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The systemic impact of ETS on the resources & waste sector

By Ceres Waste Renewables & Environment

CIWM

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Glossary

Acronym	Description
C&D	Construction & demolition
C&I	Commercial & industrial
CCS	Carbon capture & storage
CIWM	Chartered Institute of Wastes Management
DESNEZ	Department of Energy Security & Net Zero
DRS	Deposit Return Scheme
EfW	Energy from waste. In this context it extends to all facilities in the scope of ETS including hazardous and clinical waste incinerators, gasification and pyrolysis (unless for recycling)

Acronym	Description
EPR	Extended Producer Responsibility
ETS	Emissions Trading Scheme
GHG	Greenhouse gas
MSW	Municipal solid waste
PFI	Private Finance Initiative
PPP	Public-private Partnership
RDF	Refuse derived fuel

Foreword

The proposed inclusion of thermal waste treatment plants in the UK's Emissions Trading Scheme (ETS) will have system wide and evolving impacts across the resources and waste sector. The Chartered Institution of Wastes Management has commissioned this report to consider what these impacts are and how the sector can deliver the positive environmental impacts the policy aims to achieve, whilst highlighting and mitigating potential unintended consequences.

Whilst ETS will add challenges and cost for some in the sector, there are likely to be benefits and opportunities for others. This report highlights both, alongside the actions that may be necessary to prepare for, and adapt to, the implementation of ETS at a time when a number of significant new policies like Extended Producer Responsibility (EPR), Simpler Recycling (in England), a Deposit Return Scheme (DRS) etc., are also being finalised and coming into force.

CIWM is a professional membership organisation and aims to provide an impartial, influential and respected voice in policy discussions, ensuring our members' views are represented and that policy development is informed by theoretical and practical understanding and experience.

As such, one of the objectives of this work is to make UK Governments aware of the views of the sector and ensure that the policy is implemented in a way that delivers the greatest environmental benefit whist avoiding negative impacts that may fuel crime or disincentivise adherence with the waste hierarchy. The report will also support CIWM's wider mission, to educate and inform its members.

Note that in this report, the term Energy from Waste (EfW) is used as shorthand to describe the range of plants that will be in the scope of ETS including hazardous and clinical waste incinerators, gasification and pyrolysis (unless for recycling).

Contributors

- Anthony Holley, CEO of Direct Special Metals
- Tim Rotheray, Director of ESG, Viridor
- Emma Beal, West London Waste Authority
- Stuart Hayward-Higham, Suez Recycling and Recovery UK
- Paldeep Bhatti, Director of Research & Policy, INCPEN
- Harry Davies, Chief of Staff, Greyparrot
- Simon Rudd, Business Development Manager, SOCOTEC

We would like to thank them for their valuable contributions to this report.

Executive summary & recommendations

Introduction

The Chartered Institution of Wastes Management (CIWM) has commissioned this high-level report to consider the systemic impacts of the Emissions Trading Scheme (ETS) on the UK resources and waste sector.

The sector recognises the challenge of achieving net zero by 2050. It has a demonstrable track record of moving towards more sustainable methods of waste management and delivering higher recycling rates over time. Over the last approximately 20 years, this has involved a move away from landfill to Energy from Waste (EfW) as the predominant method of treating residual waste. Whilst this has resulted in a reduction of greenhouse gas emissions greater than those from EfW, there is scope to further reduce emissions by limiting fossil carbon containing materials in feedstock. ETS seeks to cap emissions of fossil based CO_2e and incentivise their reduction over time.

The objective of this report is to identify the systemic impacts of ETS on the sector and consider how it can be implemented to maximise the environmental outcome whilst avoiding or minimising unintended consequences. As a result, it seeks to emphasise the opportunity it creates for the sector to contribute to UK net zero, create the secondary resources necessary for the circular economy and drive revenue. This report presents the findings of interviews, modelling and analysis undertaken to inform this review.

Whilst some of the details around the application of ETS to EfW remain to be decided, the framework shared in consultations from the UK ETS Authority has been used to shape this report. As more detail is confirmed, aspects of this report and its findings may be superseded.

Summary of key findings

1. ETS will significantly increase the cost of EfW and impose administrative costs on the sector unless action is taken.
2. Not all stakeholders in the resources & waste value chain are impacted equally.
3. The timing and mechanism for ETS cost pass-through must be competitive but manage the risk of fluctuating ETS allowance prices.
4. Cost allocation must be practical but also reflect waste composition to fully incentivise change.
5. Action must be taken to avoid unintended consequences.
6. The extension of the ETS to EfW will create opportunities for the sector.

The cost of EfW will increase significantly unless mitigating action is taken

- **The pass-through cost of ETS allowances could add around 50% to the price of EfW for customers.**

The impact of ETS on the price paid by customers will be determined by the fossil carbon content of the feedstock (or the method used to determine it), the approach to cost pass-through by the operator and the cost of ETS allowances at the time of purchase. The latter is a factor of supply and demand. Based on the tonnage and composition of waste treated in 2023, the est. annual ETS cost burden in 2028 when payments start to be made could be around:

Local Authorities
£ 660 million/pa

+

Commercial and Industrial
£ 230 million/pa

+

Construction and Demolition
£ 6.5 million/pa

- **ETS costs can be significantly reduced by decarbonising residual waste along the supply chain**

Significant cost savings can be achieved by reducing the use of plastic and increasing recycling rates, separating material at source or from residual waste. This not only reduces ETS costs but also saves gate fees as overall tonnage is reduced. Assuming the 65% recycling target is achieved, with 30-60% plastic extraction these interventions could alter just the future ETS costs to:

Local Authorities
Potential costs of £850 million/pa in 2035
reduced to
£326 - 418 million/pa

+

Commercial and Industrial*
Potential costs of £700 million/pa by 2035
reduced to
£292 – 375 million/pa

** Note that C&I waste costs increase as more waste moves from landfill to EfW as more capacity becomes available.*

- **The actual costs to EfW will depend on the level of cost pass through to EfW customers**

EfW operators have the compliance obligation and will have to hold sufficient allowances to cover their fossil CO_2 emissions. Whilst the cost can be passed-through to customers, the ETS also incurs compliance costs for operators. These include measuring, reporting and administration, as well as potential measures to mitigate the impact of fluctuations in the allowance price. It is unclear whether these will be absorbed or passed through to customers in some way.

Not all stakeholders are impacted equally

- **Although ETS seeks to decarbonise EfW, the financial impact will be felt by waste producers who can influence waste composition.**

  Although EfW operators have the compliance obligation for ETS and will have to hold sufficient allowances to cover fossil CO_2e emissions from plants, most if not all, of these costs are expected to be passed through the value chain to waste producers who cause most of the emissions. As such, other than the financial impact of monitoring and reporting fossil CO_2 emissions and the administration of cost pass-through, the profitability of the EfW sector may be minimally impacted in the short term.

  However, reducing the emissions cap and corporate commitments to reach net zero will drive investment in measures to reduce fossil carbon in feedstock though pre-sorting, and carbon capture and storage (CCS) technology. Plants with CCS will receive UK Government support to meet some of the significant development and operational costs. Although these plants will significantly reduce their emissions of fossil CO_2e, the price of long-term storage will likely be aligned to ETS costs, therefore having a net neutral impact on overall gate fees. Where operators may benefit is through monetising the capture and storage of biogenic emissions, around 50% of emissions from the treatment of feedstock based on current composition.

- **Brands and manufacturers may escape the full cost of managing fossil-based packaging placed on the market if ETS costs are not included in EPR fees.**

  Brands and manufacturers can significantly influence the quantity and fossil content of residual waste. Plastic packaging is estimated to contribute up to 60% of the fossil carbon in residual waste and selecting alternative materials and/or increasing the recyclability of the packaging would reduce the ETS burden for waste producers. The UK ETS Authority has proposed aligning the cost of ETS with EPR fees as an indirect measure to extend the pass through of these costs. Whilst this would support waste producers, particularly Local Authorities, brands and manufacturers are understandably keen to understand whether this additional revenue would be ringfenced to improve recycling collections, sorting and plastics recycling, thereby limiting their cost exposure. This would also help to increase the quantity of better-quality recyclables which could be incorporated into new packaging and potentially reduce fees payable under the plastics packaging tax.

Managing fluctuating ETS allowance prices

Businesses in the value chain will have to consider how they will manage cashflow to meet the additional costs of ETS from off-takers and pass this to customers when the ETS allowance price is subject to change.

There are several points at which ETS costs can be paid by customers of EfW facilities, including the option to purchase them directly and pass them to the EfW operator. The timing of payments is an important consideration as it may cause cashflow issues to some customers, i.e., intermediaries that may need to pay on delivery but recharge ETS costs to their customers retrospectively. Timing also effects the actual price paid as it will vary according to supply and demand. Potential approaches include:

Risk mitigation mechanisms

- **Adding the ETS cost to the gate fee for short and spot contracts**, in the way landfill tax is embedded in gate fees. This would ensure that revenue is received before ETS fees are paid by the EfW operator or their customer and would have to be sufficient to cover anticipated fluctuations in the price of allowances.
- **Use a range of financial and accountancy mechanisms to cover fluctuating allowance prices** by introducing risk and reward share mechanisms, similar to those used by sorting facilities to reduce the risk of fluctuating commodity prices or create separate 'holding funds' to share the cost burden between EfW and feedstock supplier.
- **Incentivise waste suppliers by offering ETS price certainty**. Larger operators may also have the financial resilience to offer customers credit facilities, purchasing ETS allowances 'up front' at a known price - effectively a loan.

Contractual mechanisms

- **EfW operators in medium to long term contracts beyond 2028 will have to re-visit their PFI/PPP and/or commercial contracts.** ETS is expected to evoke the 'change in law' (CIL) provision for the EfW industry and allow for re-negotiation of terms. This might trigger some customers to seek alternative off-takers if they can offer a better deal but in a balanced market, there is unlikely to be significant price-cutting.
- **New waste supply contracts being drawn up between now and 2028** will have 'CIL' provisions but should also agree the basic approach to ETS costs to mitigate the risk of contractual disputes from 2028 when payments are required.

Practical, but precise cost pass through

For ETS to deliver the strongest incentive to decarbonise the UK waste stream, the costs passed through to customers should reflect the actual composition of their waste as closely as possible to incentivise the interventions needed.

Too simple and the incentive to decarbonise is lost

Failure to reward this action negates the business case for change and the ETS would effectively become an EfW tax, set by generic emission factors for different waste streams.

Recognising the effort and investment stakeholders make to reduce fossil carbon content could transform the way waste is managed. This is particularly important where waste producers and intermediaries have invested or are seeking investment in measures to reduce fossil carbon content in the residual waste supplied to EfW.

Too complex and the administration and costs involved become disproportionate

The detailed sampling of incoming waste streams to assess fossil carbon content is cost, space, knowledge and labour intensive. It would generate significant practical and administrative challenges for operators with numerous customers and add considerable cost to EfW operators and waste supplier and intermediaries in the sector. Forming and analysing a representative sample of around 4-6 tonnes is not unusual and the total cost of measuring composition and fossil carbon content is approximately £15k per sample.

Many European countries operate an optional ETS sampling regime as an alternative to agreed carbon factors to suit their diverse EfW infrastructure and waste supply chains. This allows waste producers to provide evidence to use lower carbon factors where the sampling costs are off-set by ETS cost reduction and 'default carbon factors' are not representative of the incoming waste composition.

Avoid undesirable consequences

There are several undesirable consequences that could result from the implementation of the ETS.

- **Switch away from EfW back to landfill**. Despite a target of no more than 10% of residual municipal waste to landfill by 2035, the diversion of waste from EfW to landfill may result if landfill tax is not increased to maintain gate fees above those for EfW including ETS. It would also impact the refuse derived fuel (RDF) export market which would be disrupted if domestic landfill became the more cost-effective option if EU ETS also increased costs at European plants. This would undermine the waste hierarchy and have negative environmental effects.
- **Incentivise cross boundary waste shipments.** if the EU chose not include European EfW facilities in the EU ETS or prices were higher or lower that the UK, a price differential between both markets would result (although several member states impose separate carbon taxes). This has the potential to incentivise the import of waste for treatment in the UK or increase waste exports, undermining the domestic EfW market with carbon emissions exported without consequence.
- **Incentivise illegal activities** in response to increased waste gate fees, particularly for commercial waste where illegal activity is typically focused. This could take the form of more waste diverted from the legitimate waste industry to illegal sites and operators, or fraud within the sector as it becomes financially beneficial to mis-represent the fossil carbon content of waste to reduce cost exposure.
- **Increase plastic export or landfill due to a structural lack of off-takers for 'hard to recycle' plastics** separated by waste producers and intermediaries to reduce fossil content of EfW feedstock. Without sufficient mechanical and chemical recycling capacity in the UK to treat the est. 1.9 Mtpa of plastics separated, they would have to be exported, used as feedstock for recycled carbon fuels, or be landfilled in the UK.
- **Disrupt the established EfW market by enabling:**
    - **EfW with CCS to potentially gain a competitive advantage** if the costs of capturing and storing fossil carbon do not align with the cost of ETS, however this is not expected to be the case. Monetisation of biogenic carbon capture and storage may enable operators to share some of the benefits with customers.
    - **Waste to 'X' facilities to be more competitive than EfW** as fossil carbon emissions from these processes are generally lower and could disrupt the market with lower gate fees. The implementation of ETS is giving these emerging technologies an advantage as they play an important role in the decarbonisation of aviation and other transport sectors. Although some projects have suffered setbacks, the UK Government supported facilities could draw up to 2Mtpa of residual waste from the EfW market.

Growth opportunities for the sector

This report has identified three opportunities for stakeholders created by the implementation of ETS for EfW. Together, they could generate between £1.18 – £2.77 billion/pa of revenue for the sector, whilst also contributing to the decarbonisation of waste management and other sectors. These revenue estimates will need to be assessed relative to additional costs of processing and carbon capture etc. as a full cost benefit assessment has not been undertaken. Additional benefits would also result including new employment opportunities, lower waste transport costs, the creation of high-quality recycled commodities for the circular economy and the associated reduction in CO_2 emissions for both.

Residual feedstock refinement and separation of plastics	Separation of waste mainly takes place in form of source segregated collection and material sorting, but ETS creates a business case for intermediaries in the supply chain to remove plastics from EfW feedstock and create new feedstocks for chemical recycling & other offtakes.
Create stable investment conditions for chemical recycling projects	The accessibility of a stable and easy to aggregate UK supply of plastic waste that cannot be mechanically recycled, is created by the regulatory certainty around ETS and other policy measures. This supports the business case for investors to commercialise these technologies.
New revenue streams from biogenic CO_2e capture & storage	While the positioning of CCS in the ETS scheme has some uncertainties, the capture and storage of biogenic CO_2e emissions from the treatment of residual waste is an undeniable plus. The storage at scale could lead to the development of commercial CO_2 usage across the sector.

Six key recommendations

#1:

Local authorities and waste producers must invest early to maximise the impact of plastic reduction and diversion measures before 2028.

#2:

Incentivise all actors along the supply chain to reduce the use of fossil carbon materials and/or increase re-use and recyclability.

#3:

Develop a practical and cost-effective framework to standardise the analysis of fossil carbon content for those wishing to use bespoke factors.

#4:

Establish a regulatory framework and resources to ensure fraud is identified and tackled quickly.

#5:

Ensure that the implementation of CCS does not disincentivise carbon reduction and material circularity in the supply chain.

#6:

Ensure that ETS and EPR revenue is ring-fenced for interventions to increase recycling and divert fossil plastics from EfW.

Approach

Developing the report and its structure

Introduction

BACKGROUND

The UK ETS came into force on the 1st January 2021 at the end of the UK's transitional period for leaving the European Union.

It sets a cap on carbon emissions for energy intensive industrial sectors and allows companies to trade allowances up to the cap. As more sectors are brought into ETS, the cap will be aligned with the trajectory necessary to reach net zero by 2050.

In 2023, the UK Government consulted on bringing Energy from Waste (EfW) into ETS from 2028, with a two-year period in which operators would monitor and report emissions (but with no requirement to purchase allowances) from 2026. Note that in this report, the term Energy from Waste (EfW) is used as shorthand to describe the range of plants that will be in the scope of ETS including hazardous and clinical waste incinerators, gasification and pyrolysis (unless for recycling).

Although the details around the implementation of ETS for the sector are still being developed, the inclusion of EfW in the ETS will add costs to the management of residual waste and have systemic impacts on the resources and waste sector.

SCOPE

The Chartered Institution of Wastes Management (CIWM) has commissioned this high-level report to discuss the systemic impacts of ETS on the UK resources and waste sector.

One of the objectives is to make UK Governments, UK ETS Authority, Regulators and stakeholders aware of these impacts and ensure that the policy is implemented in a way that delivers the greatest environmental benefit whilst mitigating negative impacts that may fuel crime or disincentivise adherence with the waste hierarchy.

Whilst ETS will add challenge and cost for some, there is likely to be benefits and opportunities for others. This report highlights both, alongside the actions that may be necessary to prepare for and adapt to these changes.

The expansion of ETS to include EfW is part of a suite of new measures aimed at reducing the environmental impact of waste management, these include Extended Producer Responsibility for packaging (EPR), Simpler Recycling and Deposit Return Schemes (DRS). These measures will complement the objectives of ETS and drive action to remove more fossil carbon from residual waste.

Approach & structure

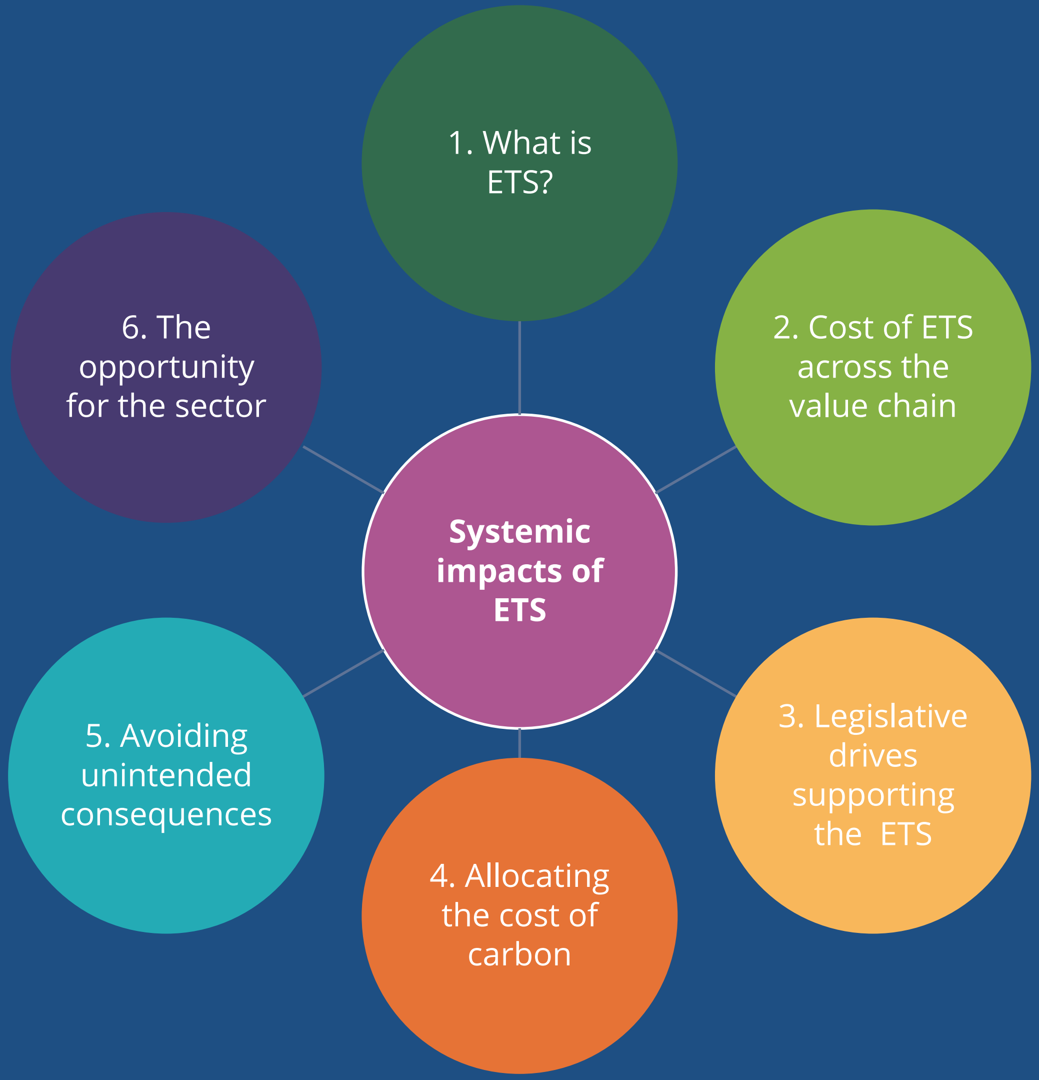
This report is not a comprehensive impact assessment. However, it aims to highlight key impacts on the resources & waste sector as a whole and explore how different stakeholder groups may react to reduce the financial impact of the ETS and drive a reduction in fossil carbon emissions.

The report is divided into 6 chapters. Each chapter focuses on a specific aspect of the application and implementation of ETS as shown in the figure to the right.

Much of the detail surrounding the application of ETS to the resources and waste sector is yet to be determined, with the UK ETS Authority having undertaken a recent consultation. This report sets out the elements that appear certain and considers different approaches where the approach is not yet decided.

The analysis is built upon:

- **High level modelling:** (based on 2023 data). The modelling illustrates waste flow scenarios after ETS comes into force, assessing the extent of potential changes and the impact of mitigation actions stakeholders can take to reduce exposure to ETS costs.
- **Interviews with industry stakeholders:** A small number of businesses and organisations that will be impacted by ETS were interviewed to capture a range of viewpoints which informed the analysis.



1.What is the Emissions Trading Scheme?

Extending the scope to include EfW

What is the ETS?

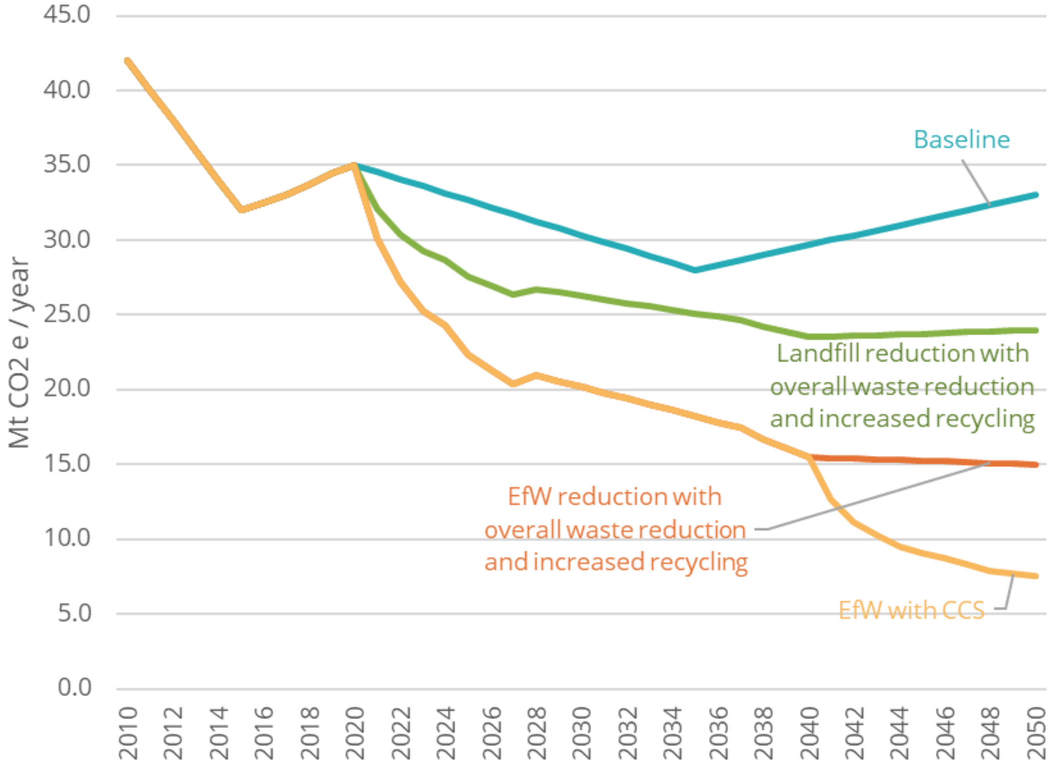
The ETS is the UK's core market-based instrument to support the long-term decarbonisation of the economy. The UK was part of the EU ETS from 2005, before it was replaced by the UK ETS from 2021 when the UK left the EU. It covers large scale industrial polluters in electricity and heat generation, industrial manufacturing and aviation sectors and was expanded in 2024 to include maritime transport emission. The UK ETS Authority is proposing to expand it further in 2028 to include emissions from waste incineration which currently contribute approximately 1% of UK greenhouse gas (GHG) emissions[1]. Similar proposals have been made to expand the EU ETS.

ETS is a "cap and trade" system where the cap refers to a threshold total amount of GHG units that can be emitted by installations covered by the scheme. The cap is expressed in a fixed number of emissions allowances, each equivalent to one tonne of CO_2e. The cap is set annually and decreases each year in line with the UK's net zero pathway. No detail of the specific trajectory for EfW has been published, but it is expected to follow the same path. As the cap decreases, so does the supply of allowances to the UK carbon market. Allowances are sold in auctions and may be traded between operators.

The EfW sector (including hazardous and clinical waste can begin trading allowances from 2028. As the number of allowances reduces, competition to access them will drive up the value (carbon price) incentivising the decarbonisation of the waste value chain to reduce emissions and cost burden at EfW sites. The core aim of the policy is to create a cost incentive to invest in alternate lower carbon alternatives to reduce emissions across the sector in line with the waste hierarchy.

The potential for the resources and waste sector to reduce CO_2e emissions is shown in the Committee on Climate Change's future GHG scenarios (see below).

UK sources of abatement in the balanced net zero pathway for the waste sector: Committee on Climate Change [2]



1. Developing the UK Emissions Trading Scheme (UK ETS)
2. https://www.theccc.org.uk/wp-content/uploads/2020/12/Sector-summary-Waste.pdf

Essential elements of the ETS

Exactly how the ETS will be applied and implemented for the EfW sector is not yet known as the UK ETS Authority recently consulted on their proposals[1] together with proposals for the role of Greenhouse Gas Removals[2]. These consultations only closed in August 2024 and the Authority is currently reviewing responses. There is no indication of when the Authority may publish its response, but it is expected in the first part of 2025. Those looking for further detail should visit gov.uk

What is certain?

- ETS will apply to EfW from 2028: with a monitoring and validation phase between 2026 & 2028.
- ETS will only apply to fossil emissions: The ratio of fossil carbon to biogenic carbon in municipal residual waste is around 50/50 and therefore EfW facilities will only have to monitor and buy allowances for ~50% of $C0_2$ emissions.
- The regulators for ETS are decided: These will be the Environment Agency, the Scottish Environment Protection Agency, Natural Resources Wales and the Northern Ireland Environment Agency.
- Greenhouse Gas Emissions Permits: EfW operators will need to apply for this permit to participate in ETS and comply with the conditions.
- Waste to fuels: These technologies are included in the scope of ETS.

What's not certain? Proposals in the consultation include:

- Full scope of the ETS and the treatment of small emitters: The consultation proposes that facilities treating hazardous and clinical waste are included in the scope of ETS. Facilities emitting <2.5 ktpa of CO_2e (Ultra Small Emitters) and <25 ktpa of CO_2e (Hospital and Small Emitters) will have to apply for the status and comply with emissions thresholds but will not be required to surrender allowances. The UK ETS is minded to exclude facilities involved in the molecular recycling of plastics albeit some do generate waste derived fuels as a fraction of the output.
- The method of measuring fossil carbon emissions: Whether this is through monitoring of stack emissions, sampling, calculation methods or a combination of approaches.
- How costs will be passed through to customers: It is assumed that EfW operators will pass the full cost of the ETS to customers but the method of allocating the cost of fossil carbon emissions back to customers is not yet determined. Options include setting default carbon factors for different waste types, a more detailed sampling-based approach, or a combination of both.
- Adjustments to the cap: It is expected that the trajectory of the cap will be aligned with the UK Government's decarbonisation pathways although no data has been published. In phase 1 of the ETS, to 2030, the cap will be adjusted to account for all changes to the traded sectors.

1. UK Emissions Trading Scheme Scope Expansion: Waste, UK ETS Authority, May 2024
2. Integrating Greenhouse Gas Removals in the UK Emissions Trading Scheme, May 2024, UK ETS Authority

2. Costs of ETS across the value chain

Impact on stakeholders and value chains

What are the costs of ETS?

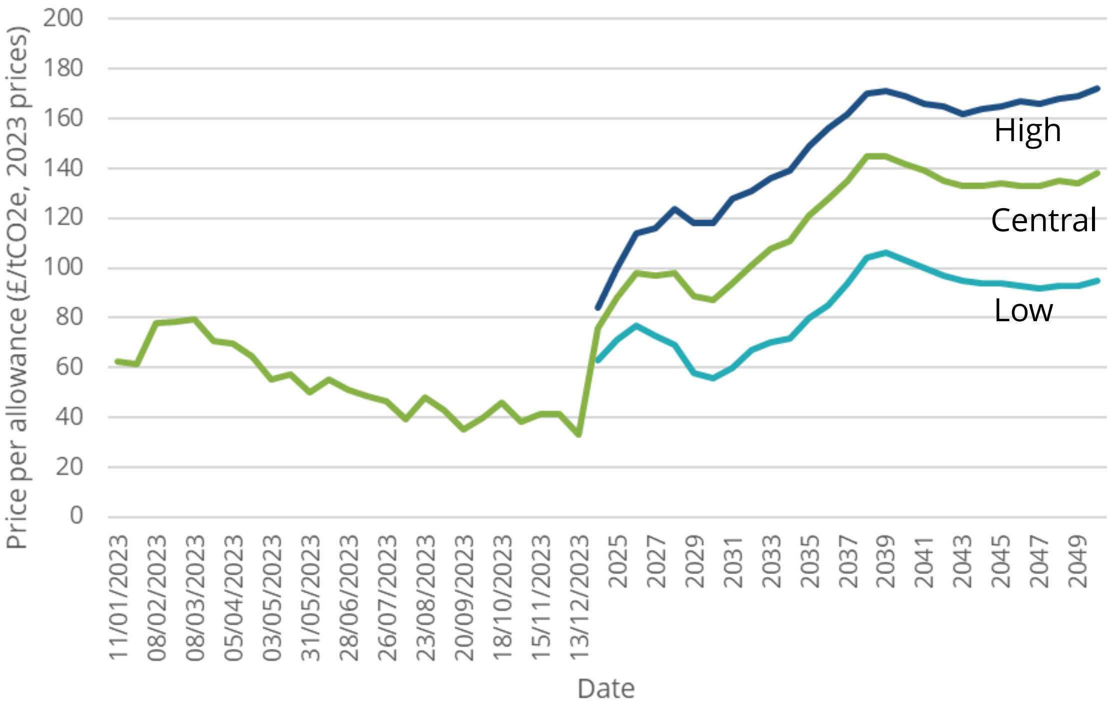
The cost of ETS allowances vary according to supply and demand. The figure on the right shows how the clearing price varied over 2023, and how it could develop going forward. These scenarios are based on the modelling assumptions published by the Department for Energy Security and net zero (DESNZ) for traded carbon values between 2023-2050.

These demonstrate that prices are expected to increase significantly going forward, driven by the reducing cap. The ETS authority can act if prices are consistently very high or subject to excessive volatility through the market stability mechanism and costs containment mechanism.

Whilst EfW operators are obligated to hold the number of allowances equivalent to their emissions, it is expected that the cost will be passed through to customers (unless allowances are purchased by customers and passed to the operator) as it is considered to be an operational cost. However, ETS costs comprise of more than just the allowances. Installing emissions monitoring equipment, reporting, sampling and administering cost pass-through back to customers will also add operational cost and it is possible that these too will be passed back to the customer in some form. Intermediaries in the supply chain may also choose to recover their costs when passing through these costs to their customers, further compounding the total cost burden of the ETS for the sector.

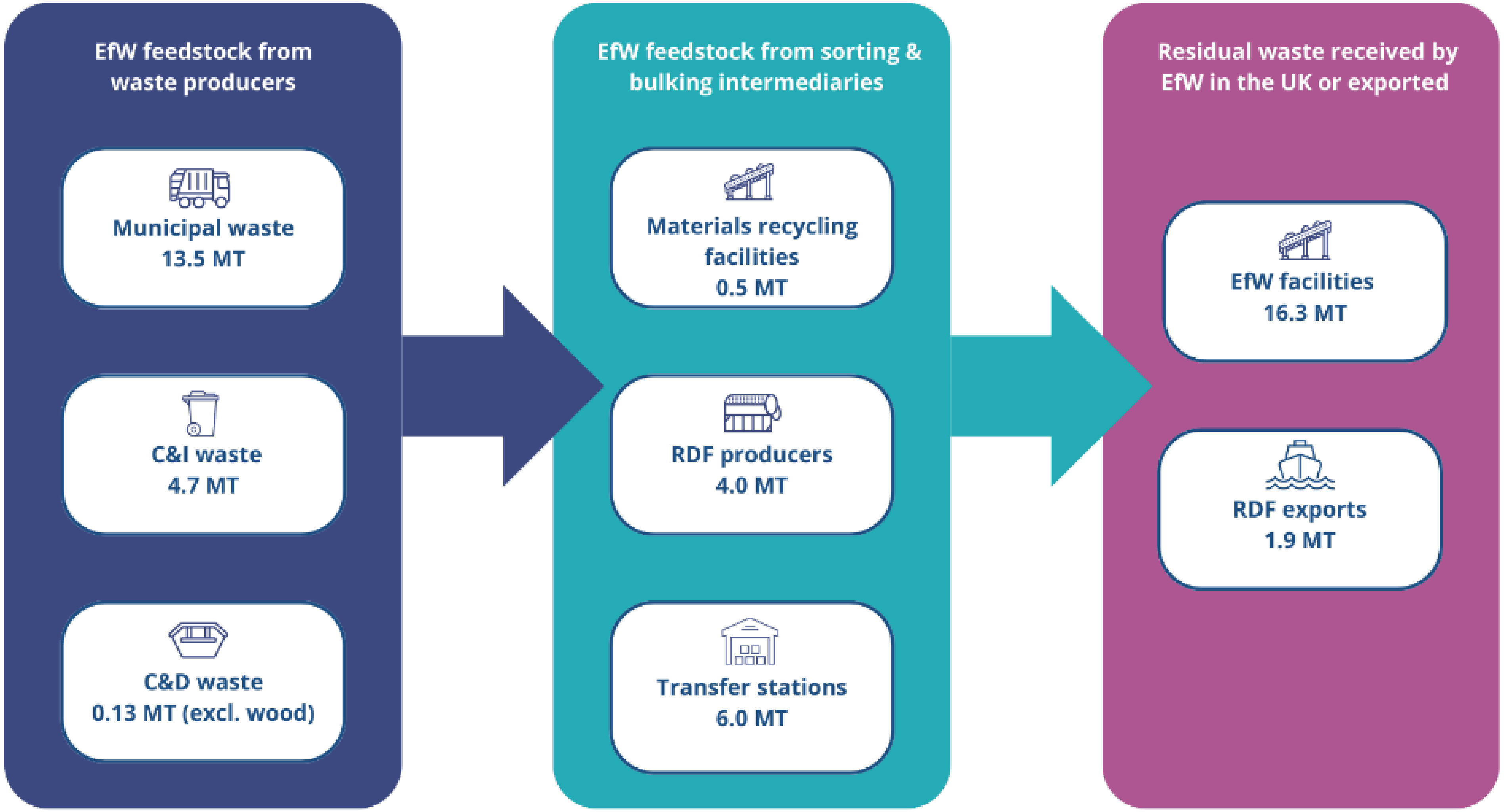
EfW customers may also have to consider how they pay ETS costs as part of contractual discussions. For example, to avoid the risk of price fluctuation, EfW operators could purchase allowances in advance at a known price, charging interest for what is effectively a credit facility.

Clearing price of ETS allowances in the UK (2023), with modelling assumptions for the evolution of the carbon price to 2050



Sources: Traded carbon values used for modelling purposes, 2023 and Report on the Functioning of the UK Carbon Market for 2023

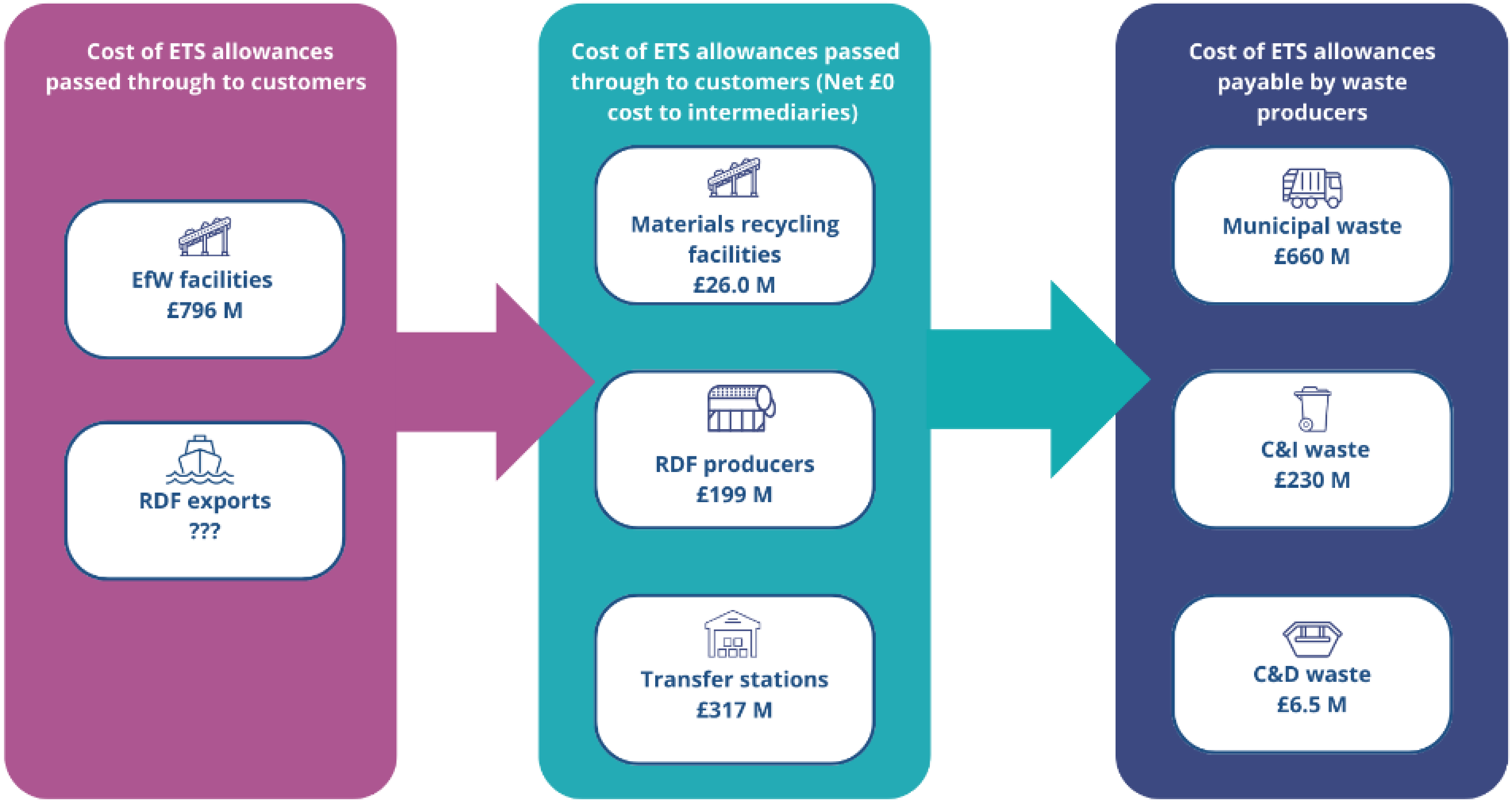
Tonnage of residual waste to EfW in 2023



The diagram shows the source and tonnage of waste treated by EfW in the UK in 2023*. Local authorities are the largest customers for EfW operators in terms of tonnage. This is unsurprising as most facilities in the UK were constructed to service long term residual PFI or PPP waste treatment contracts with local authorities. Remaining EfW capacity is taken up by commercial and industrial (C&I) waste.

** The format of the data means that there will be some duplication of tonnages as the same waste may pass-through several sites in the value chain and it is impossible to separate out waste delivered direct to EfW. Therefore, columns should be considered individually and not summed from left to right.*

‘Pass-through’ of ETS costs - 2023



The figure shows the modelled cost of ETS allowances that will flow back through the value chain if the waste flows to EfW remained the same as 2023 and 100% of costs were passed back to customers*.

As the largest EfW customers, local authorities would see costs rise by ~£660 Mpa with C&I waste producers facing an increase of ~£230 million/pa.

Note that intermediaries in the value chain will have no net costs if they pass-through 100% of the ETS costs they pay to EfW operators.

**The modelling assumes that feedstock composition is 50% fossil carbon, that the cost of an allowance is £98/TCO$_2$e (the central modelling scenario from DESNZ) and that 100% of ETS costs are passed through to customers.*

Cost Impact on EfW operators

UK ETS will have a direct impact on EfW operators as they will be required to apply for a Greenhouse Gas Emissions Permit, monitor and report CO_2 emissions of fossil CO_2e and purchase allowances. In addition, they will need to plan and implement emissions reduction measures to avoid exposure as the ETS cap reduces over time. This will result in three types of costs:

- **The cost of allowances:** Purchased through auctions, the price of allowances will vary according to supply and demand. Based on waste treated at EfW in 2023, and if 50% of emissions are fossil CO_2, the total annual cost of allowances for the sector would fall between £560 M and £1.07 Bn based on the high and low scenarios published by DESNZ.
- **The cost of monitoring and reporting fossil CO_2 emissions:** Although a range of monitoring methods have been proposed, including the analysis of stack emissions and calculations based on feedstock sampling, EfW operators will face increased capital and operational costs associated with the infrastructure, equipment and analysis required to measure emissions and may choose to mitigate some or all the additional costs by raising gate fees.
- **The cost of administration:** EfW operators will incur additional administration costs associated with reporting carbon emissions, negotiating changes to contracts via ‘changes in law’ clauses, purchasing allowances and administrating cost-pass-through. This will be more significant for operators of merchant plants with a greater number of private waste customers.

EfW operators are expected to seek to maintain their profit margin as the ETS scheme allows costs to be passed through to the customer, aligning with the ‘producer pays’ principle. It is not clear whether this will include all associated costs or only the cost of allowances. Some operators may seek to mitigate the risk of fluctuating allowance prices by building in a margin, further increasing costs to customers.

The ability of EfW operators to pass-through costs will be balanced with the need to remain competitive with landfill (subject to the expected rise in landfill tax to avoid this becoming a cheaper option) and other EfW facilities. The EfW market is nearing balance, where demand equals capacity. However, if policy is successful in increasing recycling rates and diverting residual waste to other options such as waste derived fuel, EfW operators may feel pressure to absorb some costs.

COST OF ETS ALLOWANCES FOR EFW OPERATORS

£560.8M at an allowance price of £69/TCO2e

£796.5M at an allowance price of £98/TCO2e

£1.07Bn at an allowance price of £124/TCO2e

ESTIMATES BASED ON ANALYSIS OF THE WASTE DATA INTERROGATOR 2023. ASSUMES 50% FOSSIL CARBON CONTENT. PRICE RANGE BASED ON LOW AND HIGH CARBON COST PROJECTIONS BY DESNZ

Bulking and sorting facilities

Much of the waste received by EfW facilities has already been handled by an intermediary. These businesses will see the cost of disposing of waste to EfW increase significantly if no interventions are made to reduce fossil carbon in feedstock. However, they are able to pass ETS costs through to customers, by increasing gate fees or as a specific ‘cost of carbon’ on invoices. As a result, they are somewhat insulated from the price increases, although they will have to manage cashflow and meet the administrative challenge of apportioning ETS costs back to customers. Assuming a fossil carbon content of 50%, the additional costs that intermediaries will have to manage could be:

- **Refuse Derived Fuel (RDF) producers:** 4 Mtpa of RDF is manufactured and treated by EfW annually. RDF producers will have to manage additional costs of between est. £140 – 252 million/pa for the cost of ETS allowances passed through from the EfW sector alone, if this waste is ultimately managed in the UK. The potential for increased exports of RDF to reduce ETS costs is discussed in Section 5.
- **Materials Recycling Facilities (MRFs):** MRFs produce approximately 0.5 Mtpa of rejects which are typically treated by EfW. ETS will add an additional cost of between est. £18 – 32 million/pa for ETS allowances which will need to be recovered through gate fees and/or better prices for recyclates.
- **Transfer stations and other intermediaries:** EfW facilities in Great Britain receive at least 6 Mtpa of waste from other waste treatment facilities. This figure is likely to be higher as it does not include waste that is bulked and not treated as it cannot be separated in the data. The cost of managing treated waste alone will by between £205 – 239 million/pa to cover the cost of ETS allowances if no measures are taken to reduce fossil carbon materials in EfW feedstock.

Like EfW operators, intermediary businesses will also face the challenge of how to apportion ETS costs to their customers unless default factors are applied. This will be particularly difficult for those where the composition of incoming waste will vary significantly from the outgoing waste to EfW, as the reduction in fossil carbon content following processing will vary according to the composition of waste received from each customer. Operators are likely to have to increase the amount of compositional waste analysis which will add costs and present operational challenges, particularly in making sufficient space and staff available.

Importantly, waste sorters and processors have an increasingly important role in removing plastics and other recyclables, reducing the fossil carbon content in waste to EfW. About 70% of the fossil content for residual MSW originates from plastics and removing just 30-50% would recover an additional 1.35 – 2 Mtpa for recycling or waste derived fuels, avoiding £200 - £300 million ETS cost and gate fee savings of a further £115 – 190 million/pa.

COST OF ETS ALLOWANCES FOR SORTING & BULKING FACILITIES

£140 to £252M for RDF producers at £69-124/TCO2e

£18 to £32M for MRF operators at £69-124/TCO2e

£369 to £291M for waste treated by intermediaries at £69-124/TCO2e

ESTIMATES BASED ON ANALYSIS OF THE WASTE DATA INTERROGATOR 2023. ASSUMES 50% FOSSIL CARBON CONTENT. PRICE RANGE BASED ON CENTRALSCENARIO FOR THE PRICE OF ALLOWANCES (£98 PER TCO2E)

Waste producers & collectors

Waste producers are expected to bear the ultimate cost of the fossil carbon emissions from EfW as costs are passed back through the value chain. This reflects their ability to influence waste composition and the 'polluter pays' approach to waste policy. Assuming the fossil carbon content of residual waste is 50%, based on 2023 data, the estimated additional costs for waste producers are as follows:

- **Commercial and industrial (C&I) waste producers:** Producers may face additional costs of between £160 – 291 million/pa. This is based on the amount of C&I currently going to EfW rather than RDF or alternate treatments.
- **Local authorities:** Local authorities may face additional costs of between £465 – 836 million/pa.
- **Construction and demolition (C&D):** Producers in England may face additional costs between £ 4.6 – 8.3 million/pa.

Whilst waste producers have a key role in reducing the volume and fossil carbon content of residual waste, the cost of implementing measures to do so may be significant. Particularly for local authorities for which targeted interventions can require large budget commitments. Some may choose to absorb the 'known cost' of ETS as it is easier to budget for, rather than risk investment in recycling schemes for which the outcome is uncertain. However, there will be a 'tipping point' where the 'cost of carbon' will be sufficiently high to make change a priority. In general, the incentive to invest in fossil carbon reduction measures will be greatest if the method of allocating ETS costs recognises the reduction. If default factors are applied, a reduction in fossil carbon content may not be 'rewarded' by reduced ETS costs, negating the business case for investment. The incentivisation of good performance is discussed in more detail in Section 4.

As previously discussed, the cost of ETS for EfW operators and intermediaries is not limited to the cost of ETS allowances alone. If all associated costs are also passed though, with margin protection to protect against fluctuations in the allowance price, the additional costs to producers could be even higher.

Importantly, the composition of waste arisings is heavily influenced by the packaging and material choices of brands and manufactures who are not impacted by ETS. The UK ETS Authority is consulting on aligning ETS cost with EPR which would reduce the burden on waste producers for fossil-based packaging, however this is not confirmed. Whilst this approach would offset the ETS cost of managing packaging, it would not transfer the ETS costs of managing other sources of fossil carbon in residual waste, these remain with the waste producer who has little control over the material choices and recyclability of products in their residual waste.

3. Legislative drivers supporting the ETS

Measures incentivising a reduction of fossil carbon in residual waste

ETS is part of a package of new measures

ETS is one of a suite of new resources and waste regulations to be implemented as part of the drive towards a circular economy and net zero by 2050. These measures are designed to increase recycling rates and divert fossil carbon out of the residual waste stream. As such, the effectiveness and timing of their implementation will have a significant impact on the ability of ETS operators to stay within the ETS cap and limit associated cost increases.

The Environment Act 2021[1] provides the framework for the introduction of these measures, the most significant of which are:

- **Extended Producer Responsibility (EPR) for packaging:** This makes producers responsible for the collection, sorting, recycling or disposal of their product packaging across its full lifecycle. As EPR develops, producers that place more recyclable packaging on the market, will face lower costs. The UK ETS Authority has proposed aligning EPR costs with the ETS to ensure the 'cost of carbon" is also passed back to manufacturers but this is not certain.
- **Simpler Recycling:** This aims to increase householder recycling rates by standardising kerbside collection schemes and introducing separate food waste collections; and
- **Deposit Return Scheme (DRS):** This aims to increase both the quality and rates of packaging collected for recycling. It also aims to reduce litter by providing a facility to return drinks containers 'on the go'.

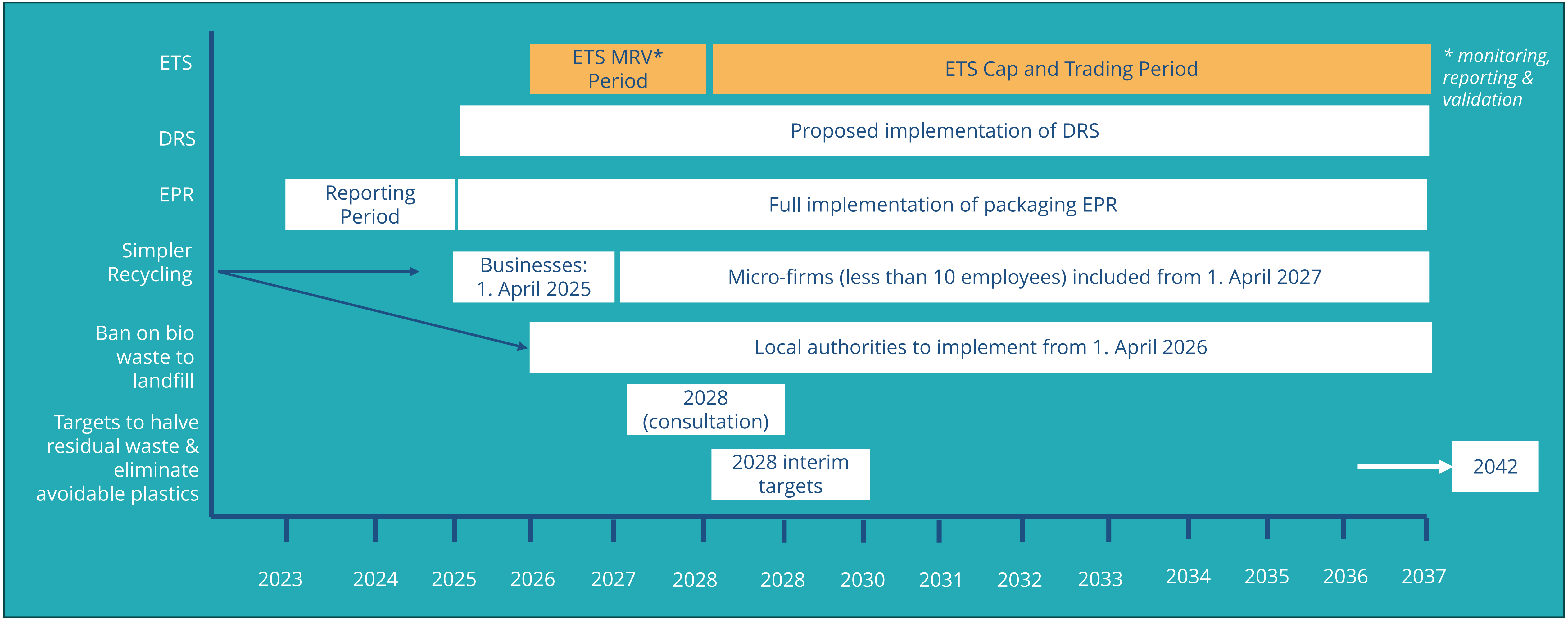
As an example, these policies aim to increase the recycling rate for beverage containers from 70-75% to at least 90%. Of the 31 billion single-use drinks containers used in the UK each year, 12 billion are plastic drinks bottles[2]. Diverting just 20% more to recycling would remove 2.4 billion more plastic bottles from the residual waste stream. This, combined with collection schemes for films and flexible packaging, would have a significant impact as plastic waste contributes up to 70% of the fossil carbon in residual waste.

In addition to EPR, DRS and Simpler Recycling, the Government in England has introduced several new targets in the 5-year Environment plan published in January 2023[3] that impacts the volume and composition of residual waste treated by EfW facilities:

- **Biodegradable waste to landfill ban (consultation):** In 2023, Defra consulted on a 'near elimination' of biodegradable waste to landfill in England by 2028. This could drive more residual waste to EfW where the removal of organics is not practical or economically viable. (Scotland implement in Dec 2025)
- **Elimination of avoidable plastic waste by 2042:** This should reduce the incidence of non-recyclable plastics in the residual waste stream.
- Halve residual waste produced per person from 2019 levels by 2042 (excluding major mineral waste): Residual waste is defined as waste sent to landfill, put through incineration or used in energy recovery in the UK or overseas. It extends to England and includes interim targets for 8 waste streams by January 2028.

1. The Environment Act 2021
2. Deposit Return Scheme for drinks containers: joint policy statement, April 2024
3. Environmental Improvement Plan 2023

Implementation timetable for new measures



ETS and other measures are symbiotic

If implemented effectively and in a timely manner, the new measures will complement ETS by helping to reduce the tonnage and fossil carbon content of EfW feedstock.

There are several mechanisms by which this is achieved:

- **Reducing residual waste arisings:** reducing/eliminating avoidable waste, particularly plastics.
- **Increasing the recycling rate:** by implementing and funding more sophisticated collection schemes including the collection of plastic films & flexibles.
- **Increasing the re-use and recyclability of packaging:** by incentivising brands and manufacturers through modulated (reduced) EPR fees. This element of EPR is expected to develop to consider carbon emissions as the scheme develops.
- **Providing a mechanism to recover ETS costs:** the proposals infer that ETS costs payable by local authorities and other waste producers will be 'built in' to EPR fees as they are designed to cover the full cost of managing the waste. However, the method and extent to which ETS costs will be aligned with EPR remains uncertain.

EPR, DRS and Simpler Recycling should have been implemented by 2026/27, in the monitoring and validation phase of ETS implementation. However, some dates have already been pushed back, and the possibility of further delays is a risk, particularly with the change in UK Government in 2024.

The graphic on the following page shows how reaching the 65% recycling target in 2035 and measures to reduce fossil carbon in residual waste could reduce the cost of ETS (pass-through cost for allowances only) for waste producers.

How much additional recyclate will be diverted from the residual waste stream?

DRS, Simpler Recycling and EPR are expected to divert 8.5 Mtpa of residual waste to recycling if implemented successfully. As much of this is dense plastics and films, they will also reduce the fossil carbon content of EfW feedstock and therefore reduce fossil CO_2 emissions. The anticipated diversion rate[1] is shown in the table below[1]:

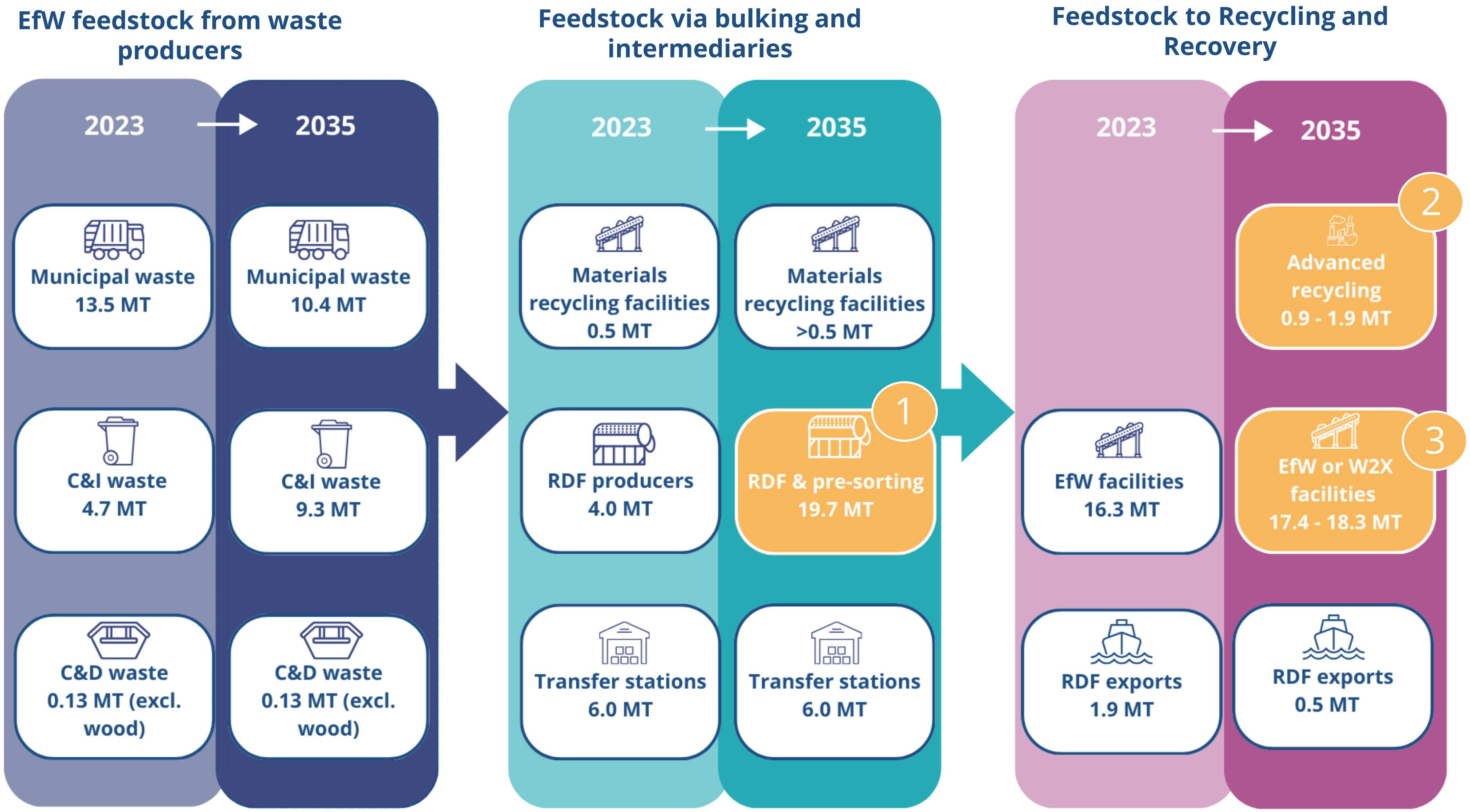
Policy lever	Uplift in MSW recycling rate by 2032	Estimated tonnage impact by 2032
Combined	approx. 17%	Approx. 8.5 Mtpa
DRS (inc. glass)	1%	0.35 Mtpa
Simpler Recycling	15%	7.3 Mtpa
EPR	1%	0.71 Mtpa

ETS also supports the implementation of these measures by creating the economic business case that makes investment in sperate collections and enhanced sorting cost effective. This will drive improvements towards delivering a circular economy, focusing interventions at the top of the waste hierarchy rather than relying on 'end of pipe; solutions, in this case, carbon capture and storage (CCS).

1. The Collection and Packaging Reforms – a summary of the impacts

Future waste flows scenario

Yellow boxes highlight key opportunities for the sector which are discussed in Chapter 6

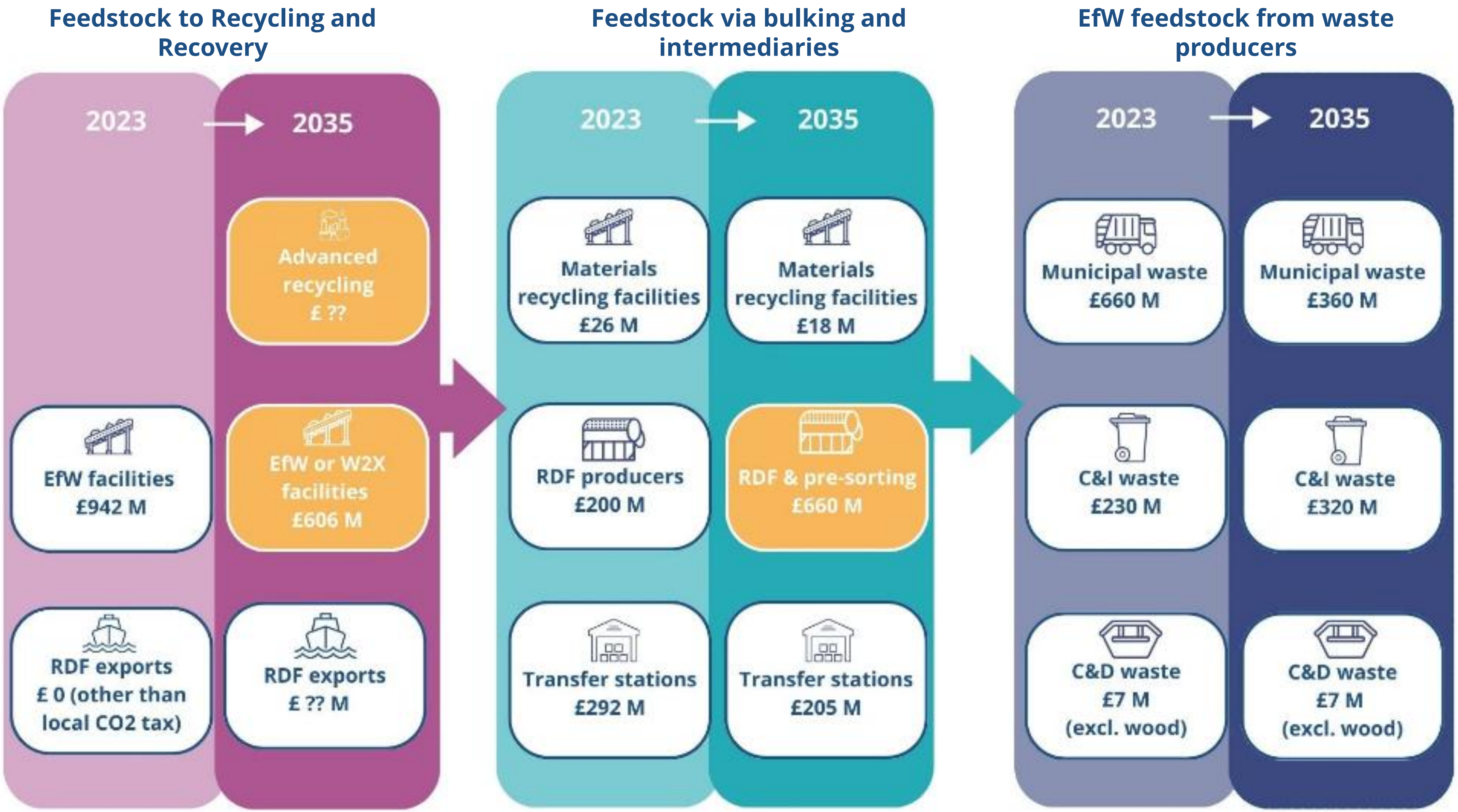


The result of the high-level modelling shows that if EPR, Simpler Recycling and DRS are successful in increasing the overall recycling rate to 65% in 2035, the quantity of residual waste that local authorities send to EfW would fall by almost 3 MT. Although recycling rates also increase for C&I waste, the continued switch away from landfill results in a material increase in this waste stream to EfW.

The value chain is incentivised to invest in more and better-quality sorting to reduce the ETS cost exposure of their customers. This creates a new offtake stream of plastics that cannot be recycled mechanically but that may be feedstock for chemical recycling and sustainable fuels.

Future waste cost scenario*

Yellow boxes highlight key opportunities for the sector which are discussed in ~~the~~ Chapter 6.



If the 65% recycling target can be achieved by 2035, and ETS drives operators in the value chain to remove 50% of the remaining plastics in the residual waste to EfW, the cost of ETS (allowance pass-through only) would be significantly reduced for local authorities.

C&I waste producers will however see additional cost as more of their residual waste is treated at EfW rather than landfill (as the demand for EfW (which is cheaper than landfill) meets capacity in the UK). ETS costs per tonne however is reduced for the reasons above.

Despite more waste treated at EfW than in 2023, reductions in fossil content would result in lower ETS costs. For waste producers to fully benefit from this reduction, 100% of the savings generated in the value chain would have to be passed through.

* 2023 prices. Assumes 30% fossil carbon at source and an allowance price of £98/TCO_2e

Cost impact analysis summary

	EfW operators	Sorting & bulking operations	C&I waste producers	Local authorities	Brands & manufacturers
+	There is the potential to pass-through all additional costs to customers. May create additional revenue if the actual price of allowances is lower than any built into gate fee. CCS potentially allows monetisation of biogenic carbon capture although it incurs other costs.	There is the potential to pass-through all additional costs to customers. Those processing waste to remove recyclates and reduce fossil carbon content of waste may be able to offer competitive pricing as the costs will be less.	The additional cost of ETS should make it cost effective to procure additional recycling collections that would previously have added cost. Makes the cost of other mitigating actions such as waste minimisation more cost effective.	If the full cost of ETS for treating fossil-based packaging can be recovered via EPR, the cost to the local authority can be neutral. Investment in measures to increase recycling rates should be more cost effective as EfW costs increase.	ETS costs cannot be passed through to brands and manufacturers placing products and packaging on the market unless added to EPR fees. Brands and manufacturers can reduce their exposure to ETS by increasing the recyclability of products and reducing the use of fossil plastics.
-	Increased operational burden associated with the need to manually sample customers' waste as or if necessary. Administrative burden of cost pass-through. Cost of monitoring & reporting if not passed through.	Increased operational burden associated with the need to manually sample customers' waste if necessary. Admin. burden of managing cost pass-through to customers. Potential cashflow issues associated with ETS payments if levied retrospectively.	Ability to reduce fossil carbon in the residual waste stream is limited by a lack of control over brands and manufacturers' design & material choices. ETS cost may be artificially increased by the compound effect of margin protection by those down the value chain.	EPR doesn't cover textiles or WEEE which both contribute to fossil carbon in residual MSW. These costs remain with the local authority. Measures to target these and other streams are costly, at a time when budget pressure is unprecedented, and depend on behaviour change.	It is possible that EPR costs will include the ETS cost for the treatment of fossil-based materials in EfW. Some products and packaging materials cannot be replaced by less carbon intensive substitutes or doing so would have negative carbon impacts in other areas of the supply chain.

4. Allocating the cost of carbon

The practical challenge of meaningful cost pass-through

Monitoring and apportioning emissions

One of the uncertainties around ETS is how emissions of fossil CO_2 will be measured or calculated by EfW operators and how those emissions and the associated costs, will be apportioned and passed back to customers. The practical and financial implications for the resources and waste sector are likely to be challenging, with a range of different approaches which could be adopted, depending on the level of accuracy required. Different methodologies could result in different results for apportioning costs with some customers potentially disadvantaged. At every point residual waste is handled or treated in the value chain, the embedded fossil carbon will need to be quantified through sampling or estimated using default carbon factors to allocate the cost of fossil carbon emissions back up to customers.

Practically, this means:

- **EfW operators** will be obligated to monitor and report on fossil CO_2 emissions. Measuring emissions at the stack is being considered as potentially the most accurate option. However, few laboratories can analyse carbon-14, the radioactive isotope of carbon, and most samples from EfW facilities are currently sent to the US creating additional risk that they may be lost or damaged in transit. To allocate costs to customers, operators will need to understand the fossil carbon content of customers' waste. Sampling customers' waste at the facility may be a challenge due to limited space and staff and the associated costs. Therefore, many EfW operators may request this information from customers and build the requirement into contracts if bespoke factors are required.
- **RDF producers and MRF operators** will need to understand the fossil carbon content of inbound waste from customers and outbound residual waste to EfW so that they can accurately apportion ETS costs. There is no guidance on the approach to attributing fossil carbon in the residual waste stream which may be very different in nature than incoming waste streams post treatment. As intermediary facilities between the waste producer and EfW facility, without default carbon factors, it is likely that these operators will bear the bulk of responsibility for sampling and analysing waste if bespoke factors are required, as EfW operators will likely push the responsibility down to suppliers and waste producers may not have the space or expertise to undertake the sampling.
- **Transfer station operators** will also need to understand the fossil carbon content of incoming and outgoing waste to quantify ETS costs and apportion them back to customers without default factors, even if the operations are focused on bulking only. As above, the bulk of waste sampling and analysis is likely to be undertaken by intermediaries.
- **Local authorities and C&I producers** will need to understand and monitor the fossil carbon content of their waste so that they can budget for additional ETS costs and inform waste collection strategies to target fossil carbon intensive waste streams. Variability in fossil carbon content and the price of ETS allowances will make budgeting challenging given the significant costs involved.

Counting carbon: simple or complex?

The UK ETS Authority's consultation on ETS implementation sets out several different approaches to calculating the fossil carbon embodied in waste from different sources which will be required to allocate stack emissions to different customers. Possible approaches range from the use of default carbon factors for different waste streams ('simple'), to a more bespoke, analytical approach based on sampling and analysing the fossil carbon content of waste from customers ('complex'). There are advantages and disadvantages with both approaches as summarised in the graphic below.

Simple – Default calculation approach

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- Default carbon factors avoid the need for waste producers to pay for compositional analysis of their waste.
- Administration of pass-through costs would be easier as there would be no need to agreed bespoke carbon factors for each customer.
- The incentive for waste producers to 'game the system' by reporting inaccurate data for fossil carbon content is reduced as standard carbon factors are applied.

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- Unless default carbon factors are sufficiently granular to reflect the level of recycling, there will be no incentive for waste producers to invest in measures to separate recyclables or for intermediary sorting facilities to remove materials such as plastics etc., to reduce ETS costs.
- Default carbon factors will not reflect the heterogeneous nature of some waste streams. Some will benefit from this whilst others will pay more.
- Extensive compositional analysis of different waste streams will be required to set default carbon factors unless those already in use, for example, those used by Ofgem for the Renewable Energy Guarantees of Origin (REGO) scheme, are considered suitable.

Complex – Feedstock sampling and analysis

+

- Carbon costs would be passed through to customers more accurately with payments based on the producers' own waste composition.
- The carbon cost of managing their waste will be bespoke to customers, incentivising them to take action to reduce it.
- Any interventions by waste producers or intermediaries that reduces fossil carbon content would be rewarded by a reduction in costs. This maintains the incentive for mitigations.

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- If waste producers are required to report the fossil carbon content of their waste, it would add significant additional costs. Sampling and analysis of waste for biogenic/fossil carbon content can cost circa £15k per sample.
- The greatest sampling burden is likely to rest with intermediary companies in the value chain that will have to manage the sampling of customers' waste, in addition to sampling output streams to EfW.
- It may incentivise producers and others in the value chain to falsify analytical results or take unrepresentative samples to reduce exposure to ETS costs, increasing the risk of fraud and undercutting legitimate business.

Case studies – Germany & the Netherlands

Implementation in Germany:

In Germany, CO_2e pricing for thermal waste treatment plants was introduced in January 2024 as part of the national fuel emissions trading scheme, the BEHG (Brennstoffemissionshandelsgesetz). The CO_2e certificate prices were increased from 35 €/t CO_2e to 45 €/t CO_2e for 2024, these increased to 55 €/t CO_2e in January 2025 and could further increase to 55 – 65 €/t CO_2e in 2026. From 2027 ownards, market pricing is expected to prevail and the CO_2e pricing will become a part of the overall ETS, where prices are expected to be around 80 €/t CO_2e.

Alongside this Germany has been able to employ standard emission factors for waste as the collection systems across the country are relativly consistent. These factors equate to 0.462 tonnes of fossil carbon per tonne of MSW and 0.475 tonnes of fossil carbon per tonne of RDF. German government estimated that between 10-30% of costs would be passed through to producers, but in reality this has been much higher.

Funds raised from ETS expansion will not be an added burden on citizens in Germany as all the proceeds will be given back to them through funding measures and parallel relief measures. The Federal Government in Germany will use proceeds from CO_2e pricing primarily to reduce the renewable energy levy and therefore electricity prices. In addition, there will be a rise in the tax-deductible commuting allowance, a mobility premium will be granted, and measures of the Climate Action Programme 2030 will be funded – to promote climate-friendly transport and energy-efficient buildings.

Implementation in Netherlands:

The waste sector in the Netherlands has had a national CO_2e levy since 2021 (Industry Carbon Tax Act [Wet CO_2-heffing industrie]). However, a large part of the emissions have been exempted from the levy, so companies will only have to pay for their CO_2e emissions from 2026 onwards. The Dutch 2024 spring budget announced a tightening of the exemption for EfW plants. The portion of emissions exempt from the levy will decrease more strongly each year and will be at a lower level in 2030. As a result, the costs per tonne of incinerated waste will increase substantially. In addition, from 2028, waste-to-energy plants (WtE) will likely fall under the European Emissions Trading System (EU ETS).

The variability in collection techniques in Netherlands means that one single characterisation of MSW in the Netherlands is not possible, however the Rijksdienst voor Ondernemend Nederland (RVO), the Netherlands Enterprise Agency, has published one single emission factor for waste which equates to 0.464 tonnes of fossil CO_2e per tonne of MSW as a default value where other data is unavailable.

Sampling waste for fossil carbon content

Whether the allocation of fossil carbon emissions is based on default carbon factors (the 'simple' approach) or bespoke carbon factors for each producer (the 'complex' approach), the extent of waste composition analysis will need to significantly increase.

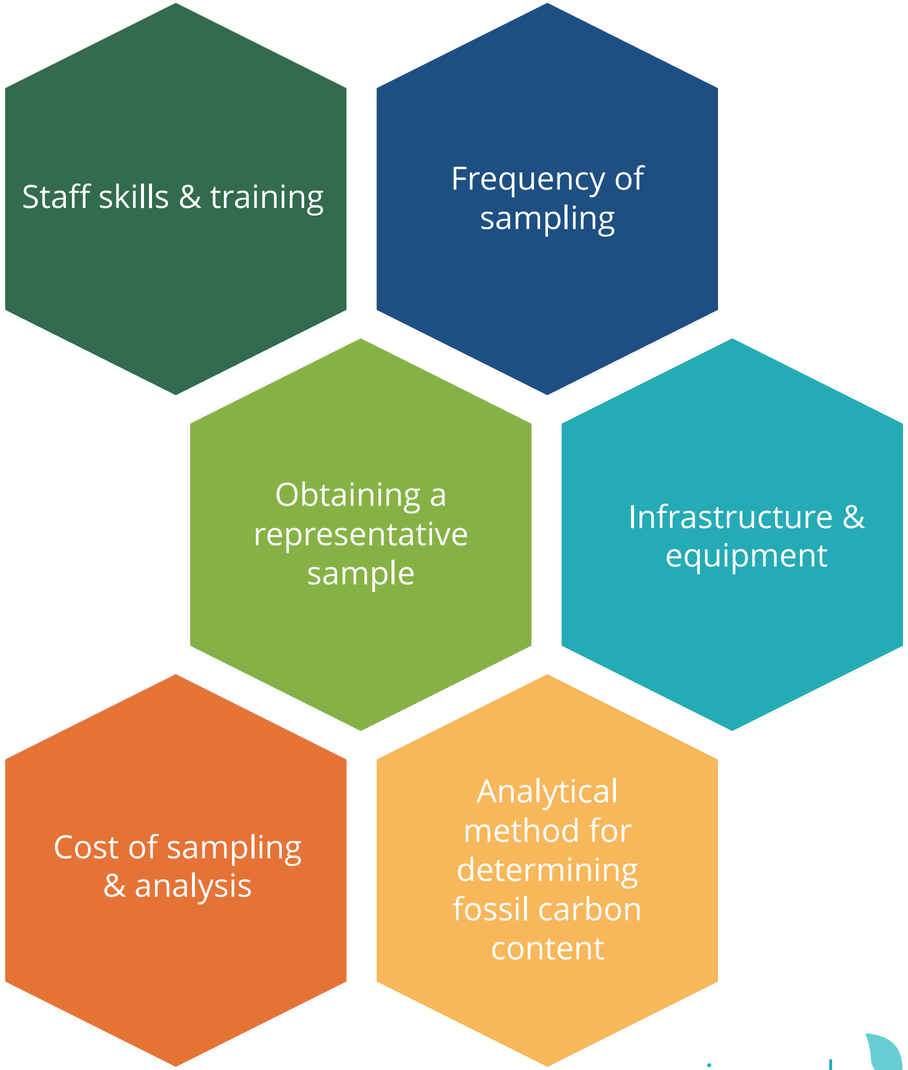
The graphic to the right summarises the key issues that the sector will have to consider. This presents a challenge for all stakeholder groups. Where the burden and responsibility for sampling waste lies will likely be determined by contract negotiations. Currently, most EfW contracts with feedstock suppliers, particularly those for RDF, require the supplier to sample the feedstock and provide evidence that it is within specification.

Waste sampling & analysis is a specialist area that requires knowledge and expertise to ensure that results are accurate and representative. More detail on the process for sampling and analysing residual waste, and relevant standards is shown in Appendix 1.

The key issues for the sector to consider in relation to sampling are as follows:

- **Staff skills & training:** Whilst several standards are available for waste sampling & analysis, it can be complex and resource intensive. Additional staff and training may be required, or work could be contracted to specialists;
- **Obtaining a representative sample:** Residual waste is heterogenous with bulky elements. As such, obtaining a representative sample can require the segregation of 3-4 tonnes to be representative. This requires space and the availability of plant and equipment to handle waste. Site operators will need to make both available and consider the health & safety of workers; and
- **Frequency of sampling:** There is no specific guidance on the frequency of sampling. For comparison, Ofgem require monthly sampling to determine the fossil content of fuels for the Renewable Energy Guarantees of Origin scheme. At a cost of ~£15k, this type of analysis would add significant cost to the sector.

Key issues for analysis fossil carbon in residual waste



Digital alternatives to manual sampling?

Very little data is available on the chemical and physical composition of most waste streams collected and managed by the resources & waste sector. This is because the majority of the European Waste Catalogue (EWC) codes that are used to describe it are high level and generic. Any compositional information is generated through periodic sampling, and this is usually only undertaken where legislation such as the MRF Regulations*, requires it or when required to demonstrate the waste meets an agreed specification such as is the case for RDF.

Manual sampling and analysis would add significant costs and operational challenges to many operations, particularly for 'merchant' facilities that may have many customers with distinct waste streams.

There are two technological advancements in the sector that have the potential to improve the measurement and communication of waste compositional data through the value chain:

Artificial intelligence:

Material recognition technology has progressed to the point where if an item can be recognised by the human eye, the technology can identify it. There are several suppliers and waste management companies that have successfully deployed this technology in MRFs and are collecting real time, granular data on the composition of their customers' waste. There is the potential to deploy this technology at different points in the value chain, however, for the data to be accurate, waste must be presented on a belt with all items visible. This is a challenge where waste is moved and treated in bulk. At least one company is currently trialling the technology at an EfW facility to determine whether it could be used to measure the fossil content of feedstock as it is fed into the grate.

Digital waste tracking :

The aim of digital waste tracking, which is currently being developed by Defra and the devolved administrations, is to track waste from producers, through the value chain, to its end destination. If successful, it will transform the waste data that is available for analysis and deter waste crime. The consultation confirms that waste producers will be required to describe waste using an EWC code and a written description. Collecting this information nationally and in almost real time will significantly increase our understanding of waste streams. However, the challenge remains that EWC codes do not provide insight into the detailed composition of different waste streams. As such, they are of limited value for calculating or apportioning carbon costs unless default carbon factors can be developed.

Although both developments are useful tools to support the implementation of ETS, they are unlikely to provide a basis for allocating CO_2 costs. However, they will allow operators to improve their understanding of waste composition and share this information with their customers.

* The Environmental Permitting (England and Wales) (Amendment) Regulations 2023

5. Incentivising action & avoiding unintended consequences

Are the signals right and will they drive the right actions?

Incentivising the right actions

For ETS to be successful in maximising the reduction of carbon emissions from EfW, several conditions need to be met. These include:

- A strong regulatory framework that applies the rules of the scheme consistently, combined with proactive and effective enforcement against possible ETS fraud and the leakage of waste to illegal operators.
- Alignment of other fiscal drivers and waste policy with ETS to drive behaviour in the supply chain and avoid a return to landfill.
- A carbon price that is sufficiently high to create a business case to remove carbon intensive materials from residual waste and invest in CCS.
- Infrastructure and technology to treat 'hard to recycle' products and packaging such as chemical recycling.
- Alignment between UK and EU ETS prices to prevent unnecessary cross-border waste movements.

POSSIBLE UNINTENDED CONSEQUENCES*

1. Landfill (disposal) becoming cheaper than EfW (recovery).
2. Increase in cross-boundary shipments of RDF and SRF.
3. Potential for increased fraud and waste crime.
4. Development of a 'two tier' waste market.
5. Lack of suitable offtakes for plastics
6. Market disruption as 'waste to X' technologies increase.

** Identified through stakeholder interviews, research & analysis*

Potential unintended consequences

Return to Landfill

The current expectation is that unlike EfW, landfill will not be included in the scope of the ETS expansion. This creates a risk of gate fees for EfW increasing above those for landfill.

As an example, using an approximation of current pricing, EfW gates fees could rise from around £100/T to £149/T*. This exceeds the current cost of landfill which is around £128/T including landfill tax. If the price of carbon rises further, the differential also increases which would incentivise waste producers to divert more waste to landfill, the waste management option that is at the bottom of the waste hierarchy.

UK Government have recognised this in consultation responses and landfill tax for 2025 is expected to rise above inflation. Beyond that, there is a commitment to monitor the relative pricing dynamics but forecasting the level landfill tax will need to be set at to offset variable carbon pricing will be a challenge.

Another solution could be to include landfill in ETS but monitoring and measuring emissions from sites is challenging.

Increases in transfrontier shipments

The UK exports approximately 2Mtpa of RDF and SRF to EfW facilities and cement plants in Europe. Waste exports provide an alternative to domestic EfW facilities when there is insufficient capacity due to a structural infrastructure gap or planned and unplanned shutdowns.

Given that ETS will significantly increase gate fees at domestic EfW facilities, it could make overseas EfW facilities more competitive and increase exports. Although to an extent, this may be reasonable if EU fleet are more efficient in their use of waste via use of heat networks, the policy itself should not drive market distortions. The divergence between gate fees would be minimised if EU ETS is extended to cover municipal waste incinerators for which there is provisional agreement. The European Commission (EC) will not confirm this until July 2026 and there is some ambiguity over a start date. The aim is to start from 2028, which would align with the start of the UK scheme, but the EC is considering an ‘opt-out’ to 2030. However key UK export destinations, Germany, Sweden, Denmark and the Netherlands, already have carbon pricing for waste to EfW. There is also the potential for imports to the UK if the EU ETS price is significantly above that in the UK.

Increase in prevalence of Waste Crime

As the costs of waste disposal increases, so does the incentive to avoid them. Waste crime is already estimated to cost the UK around £1Bn annually and this undermines legitimate operators. ETS will significantly increase the cost of residual waste disposal and mitigating the increased incentive to avoid these costs must be considered in the implementation.

In the case of ETS, there are two types of crimes that should be considered:

- Increases in fly-tipping & illegal waste sites as waste producers seek to avoid cost increases & criminals take advantage of this; and
- Data fraud if those subject to ETS costs seek to misrepresent the carbon intensity of their waste and therefore reduce the ETS costs passed through to them. This has the potential to involve significant avoided costs and negatively impact legitimate customers who may take some of the carbon burden.

The UK ETS Authority and the environmental regulators will require sufficient resources and expertise to monitor, investigate and tackle waste crime.

** Government’s central price scenario & 50% fossil carbon content.*

Potential unintended consequences (2)

Two Tier EfW market due to CCS adoption

The ETS aims to drive down point source carbon emissions from EfW. CCUS can achieve this by capturing more than 90% of CO_2e emissions at the facility and transporting it for long term storage or certified use. The UK Government is investing heavily in the deployment of CCS networks to capture carbon from large emitters and to date, two EfW facilities have been selected to receive support (Viridor in Runcorn and Protos in Cheshire).

EfW facilities with access to offshore storage hubs in the North East and Irish Sea and the ability to co-locate carbon capture technology, may build a competitive advantage over those that do not. The structure of Government support for CCS is likely to ensure that there is no commercial advantage in terms of ETS costs, over sites without CCS. However, the monetisation of carbon removals for captured biogenic carbon may allow operators to offer lower rates in the market or offer incentives to customers such as sharing revenue from carbon removals associated with their feedstock.

Suitable offtakes for plastics

ETS will incentivise all stakeholders in the value chain to separate plastics and other 'plastics rich' products such as absorbent hygiene products, synthetic textiles and WEEE that significantly contribute to the fossil carbon content of their waste.

This means that effective and commercial recycling technologies will have to be developed and deployed to manage typically hard to recycle plastics.

Commercialising closed loop chemical recycling for plastics will be crucial. It is currently outside the scope of ETS. Timing the delivery of sufficient capacity to treat plastics diverted from EfW will rely on clear signals from the UK Government to give investors' confidence in addition to avoiding planning and permitting delays.

If insufficient capacity is available, it may lead to stockpiling of hard to recycle plastics, increased reliance on overseas capacity and potentially waste crime that leads to environmental damage.

Waste to 'X' technologies

Effective implementation of ETS should incentivise investment in new technologies that provide less carbon intensive treatment routes for residual wastes and with the potential to support the decarbonisation of other sectors of the economy. The growing interest and Government support for "waste to X" technologies producing sustainable aviation fuels (SAF), off grid heating alternatives and low carbon marine fuels are all examples of products that could be supported by the economics of ETS. Carbon emissions from these processes are typically less than EfW, therefore the cost passed through will also be less, potentially making it more competitive with EfW to electricity and heat.

These technologies are new to the market and bring their own challenges. Firstly, none are operating at the large, commercial scale required to provide a reliable offtake for significant tonnages of residual waste. This will make it challenging for local authorities to commit to contracts. There is also the risk that should all of the waste fuelled, large-scale facilities supported by the UK Government be delivered, they could disrupt the EfW sector by drawing feedstock away from less competitive conventional plants and reducing the incentive to divert fossil wastes to recycling, further up the waste hierarchy.

Incentivising action to reduce emissions

The additional cost levied by the ETS should create a commercial opportunity for waste producers and the resources & waste sector to reduce waste arisings and invest in additional measures to remove items that contribute to fossil carbon emissions and increase recycling rates. The actions that could be taken by stakeholder groups include:

Household and commercial waste producers

- Implementation of waste reduction measures to minimise residual waste tonnage.
- Maximising recycling rates when waste is unavoidable.
- Target the separation and recycling of waste items with a high fossil carbon intensity.

Bulking and sorting facilities

- Invest in the sorting and separation of wastes with a high fossil carbon intensity to reduce the ETS burden of customers and maintain a competitive position.

EfW operators

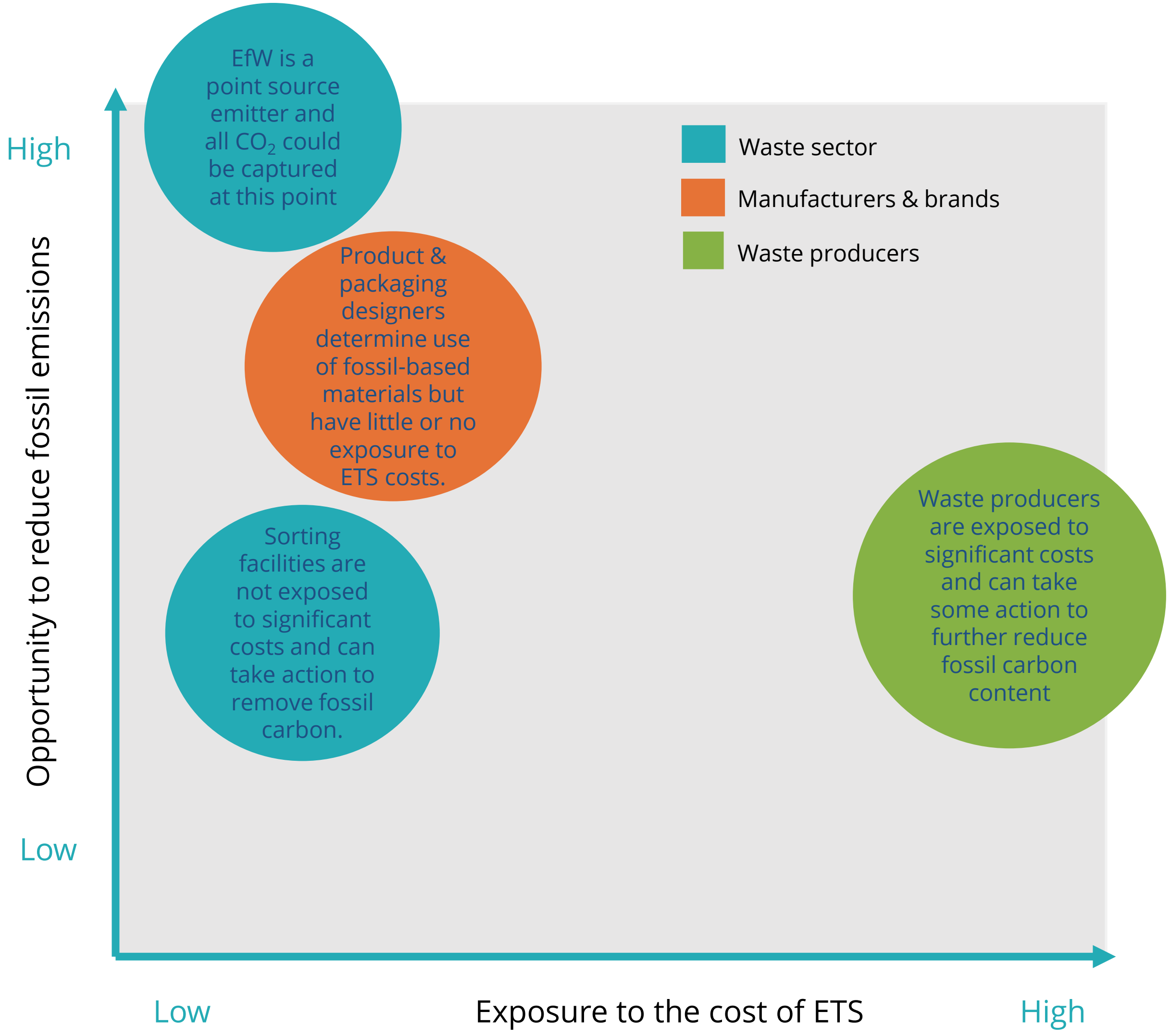
- Invest in the pre-sort to remove plastics from feedstock and CCUS and potentially benefit from the sale of carbon removals.

Brands and manufacturers

Outside of the resources & waste sector and not directly impacted by ETS (other than perhaps via EPR for packaging), brands and manufacturers also have a role in reducing fossil carbon emissions by:

- Designing products that are re-usable and/or recyclable and easy to separate from residual waste.
- Using sustainable materials which minimise emissions at end of life.

Financial burden v impact potential



Waste producers will bear most of the carbon cost of ETS and potentially, some of the administrative costs of the scheme. However, waste producers alone do not have the ability to take the full range of interventions required to minimise the fossil carbon of residual waste. Other stakeholders can make a significant contribution to limiting and avoiding fossil CO_2 emissions but are less exposed to ETS costs:

- EfW is a point source of fossil CO_2 emissions, and for some plants, it is possible to capture almost 100% of carbon emissions though CCS. However, CCS is expensive to implement and operate. As such, commercial and/or regulatory signals must be in place to incentivise investment. The UK Government has made its support for CCS clear through support for at least two networks (HyNet & the East Coast Cluster) and two large EfW facilities (Viridor Runcorn and Protos Energy Recovery Facility) have been selected to negotiate contracts). CCS could potentially offer an additional revenue stream for EfW operators if the capture and storage of biogenic emissions can be monetised as carbon removals. This is currently subject to consultation.
- Sorting facilities in the resources and waste value chain can play a significant role in removing plastics from the residual waste stream prior to EfW. ETS costs can be passed through to customers but offering this service may increase competitiveness if the carbon price is sufficiently high.
- Brands and manufacturers select the materials used to create products and packaging which ultimately end up in the waste stream. However, the carbon cost of end-of-life management remains with the waste producer. EPR costs are likely to be set in a way that accounts for ETS costs but only packaging is currently obligated.

Stakeholders outside of the ETS

Brands & manufacturers

The ETS scheme is designed so that the cost of carbon is ultimately borne by the polluter, the costs paid by EfW operators being passed back up the waste value chain to the waste producer. Whilst ETS creates the commercial case to invest in separating more waste for recycling, waste producers are not able to influence the recyclability or carbon content of products and packaging in the bin. Instead, this is controlled by brands and manufacturers. However, cost-pass-through for ETS does not extend to past the point of waste production or collection.

To address this issue, the ETS consultation seeks to link EPR costs with the carbon price of ETS so that brands and manufacturers indirectly do pay the ETS costs, adding this to EPR fees to reflect the true waste management costs. The UK ETS Authority's May 2024 consultation document states that an estimated "*20-30% of fossil waste by weight that is incinerated is within scope of pEPR, and potentially the carbon price for approximately 20-30% of waste by weight handled by local authorities could be covered by pEPR payments*". However, the remaining 70-80% of waste generating the majority of fossil emissions is not packaging and therefore the ETS costs associated with managing these wastes at end-of-life will remain with waste producers and not their brands and manufacturers. As such, ETS does not incentivise these stakeholders to reduce the use of fossil plastics and increate the recyclability of their products.

Scheme administrators for ETS and EPR

The UK ETS authority will collect the revenue that is generated from the sale of allowances but there is little definitive information about how this money will be used. Although it is inferred that the revenue will be used to fund carbon reduction measures, it is certainly not ring-fenced for the resources and waste sector.

The issue of ring-fencing EPR revenue to fund targeted interventions has also been raised. There is no requirement for local authorities to ensure that revenue from EPR is used to fund improvements to the collection and management of municipal waste. Instead, that money may be used to fill budget deficits in other areas such as social care. INCPEN has reported that its members are concerned that 'if the full cost of EPR is passed through to them through EPR, local authorities would not be incentivised to invest in services as they would not be exposed to the costs.

1. Environmental principles policy statement, January 2023

6. Building growth, reducing emissions

The ETS creates commercial opportunities if the right actions are incentivised

ETS will bring opportunities for the sector

The quantity, composition and fate of waste flowing through the resources & waste sector will change when EPR, Simpler Recycling and DRS are fully implemented. These policies are primarily aimed at the beginning of the value chain, i.e., reducing waste arisings, increasing the recyclability of packaging and increasing the quantity of waste separated for recycling. The ETS is focused on minimising fossil CO_2e emissions from the recovery of the remaining residual waste.

High-level modelling has been undertaken to estimate how the expected impacts of EPR, Simpler Recycling and DRS will impact on the volume of residual waste treated by EfW and the potential reduction in ETS costs for waste producers as a result. The modelling also considers the impact of cost mitigation activities on waste flows and the new market segment that is likely to develop around the separation, recycling and recovery of 'hard to recycle' plastics and 'waste to X' technologies. It does not consider the cost of implementation or further environmental benefits.

This section presents the results of the modelling and discusses the growth opportunities for stakeholders in the value chain, illustrated by a series of examples from the sector. In summary, these are:

1. Investing in plastics separation for recycling and fuels across the value chain;
2. The opportunity for chemical recycling in the UK; and
3. The capture and storage of biogenic carbon.

Modelling approach & assumptions

The model takes the 2023 baseline (presented in section 2, and projects this forward to 2035). The modelling assumes that:

- Waste arisings grow by 1% pa
- Recycling rates reach the targeted 65%, driven by EPR, Simper Recycling & DRS by 2035.
- Different materials (paper, plastics etc.) are assumed to be separated for recycling at equal rates.

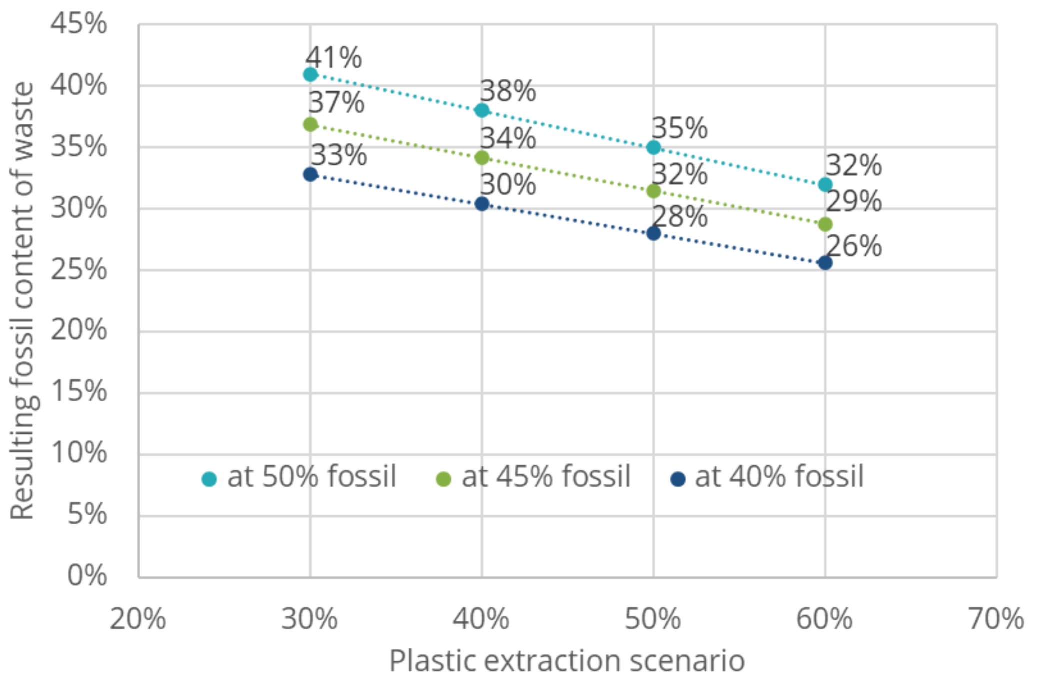
These assumptions result in a residual composition of 13% plastic, of which 30 – 60% could be removed with additional pre-sorting for advanced recycling.

Opportunity #1 A new business case for plastics separation

The extension of ETS to cover EfW facilities could increase the cost of waste treatment by around 50% if the price of ETS allowances reaches around £100/T (assuming 50% fossil carbon content). If the UK ETS Authority allows for cost allocation to be based on sampling or default factors that more accurately reflect actual waste composition, this creates an opportunity for intermediary sorting and processing facilities to invest in more sophisticated operations to remove materials with a high fossil carbon content, whilst remaining competitive or potentially gaining a competitive advantage, effectively offering customers a service to reduce their ETS costs.

Even if EPR, Simpler Recycling and DRS increases the recycling rate to an average of 65% recycling, an estimated 2.5-3 Mtpa of plastics would remain in the residual waste stream in 2035. This plastic accounts for up to 60% of fossil-based emissions in waste treated at EfW as shown in the figure to the right. If 30-60% of plastics in residual stream can be captured, it would create a new waste stream of between 0.9 – 1.9 Mtpa of hard to recycle plastics that could be feedstock for the new fleet of chemical recycling and ‘waste to X’ plants being developed in the UK, discussed in more detail in opportunity #2. In addition to plastics, the development of advanced sorting facilities in the value chain is also likely to increase the capture rates of other recyclable materials, boosting revenue for operators (where this is supported by the market) and the quantity of secondary materials available for the circular economy.

Impact of plastic capture rates on fossil CO_2 content



Opportunity #1 A new business case for plastics separation (cont.)

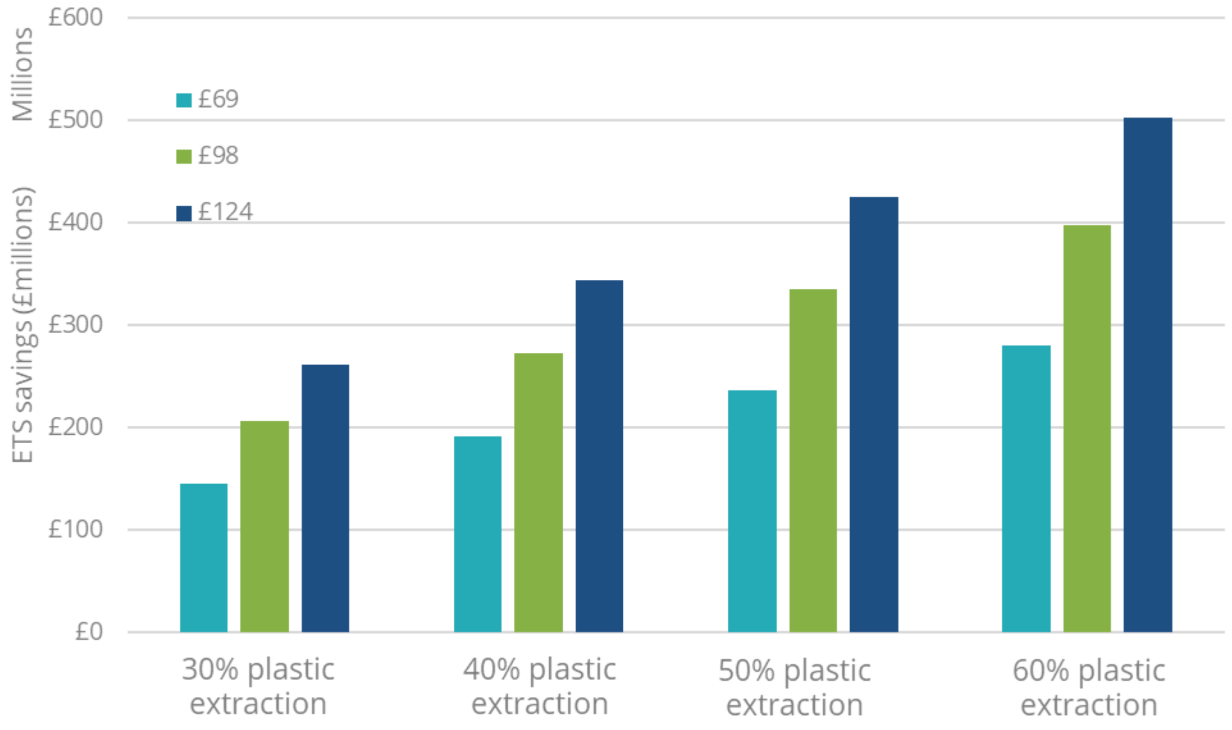
Separating plastics at scale in the waste management system could prevent between 2.1 - 4.1 MT/CO2e of fossil carbon emissions annually from EfW facilities, based on the high-level modelling of future waste flows.

This would reduce the cost of ETS payable by waste producers by between £145-500 million per annum depending on the capture rate and price of allowances. This equates to a 22% saving if the capture rate is 30%, rising to a saving of 42% if 60% of plastics remaining in residual waste can be removed prior to treatment at EfW facilities.

Removing plastics from residual waste will also reduce the overall quantity of waste to EfW by between 0.9 - 1.9 Mtpa. This equates to gate fee savings of between £79-160 million per annum. With savings of this magnitude, waste producers and/or intermediaries in the value chain could invest an additional £10-32 per tonne in collections and processing to remove plastics from residual waste without incurring additional cost. The breakdown of these savings is shown in the graphic on the right.

This incentivises investment in the early stages of the value chain as a priority rather than simply opting to capture fossil caron emissions at the 'end of pipe', i.e., CCS. The challenge for the waste value chain is to quantify the relative cost benefit of the options available, particularly given the potential future uplifts in ETS cost because of expected price rises for ETS allowances.

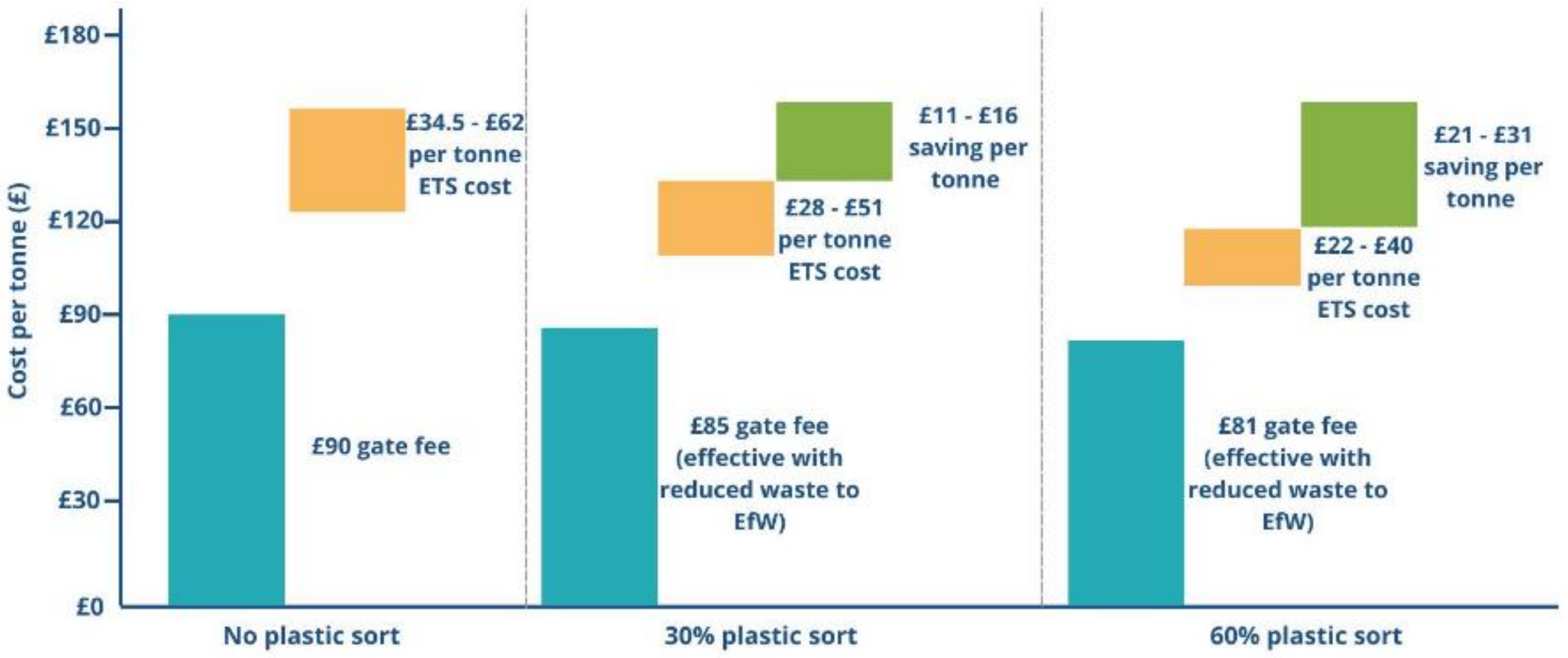
ETS savings delivered by increased plastic separation*



** Assuming 50% fossil CO_3 content and based on residual waste composition in 2023*

Opportunity #1 A new business case for plastics separation (cont.)

Breakdown of cost gap that could be invested in plastics removal (2024 prices)



- *Gate fees based on £90 per tonne with relative reduction resulting from reduced tonnage to EfW post plastic extraction.*
- *ETS costs valued based on 50% biogenic starting point and reduced burden resulting from removal of fossil fraction.*
- *Savings per tonne are cumulative impact of ETS saving and reduction in gate fees from reduced waste to EfW*

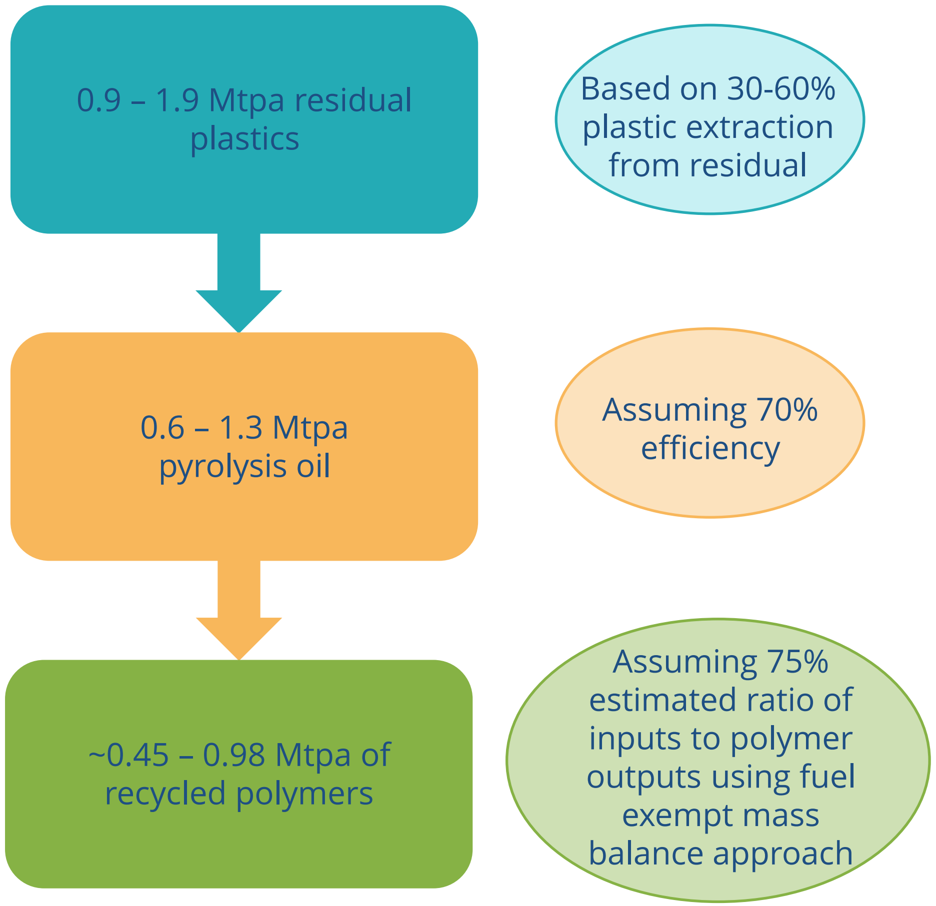
Opportunity #2 A role for chemical recycling

The second opportunity for the resources and waste sector is linked to the first, being created by the increased quantity of plastics separated from residual waste by intermediaries to reduce the fossil carbon content of waste to EfW. This creates a new market segment that will also manage plastics from waste producers as local authorities and others implement measures to collect films and other 'hard to recycle' plastics at source, although this element has not been quantified for this report.

Plastics separated by 'dirty' MRFs will be a mix of those that may be suitable for mechanical recycling and those that are too contaminated or that cannot economically be separated. Currently, there is little opportunity to recycle the later fraction. Chemical recycling describes a range of technologies, including pyrolysis, that break down plastics to varying degrees, from purification to full depolymerisation where plastics are broken down to composite molecules. The output of these processes (pyrolysis oil) can then be used as feedstock for refineries that produce naphtha, the chemical precursor for plastics manufacture, including food grade packaging, and the 'heavy' fraction is used to manufacture recovered fuels.

Depending on the capture rate, increased plastic separation by intermediates or from pre-treatment facilities at EfWs would generate between 0.9 - 1.9 Mtpa of plastics, creating the feedstock stream required for new chemical recycling facilities. The wider policy framework, including EPR and recycling targets for local authorities, also supports the development of chemical recycling as a means of recycling plastics that cannot be recycled mechanically and to some extent, the production of recovered fuels. Its contribution has also recently been recognised by the approval of a mass balance approach[1] when defining the recycled content of plastics.

This emerging technology could produce between 0.6 – 1.3 Mtpa of pyrolysis oil which could, depending on the mass balancing approach, produce between 0.45 – 0.98 Mtpa of recycled polymers. These include high quality 'food grade' plastics that are necessary for food contact packaging and of which, a supply of recycled polymer is currently limited.



1. Plastic Packaging Tax - chemical recycling and adoption of a mass balance approach - GOV.UK

Opportunity #3 Greenhouse gas removals with CCS

The UK ETS Authority consulted on the integration of greenhouse gas removals (GGRs) in the UK ETS[1] in May 2024. The response has not yet been published, but in the consultation, the Authority explains that it believed that the ETS is a suitable market for GGRs (both engineered, and nature based). The Intergovernmental Panel on Climate Change (IPCC) has recognised GRRs as a vital tool for the UK to meet its net zero targets.

EfW with carbon capture and storage (CCS) will capture between 90-95% of CO_2e from flue gasses from a facility using amine technology. This can then be transported to a permanent storage site, usually in geological formations. Captured emissions will include both fossil and biogenic CO_2e, the relative amounts being dependant on feedstock composition. This is an example of Negative Emissions Technology, removing more greenhouse gases from the atmosphere than are generated from the carbon removal process. If GRRs are integrated into the ETS, operators that meet participation requirements and offer a permanent storage solution, will be awarded allowances for removing biogenic CO_2 from the atmosphere. They could then choose to sell these allowances to generate an additional revenue stream or use them to meet their own compliance obligation if they do not fall under the threshold for a small, or ultra-small emitter.

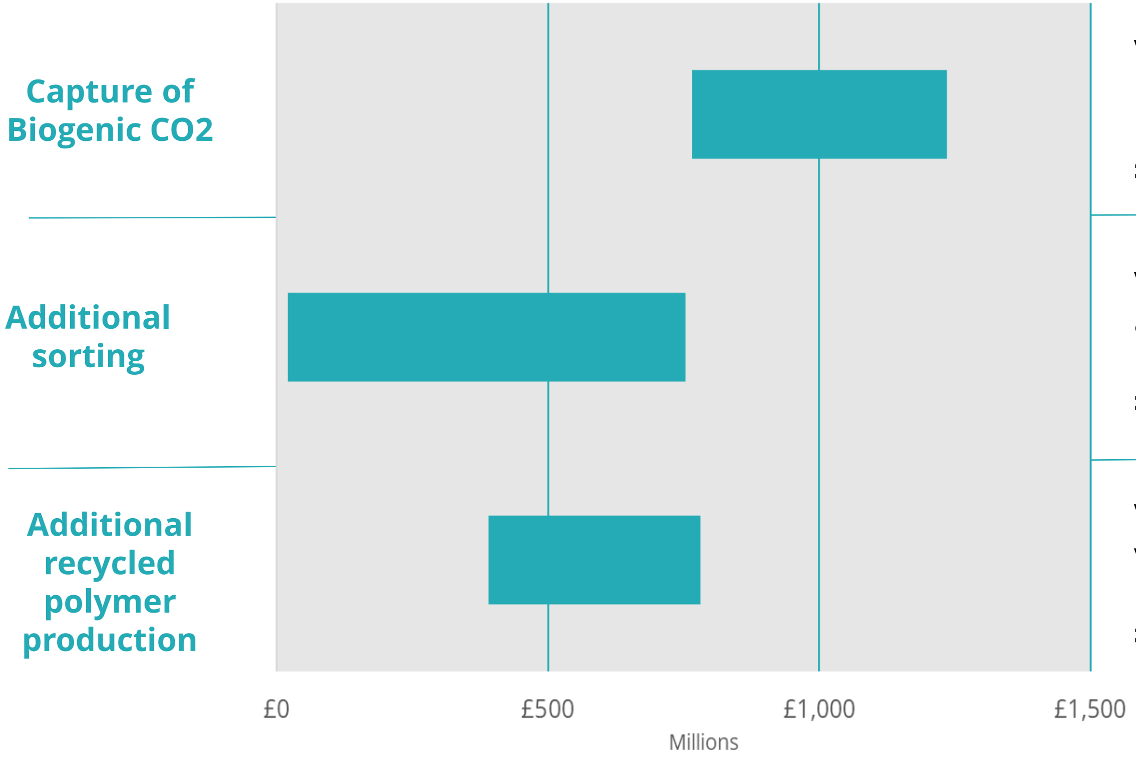
The implementation of CCS for EfW is costly and requires significant energy to operate, negatively impacting revenue from the sale of electricity. There are also physical constraints such as the sufficient space adjacent to existing plants on which to locate the plant and access to the network of CO_2 pipelines proposed in a series of Government backed 'clusters'[2]. Whilst other options for transporting CO_2 are available including by road, this adds more cost. Despite this, CCS is recognised by the IPPC as a necessity if the resources and waste sector is to reach net zero.

There is some concern that the significant and long-term investment that CCS requires may deter other stakeholders higher up the value chain in investing in the measures needed to separate recyclables and produce high quality recycled materials for the circular economy, instead relying on the abatement of fossil carbon emissions and 'locking in' waste to these facilities. However, there is still expected to be a cost incentive to decarbonise feedstock.

1. Integrating Greenhouse Gas Removals in the UK Emissions Trading Scheme: consultation
2. CCUS net zero Investment Roadmap

Summary: Scale of the opportunity for growth

Areas for growth in the sector



Potential value to be created

Valued based on 90% of biogenic carbon in waste after plastic extraction. (Effective biogenic content of 59-74%)

£735 – 1,200 million

Valued based on ETS and gate fee savings potential of additional sorting multiplied by waste to sorting

£20 – 615 million

Valued based on additional plastic to advanced recycling valued at £800 per tonne

£390 – 780 million

Note that the estimates are based on an assumed value of the products and/or gate fee savings. They do not consider cost of implementation or value the additional benefits that would also result such as increased employment opportunities and similar.

Appendix

OVERVIEW OF SAMPLING AND ANALYSIS OF RESIDUAL WASTE FOR FOSSIL CARBON CONTENT

Sampling for fossil content

An overview of the process for taking a representative residual waste sample from a stockpile

Step 1 - Calculate the minimum size of sample required to ensure it is representative.

The calculation is based on:

- Dimensions (length, depth and breadth of a typical particle) and other variables.
- The nominal topsize (the screen width at which 95% of the waste would pass-through); and
- The bulk density of the waste (weight per m^3)

The typical minimum size of a residual MSW samples can be between 3-4 tonnes.

Step 2: Generate the sample.

The sample is made up of individual samples from the whole waste mass. A minimum of 24 increments must be taken from different parts of the stockpile, with each having an equal chance of being sampled. In most cases, this means a machine is required to access the interior. The size of each increment is calculated by dividing the target sample size by 24.

Step 3: Manual sorting.

The sample generated in Step 2 is then manually sorted into categories including paper, card, wood, dense plastics, plastic film, putrescibles, garden organics, miscellaneous combustibles, hazardous waste and a <10mm fraction.

Step 4: Laboratory analysis.

If default fossil carbon factors for each category of waste sorted in Step 3 are not available, laboratory sampling is required. Selective dissolution (using sulphuric acid and acid peroxide) is a recognised method, although it can result in false positives with some synthetic textiles reporting as biogenic. However, it is quick and relatively low cost (£50-£100 per sample).

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