system reform under the Fit for 55 Package, the European Parliament and Council revised the EU ETS. The agreed proposals included a commitment to cover MSW incineration installations within its scope. As of 2024, EU countries are required to measure, report, and verify the emissions from EfW facilities. By 31st July 2026, the Commission will have conducted an impact assessment informed by the reported emission data and outline on the possibility of including EfW in the EU ETS by 2028. There is however a contingency of a possible opt-out until 31st December 2030 at the latest.[59]

4.4.1 Which Types of Carbon Should be Taxed?

Biogenic material (or biomass) is organic material derived from plants and animals. Biomass contains carbon that has been stored on a relatively short timescale i.e. the life of that plant or animal during a natural carbon cycle. Biogenic carbon represents a temporary storage of carbon i.e. carbon released from burning biomass will be captured again during biomass growth. In contrast, fossil material such as coal, oil, and gas, contain carbon stored from the atmosphere millions of years ago. Fossil carbon would not have been released if not for anthropogenic activities, such as fossil fuel extraction. It is this fossil carbon that, when returned to the atmosphere, creates a significant change in atmospheric chemistry leading to climate change.





WDF is residual waste that has been processed and prepared to a specification relevant for the end user of the fuel. WDF will contain a mixture of materials such as plastics, textiles, paper, card, metals, glass and organic material to varying degrees. Materials like organic waste and paper/card contain largely biogenic carbon, and materials such as plastics and textiles contain carbon of mainly fossil origin. This is why the composition of WDF can affect its overall carbon content, specifically its fossil versus biogenic carbon content.

Carbon taxes should only be applied to the fossil carbon content of waste. This will maximise the reduction in fossil carbon in WDF to slow climate change and achieve a net-zero economy. Release of biogenic carbon to the atmosphere should not be covered by carbon taxes.

[59] European Commission (2024) EU Emissions Trading System (EU ETS). Available at: https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en

4.4.2 How Should Fossil Carbon Emissions Be Quantified?

While it is widely understood that carbon taxation should apply to fossil-derived emissions, the challenge in applying such a tax, is to understand the sources of the carbon being emitted from EfW facilities. There are several verified methods to calculate or estimate the fossil-biogenic split, either from the waste itself before recovery, or from monitoring of carbon emissions directly from the facility, specifically through stack emissions. The most commonly used approaches have been outlined below, including their relative advantages and disadvantages.

Calculation Approaches

Waste Emissions Factors

Some governments have chosen to use a national factor which accounts for an average assumed proportion of fossil carbon within residual waste. Norway and Germany use national factors for their carbon taxes of 0.5498 and 0.475/t of fossil CO_2 respectively. These factors can be determined for different waste codes to increase accuracy and reflect waste composition. In Norway, EfW facilities can also apply for their own tailored factors to be used in their tax liability calculations. Despite the carbon factors used by Norway and Germany, studies have suggested the proportion of fossil carbon in MSW is much lower. One study using four different analysis methods across seven EfW plants in Sweden suggests the proportion of fossil carbon in MSW is closer to a third. Other recorded factors from European plants suggest the average fossil content is around 40%.

Pros

Simple approach which is easily understandable and gives an element of certainty to tax liability calculations. Approach can be tailored according to waste code. Taxes can be clearly passed on to customers (following the Polluter Pays Principle) allowing them to budget more accurately.

Cons

There is no incentive for EfW facilities or their suppliers to reduce the amount of fossil carbon in the waste. A national factor may quickly become inaccurate if residual waste composition changes, for example due to the introduction of separate collection for plastic films.

Measurement Approaches

Waste Sampling and Testing

Often waste is sampled and tested to determine key characteristics such as its CV, density, and proportion of non-combustible fractions, amongst other things. However, determining fossil carbon content can be difficult. The most accurate method is the Carbon-14 method (C14). This employs radiocarbon dating techniques to determine the percentage of biogenic versus fossil carbon present. Selection dissolution can also be used as a laboratory method for determining waste carbon content. Manual sorting (aka pick analyses) is another method which can be used, where employees physically separate, categorise and weigh material from the waste stream. However this method applies assumptions about the amount of fossil carbon in each waste stream: it is not a laboratory measurement and therefore not as accurate.

A recent innovation driven by a collaborative effort between Vattenfall, Tekniska Verken I Linköping and Umeå Energi, has seen the development of FossilEye technology. The smart portable facility developed in collaboration with RoboWaste can identify and measure the content of various plastics in waste (and therefore estimate fossil content) before incineration as it moves along a conveyor belt.[62] This is done using a combination of cameras and AI technology and can measure waste from individual suppliers. Measuring fossil content at the front end, without the need for timely and costly pick analyses, provides the opportunity to pass costs back to suppliers in a proportionate manner, incentivising the prevention of this material ending up in waste streams in the first instance and encouraging recycling.

Pros

Sampling and testing of waste can be done on a supplier-by-supplier basis, allowing tax liabilities to be estimated based on the fossil content of the waste for each supplier.

Cons

Waste sampling must be done to certain standards to provide an accurate representation of the overall larger volume of waste. Results can still vary greatly between loads and samples making it difficult to pass back costs to the customers. Significant amounts of waste sampling can be costly and require space at waste facilities that is not always available. Laboratory testing can be expensive, takes time and is reliant on sufficient laboratory capacity. A Swedish study found a greater measurement uncertainty with waste sampling methods compared to stack emission methods.[63]

[62] Vattenfall (2024) Watching eye encourages plastic recycling. Available at: https://group.vattenfall.com/press-and-media/newsroom/2023/watching-eye-encourages-plastics-recycling

[63] Avfall Sverige Utveckling (2012) Determination of the fossil carbon content in combustible municipal solid waste in Sweden. Available at: https://www.osti.gov/etdeweb/servlets/purl/1041277#:~:text=The%20fossil%20carbon%20content%20in%20the%20solid%20waste%20samples%20and,waste%20is%20of%20fossil%20origin

Stack Emission Monitoring

The gases emitted by the stack of an EfW facility can also be analysed to determine fossil and biogenic carbon content. This patented method is only available through sending samples to Beta Analytic in Miami, the only laboratory to offer C14 analysis for stack emissions by Accelerator Mass Spectrometry (AMS), which is the recognised method for stack monitoring.

Pros	Cons
Highly accurate reporting of actual fossil carbon emissions. Danish and Swedish EfW facilities have been taking this approach under their national ETS schemes.	Fossil carbon emissions cannot be traced back to waste suppliers. Monitoring equipment can be expensive and needs to be proportionate in cost. Laboratory testing is also highly restricted, which means costs are high and turnaround times for testing can be long.

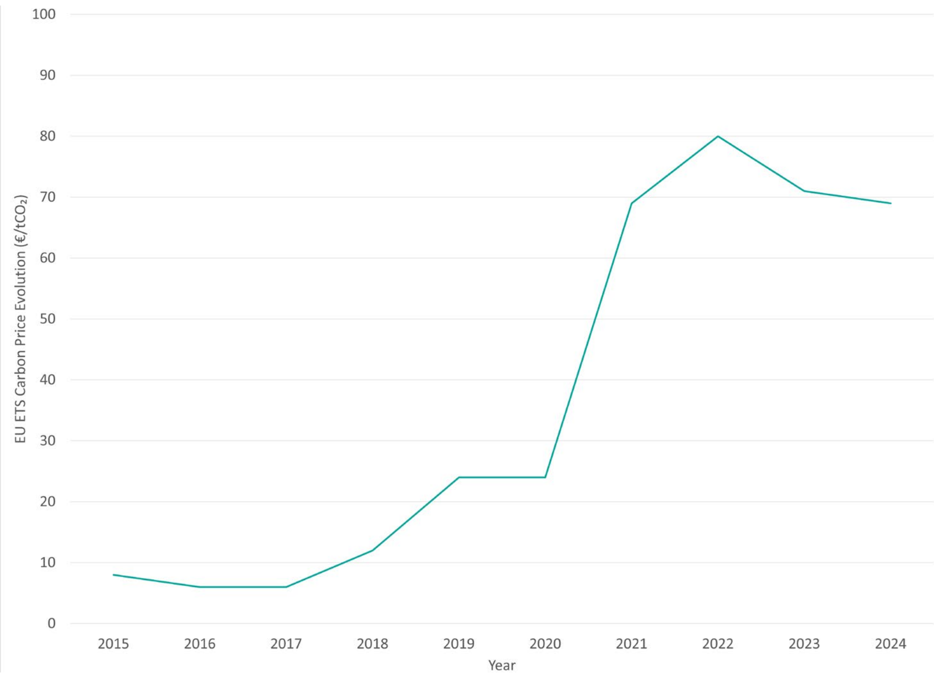
There are several different methods for how fossil carbon can be measured and monitored, in order for energy from waste facilities to report this to carbon tax scheme operators. As each of these methods has its own pros and cons, individual operators will take commercial decisions into account when choosing which method is most advantageous for them. The carbon calculation methods open to EfW operators in carbon taxation schemes should be practical, affordable, and robust. Enough flexibility should be built into scheme design to allow for a choice between calculation and measurement approaches.

4.4.3 What Carbon Price Should be Set?

The EU ETS follows a 'cap-and-trade' approach, where a cap is set on how much carbon can be emitted, decreasing annually. Companies need to have enough allowances to cover every tonne of carbon they emit within a year. They may receive some free allowances and must then buy a sufficient amount to cover their emissions. However, they can also trade any allowances they do not need. After each year, they surrender enough allowances to cover their full emissions.

The idea is that this results in emission reductions in the most cost-efficient way. However, it can also mean that the financial burden associated with securing enough allowances is uncertain and can change year to year (for example see past carbon prices show in Figure 15). This is especially important for the EfW sector because of the unique financial flows involved. By the time the waste arrives at the EfW facility, the gate fee has already been agreed. ETS liabilities will ultimately be passed back to the waste producers and suppliers, especially if the fossil carbon content of individual waste suppliers can be established. EfW facilities will therefore need to determine the cost impact of recovering the waste before it is recovered, and the emissions are declared.

FIGURE 15: EU ETS CARBON PRICES (€/METRIC TONNE CARBON)*[64]



Some existing carbon taxes have opted for a fixed carbon price, with fixed increases in this price over time, rather than a market-based approach. The advantage of this is that it provides more certainty over carbon-based liability and allows subsequent financial modelling that can be used to adjust gate fees and contracts accordingly. However, it is also possible to manage the price risk of carbon emission allowances using futures contracts, rather than spot-pricing.

Policymakers should consider whether fixed carbon rates are more suitable for carbon taxes affecting EfW facilities. This will provide greater certainty for EfW facilities determining how to pass through the costs of carbon taxes to waste producers, in line with the polluter pays principle, and provides local governments with more budgeting certainty. Fixed carbon rates could be replaced with market-based mechanisms using a phased approach.

[64] Enerdata (2023) Is the current design of the EU ETS suited for post-2030 deep decarbonisation? Available at: https://www.enerdata.net/publications/executive-briefing/carbon-price-projections-eu-ets.html#:~:text=The%20EU%20ETS%20price%20is,by%20an%20increasing%20decarbonisation%20context.

4.4.4 How do EfW Operators Reduce their Carbon Emissions?

The ultimate purpose of carbon taxation is to incentivise carbon reduction through behavioural and technological changes, rather than solely to raise revenue. Given the upcoming changes to the scope of both EU and UK ETS and other national carbon taxes as well, many operators are looking for ways to reduce their GHG emissions. This can be done in two main ways: controlling waste composition to reduce the amount of fossil carbon content; and capturing carbon emitted from the facility before it enters the atmosphere.

Waste Composition

Operators can reduce the fossil carbon content of the waste through interventions aimed at either waste being delivered to the facility, or waste being fed into the bunker:

- Waste delivered to the facility: EfW operators have contracts with waste suppliers which detail the specification of the waste to be delivered. Operators can use these to specify either a proxy for fossil carbon, such as a maximum percentage of plastics, or give a maximum level of fossil carbon that should be present within the waste. This allows the operator to reduce the amount of fossil carbon entering the facility. However, there will be a reduction in CV of the waste which needs to be taken into account. Consideration should be given to the gate fee that can be charged, as there will be additional costs to suppliers in recovering plastics and consequently diverting waste from such facilities.

- Waste fed into the bunker: EfW operators with sufficient space could install pre-treatment equipment onto the front end of their facilities, to add an additional processing step before the waste is fed into the bunker. If focused on removal of plastics and other material containing fossil carbon, then this will reduce the GHG emissions exiting through the stack.

Extended Producer Responsibility (EPR) is an environmental policy framework that extends the accountability of product producers to cover waste management issues. EPR can require, or incentivise, better product design to reduce waste, increase recyclability or decrease fossil carbon content of waste, for example through the use of alternative materials. It can also place financial liabilities on product producers to support the costs of managing the product waste at the end of its life cycle.

Pre-treatment of waste to reduce fossil carbon before EfW is feasible and should be incentivised, however, the presence of plastics particularly in residual waste is a wider problem which must be addressed by policymakers. Policies (such as EPR) around reduction, re-use and recycling of plastics must also be progressed to reduce this challenge for the whole waste sector.

Recycled plastics can struggle to compete with cheap virgin plastics. Mandatory levels of recycled content in new plastics products should be used to support market demand, with further support from governments through good practice public procurement policies. EfW also provides an affordable sustainable treatment route for sorting and recycling residues, an essential service to support a circular economy. Taxation of residue treatment through EfW taxation is therefore counterproductive and leads to an unlevel playing field compared with virgin materials.

Supporting Heat Networks

10% of Europe's district heating energy comes from EfW. In many cities, such as Stockholm, EfW facilities are integral to district heating and cooling networks. This renewable source of energy contributes to decarbonising the heat sector, a sector which is proving far harder to decarbonise than the electricity grid has been. EfW facilities can act as a baseload for district heating, allowing other smaller renewable sources of heating to also be used as part of these networks. This is especially important given the transition to electrified heat can lead to grid congestion and related infrastructure limitations. Therefore, there is a pressing need to prioritise the development of district heating systems wherever a sustainable heat source is available. By adopting a diversified approach to heating solutions, nations can ensure a more resilient and sustainable energy infrastructure while effectively reducing carbon emissions.

Given the significant contribution EfW makes to district heating and thus to reducing carbon emissions from heat, heat offtake from EfW facilities should be exempt from carbon taxation, or provided with free allowances to incentivise and support the expansion of these sustainable heat sources.

Capturing Carbon

In its Sixth Assessment Report, the IPCC emphasised the viable role provided by EfW in providing climate mitigation solutions, both through landfill diversion as already discussed, but also through carbon capture.[66] It is important to differentiate between carbon capture and utilisation (CCU) and carbon capture and storage (CCS). While both methods refer to the process of capturing CO_2, CCS permanently stores this carbon, whereas CCU utilises it by converting it into valuable fuels and chemicals. Utilised carbon is not permanently stored, and therefore does not have the same carbon reduction impact.

CCU

AVR, a Dutch waste management company has been capturing CO_2 at its Duiven facility since 2019. The flue gas from its stack is cleaned, cooled and combined with a dissolving fluid which absorbs roughly 85% of the CO_2. The fluid is then heated to extract the CO_2 in a pure gaseous form, which is liquified by cooling to -20°C. The liquid CO_2 can then be easily stored and transported. 60,000 tonnes per annum of liquified CO_2 is fed into the greenhouse and horticulture industry sectors where it enhances crop growth.[67]

CCS

Hafslund Oslo Celsio plans to capture 400,000 tonnes of CO_2 from the Klemetsrud EfW in Oslo.[68] Delivered based on Aker Carbon Capture's modularized Just Catch 400 unit, 95% of CO_2 is expected to be captured annually.[69] The project is part of Norway's Longship Project, backed by the Norwegian Government which aims to establish a comprehensive CCS value chain in Norway by 2024. The captured CO_2 will be conditioned (compressed following oxygen removal and dehydration) and transported to a port 10km away. Liquified CO_2 will be transported via pipelines and stored below the seabed in the Norwegian continental shelf at depths of 1.2 to 7km below sea level.[70]

65 CEWEP (2022) Waste to energy climate roadmap. The path to carbon negative. Available at: https://www.cewep.eu/wp-content/uploads/2022/06/CEWEP-WtE-Climate-Roadmap-2022.pdf.pdf
66 IPCC (2022) Sixth Assessment Report. Available at: https://www.ipcc.ch/assessment-report/ar6/
67 AVR (2024) CO_2 - capture plant. Available at: https://www.avr.nl/en/optimal-process/co2-capture-plant/#:~:text=Since%20August%202019%20AVR's%20facility,greenhouse%20horticulture%20and%20industry%20sectors.
68 Gassnova (2023) Carbon capture: Hafslund Oslo Celsio. Available at: https://ccsnorway.com/capture-hafslund-oslo-celsio/
69 Aker Carbon Capture (2023) Aker carbon capture awarded FEED Hasflund Oslo Celsio's CCS project on their waste-to-energy plant at Klemetsrud in Norway. Available at: https://akercarboncapture.com/?cision_id=637CE56D2A8E4DDE
70 Geos.ed (2021) Klemetsrud: Project Details. https://www.geos.ed.ac.uk/sccs/project-info/1684

Currently there are around 518 EfW facilities in Europe, with a combined annual residual capacity of 104Mt.[71] Even with only a partial integration of CCS, the carbon balance per tonne of waste treated will improve. A capture of 50% of the total CO_2 would be equivalent to saving an additional 500kg CO_2e/t of treated waste. Taking an LCA approach (so accounting for the existing climate benefits of energy substitution, landfill diversion, and IBA recovery) that includes the impact of CCS technology shows a net impact of -1040kgCO_2e/t waste treated.[72] The IPCC estimates the potential contribution of CCS technology on European EfW at 60-70Mt of additional carbon savings.[73] As such, when combined with CCS, the European waste management sector could not only become climate neutral but carbon negative, contributing to a clean and safe environment as well as to the wider European green economy. This highlights the important contributions of the waste management industry to key European Union policy objectives such as the commitment to a climate neutral continent by 2050 as set out in the European Green Deal[74].

CCS will not be suitable for all facilities and EfW operators. However, carbon taxes must allow EfW operators to reduce their liabilities by exempting carbon that is permanently stored. If CCS is to succeed, governments will need to ringfence a portion of carbon tax revenue for this purpose. Negative emissions from CCS should also result in tradeable allowances.

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[71] Footprint Services (2021) EU Energy from Waste Summer 2021. Available at: https://footprintservices.co/articles/eu-energy-from-waste-summer-2021/#:~:text=The%20report%20identifies%20EfW%20sites,capacity%20of%20104%20million%20tonnes.

[72] CEWEP (2022) Waste to Energy Climate Roadmap. The path to carbon negative. Available at: https://www.cewep.eu/wp-content/uploads/2022/06/CEWEP-WtE-Climate-Roadmap-2022.pdf

[73] IPCC (2022) Climate Change 2022. Mitigation of Climate Change. P 650. Available at: https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_FullReport.pdf

[74] European Commission (2024) 2050 long-term strategy. Available at: https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2050-long-term-strategy_en#:~:text=The%20EU%20aims%20to%20be,to%20the%20European%20Climate%20Law%20.

5 ACHIEVEING JOINED-UP POLICY DESIGN AND IMPLEMENTATION

The production of WDF and sharing of EfW capacity is vital to Europe's shift to sustainable waste management, diverting waste from landfill and significantly cutting GHG emissions in line with the EU's climate goals. To accelerate the transition towards a circular economy and a net zero society, it is crucial to harmonise policies across the waste management, energy, carbon, and resources sectors. The Group strongly supports the implementation of key policy recommendations outlined in this document. While EfW provides an essential and environmentally beneficial alternative to landfilling, effective and equitable carbon taxation policies, along with technological and operational improvements, are crucial for maximising its potential in contributing to a sustainable and carbon-neutral future in Europe

When waste-related policies are developed, especially those affecting WDF, the impact on related policies should be carefully assessed, for example: Fit for 55; Global Methane Pledge; REPowerEU; Circular Economy Action Plan; Waste Framework Directive; Landfill Directive and the EU ETS.

Ultimately, the greatest GHG benefits will come from waste reduction and recycling, so we urge policy makers to ensure resource efficiency policies are prioritised in the same way as carbon taxes. Policies such as EPR are essential for ensuring it is not just the waste producers i.e. the general public that bear the cost burden of improved waste management, but also those responsible for designing waste into the system in the first place.

With a move towards including EfW within scope of the UK and EU ETS later this decade, it is vital that parts of the waste sector not subject to carbon taxes, i.e. landfill, are not inadvertently incentivised. Increasing the cost of EfW but not landfill will reduce the cost gap between these two treatment methods. Any policies which jeopardise landfill diversion contradict the waste hierarchy and risk leading to an increase in GHG emissions, exactly the opposite of what carbon taxes are aiming to do. Improvements to landfill diversion policies need to be introduced at the same time as the financial burden of carbon taxes kicks in, to prevent diversion to landfill.

The EU (both as a whole political entity, and every individual Member State) has committed to carbon reduction targets under the Paris Agreement, while all EU Member States signed the Global Methane Pledge. Achieving these targets require European and global commitment, demanding a collaborative approach. To ensure there is cross border coordination on EfW capacity, all national carbon taxes and incineration taxes that apply to EfW should be removed when the scope of the EU ETS includes this sector. This will ensure there is no double or even triple taxation on the industry and will allow a European-wide level playing field.

An example of this is waste being exported from the Republic of Ireland will pay the €10 Irish waste recovery levy, and if it is being imported into the Netherlands it will also pay the €39.23 Dutch import tax. Dutch EfW facilities may then have to pay an estimated €16/t of waste under their national carbon tax, and from 2028 potentially also under the EU ETS a value of €20-€45/t of waste. At the same time countries such as the Netherlands do not place similar tax burdens on imported fossil fuels. A more holistic and consistent view is needed to make the transition to a more circular, climate-neutral economy that runs on sustainable energy. Policy must be designed in such a way that all available EfW capacity in Europe can be reached economically and technically in an easy way to achieve landfill diversion, methane reduction, energy-self-reliance and low-carbon district heating.

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