environmental services association

Recovering energy from waste FAQs

March 2021

Introduction

This document has been prepared to address common questions about the role and operation of energy recovery infrastructure in the United Kingdom. This document sets out the position of the Environmental Services Association (ESA) in response to these questions. The information in this document will be kept under review and may be subject to change in future versions.

Background to energy recovery

Recovering energy from waste material left over after recycling is an essential component of the "waste hierarchy" and, as a result, the UK's recycling and waste management system.

The waste hierarchy[1] (pictured below) is the policy framework which ranks waste management options according to what is best for the environment, and it has been largely responsible for determining the way the UK's waste management infrastructure looks today.

Preventing waste, at the top of the hierarchy, is the best environmental option for all forms of material, while disposing of waste material in landfill, or through incineration without energy recovery, is the least preferred option.

1 Defra (2011), *Guidance on applying the waste hierarchy.* **https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69403/pb13530-waste-hierarchy-guidance.pdf**

Despite the Landfill Tax, the UK still sends millions of tonnes of residual waste to landfill every year

The Landfill Tax, introduced in the UK in 1996, aimed to drive more waste material further up the waste hierarchy into energy recovery and recycling and thereby reduce disposal in landfill. As a result, over the past two decades, the UK has moved from single-digit recycling performance figures to an average household waste recycling rate of more than 45 per cent, while millions of tonnes of "residual waste" (the waste left over after recycling) is now used to generate energy instead of being disposed of in landfill.

There are currently between 50 and 60 energy recovery facilities across the United Kingdom and these typically serve the needs of specific local authorities and their surrounding areas. Combined, in 2019, these plants exported around 2% of the UK's total electricity generation or 6,600GWh, while those facilities connected to heating networks also exported 1400GWh of heat[2].

2 Tolvik (2019), UK Energy-from-waste statistics.
https://www.tolvik.com/published-reports/view/uk-energy-from-waste-statistics-2019/

Frequently asked questions

Is energy recovery from waste compatible with a circular economy?

The ESA, its members, and the wider recycling industry, are key proponents of a circular economy and this is at the heart of all that we do. The majority of our members have invested in services and infrastructure that provide solutions across the whole waste hierarchy – not just energy recovery – and we would like to see as much waste material recycled, re-used and put to good use as possible.

Once buried in landfill, the inherent resource value of waste materials is lost and cannot be returned to a circular economy, whereas activities further up the waste hierarchy are designed to extract the maximum value from these waste materials.

For residual waste left over after upstream recycling, re-use and waste avoidance measures have been implemented, generating energy and returning that energy back into the cycle of production is an essential, complementary, component of a circular economy.

Does energy recovery suppress recycling?

Recycling and energy recovery have very different drivers and the availability of energy recovery infrastructure does not impact upon investment in recycling infrastructure or the performance of recycling services.

Investment in recycling to date has primarily been determined by the health of global secondary raw material markets, which have shown their constraints in recent years.

Recycling performance, and the availability of quality recyclable materials in the waste stream, is also influenced by myriad complex drivers including product and packaging design choices and material uses; demographic and geographic factors; individual behaviour (and the factors that influence this behaviour); and recycling service design, among others. Analysis of some of these factors previously conducted by the Waste and Resources Action Programme (Wrap)[3] provides an illustration of this.

However, if implemented correctly, measures due to be introduced in England through Defra's Resources & Waste Strategy[4], along with counterpart policies in the devolved administrations, are likely to address many of these drivers and unlock a new wave of private sector investment in recycling infrastructure and funding for recycling services – while removing many un-recyclable packaging formats from the market.

As just one example of the efficacy of policy in this area, over the past two years, ESA members have already increased investment in domestic plastics reprocessing on the promise of a new "Plastics tax" which will drive market demand for recycled polymers in the UK.

Is there a correlation between low rates of recycling and energy recovery?

There is no defined causal relationship between availability of energy recovery and recycling rates because there are a large number of complex factors which influence local recycling performance, which in turn affects the volume of residual waste arising as a proportion of all waste generated – since recycling activity always happens upstream of energy recovery.

To further illustrate this, both in Europe and in the UK, there are many local authorities which have access to energy recovery infrastructure and high rates of recycling, and there are also examples of local authorities which have access to energy recovery and low rates of recycling.

Any correlation between the two factors, in either scenario, is often cited as evidence of a causal relationship, but there are simply too many variables across local and national drivers to allow for a true and accurate comparator analysis to date.

3 Analysis of recycling performance and waste arisings in the UK 2012/2013. **https://wrap.org.uk/resources/report/factors-influencing-recycling-performance**

4 Defra (2018), *Our Waste Our Resources: A strategy for England.* **https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/765914/resources-waste-strategy-dec-2018.pdf**

Could the material going to energy recovery be recycled instead?

Energy recovery infrastructure is designed to treat "residual waste", which is a term used to describe the waste material left over after other upstream recycling, re-use and waste prevention activities and processes have taken place. This is typically anything people put in a general rubbish bin rather than separating for recycling.

Every person and business in the UK has access to comprehensive recycling services and we are all encouraged to reduce, re-use and recycle as much as possible in accordance with the waste hierarchy.

Despite this, many recyclable materials are disposed of as residual waste by waste producers and must be treated as such, because it is not practicable or economically viable to extract these materials for recycling once they enter the residual waste stream.

The more we all recycle, the less recyclable material will be left in the residual waste stream, but there are many complex drivers of recycling behaviour. All of these drivers need to be considered and addressed to help people to recycle more.

The UK average recycling rate has stagnated at around 45 per cent for the past five years[5] and new interventions are required if the UK is to achieve its ambition of reaching a 65% average recycling rate by 2035.

Many of the interventions required to address the complex drivers affecting recycling are considered in Defra's Resources and Waste Strategy and the corresponding resources and waste policies of the devolved administrations. The ESA is in strong support of many of these emerging new waste policies and our members will be instrumental in delivering their intended outcomes.

Does material separated to be recycled end up in energy recovery?

Materials which could have been recycled often arise in the residual waste stream and this can happen for one of several reasons.

Typically, materials which could have been recycled are simply placed in the residual waste bin by a person discarding the material instead of being recycled. Once they enter this waste stream, these materials are destined either for landfill or energy recovery because it is not viable to extract these materials from the waste stream. This is why it is important that we all place the right material in the correct waste stream.

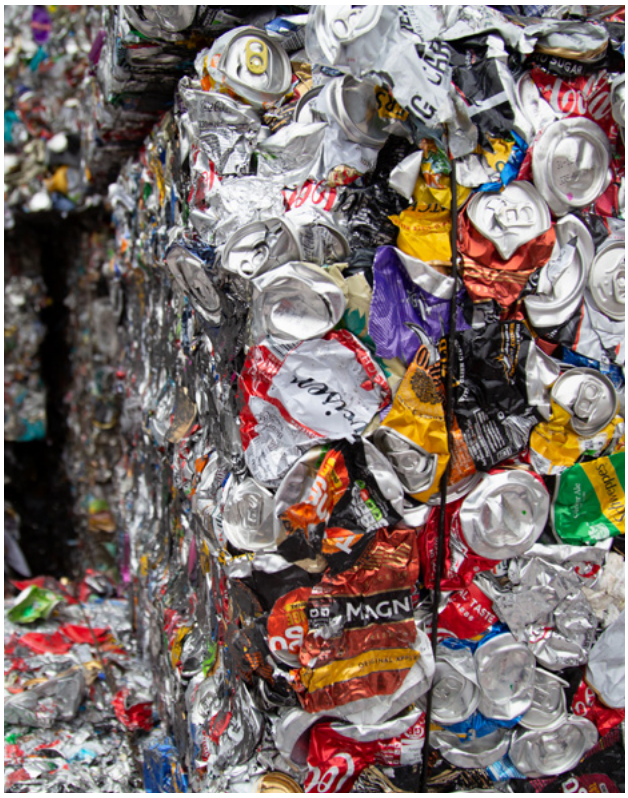
In some cases, materials are separated for recycling but are either not recyclable, or become too heavily contaminated – with food waste for example – to be economically recycled. Typically, any material separated for recycling that is not subsequently of sufficient quality to be made into new things, will be diverted to the residual waste stream and will therefore be treated in energy recovery or landfill.

5 Defra (2020), UK Statistics on Waste. **https://www.gov.uk/government/statistics/uk-waste-data**

What is the future role of energy recovery in the United Kingdom?

Energy recovery is a largely transitionary technology which allows waste producers to divert material from landfill while society pursues a more circular economy – by moving an increasing proportion of waste material further up the waste hierarchy.

However, even if the UK meets its ambition of achieving a 65% average recycling rate by 2035, the waste sector still forecasts a significant shortfall in energy recovery capacity in 2035 based on current trajectory, since there will always be a remaining portion of waste material left over that will require treatment without relying on landfill. The Resources & Waste Strategy also sets a target of no more than 10% municipal waste to landfill by 2035 and energy recovery will be essential to achieving this.



Furthermore, the UK currently has a significant energy recovery infrastructure capacity gap, which is why we continue to either landfill or export around ten million tonnes of waste material every year.

All new energy recovery facilities are planned in the context of future feedstock availability and composition, which itself is considered in the context of planned and likely policies. This is why long-term policy clarity is so essential to the planning of waste treatment infrastructure.

Does energy recovery lock councils into long-term contracts and stifle investment in other measures?

New energy recovery facilities require a significant investment and a typical-size facility can cost anywhere in the region of between £200-250 million to build.

In the majority of cases, the need case for new regional or local energy recovery infrastructure is established by a local authority (or partnership of authorities), based on current and anticipated future needs over the lifetime of any new asset, and in the context of external drivers affecting waste volume and composition. Future investment in local recycling services and associated recycling performance levels are a component of these considerations.

Local authorities may choose to finance, build and/or operate their own new infrastructure to meet this need, but in many cases, the private sector is invited to bid competitively for the opportunity to finance, design, build and operate new plants on the basis of the anticipated required capacity.

As such, contracts between operators and local authorities represent a way of delivering this vital public infrastructure while sharing risks between both parties and accessing the expertise of the private sector.

Payment to operators is made through different mechanisms depending on the financial structure of the contract between parties, but this typically occurs through a "gate fee" priced on a per-tonne basis of residual waste. Over the lifetime of the contract, the volume of waste being treated by the facility at the agreed gate fee rate would be sufficient to meet the terms of the financial agreement between operator and authority – recouping the investment in the facility and operating costs.

Operators also generate revenue through the sale of generated energy, which may be used to offset waste disposal costs for the authority. In addition to this, many contracts will require or allow operators to maximise the utilisation of plants (above the local authority contracted tonnage but within the permitted tonnage) to accept commercial and industrial waste from the region they serve, which would have otherwise gone to landfill. Revenues from treating this waste often further reduce the cost of municipal waste management to the local authority partner.

In some cases, "merchant" energy recovery facilities will be built by private sector operators based on regional need, but these still typically require a long-term contract for a certain proportion of waste to de-risk the investment and, typically, only a limited number of operators or local authorities have control of sufficient tonnage to guarantee material over the life of the asset.

How does energy recovery compare to other forms of energy generation?

The primary role of energy recovery is to provide a sanitation service to society by treating the residual waste left over after recycling. This waste would otherwise go to landfill. It cannot therefore be directly compared with other forms of energy generation, since the energy generated is a by-product of the primary waste sanitation process, while conversely, other forms of energy generation clearly are not designed to process waste.

Policy-makers and those involved in recycling and waste management use the Greenhouse Gas (GHG) emissions arising from the treatment of waste in landfill as the basis for comparison with energy recovery carbon performance, since the primary purpose of both solutions is to dispose of residual waste.

At present performance, energy recovery represents a lower carbon solution for the treatment of residual waste than landfill and the delta in emissions performance between energy recovery and landfill is likely to further grow in favour of energy recovery with efforts to de-carbonise feedstock and improve the efficiency of these facilities in future.

Is the energy generated by these facilities renewable or sustainable?

The residual waste processed by energy recovery facilities is a mix of biogenic and fossil-based material left over after viable recyclable materials have been separated by the waste producer.

The biogenic proportion of this residual waste could be considered a lower carbon alternative to fossil fuels, but because it contains fossil-based materials (like plastics) residual waste is not a wholly renewable or low carbon source of energy when directly compared with some other fuels or energy sources. However, drawing a direct comparison with other energy sources is not appropriate, since the primary function of energy recovery is to treat residual waste rather than generate energy.

Treating residual waste is primarily achieved either through landfill or energy recovery and each have different drivers of emissions.

The biogenic fraction of residual waste degrades in landfill and releases methane (a potent greenhouse gas) – whereas the fossil-based fraction of residual waste releases CO2 when treated in energy recovery. However, overall, treating residual waste in energy recovery instead of landfill saves 200kg of CO2e per tonne of waste treated, which is just one of the reasons why on average energy recovery remains the preferred option.

Does the UK have too many energy recovery plants?

Far from having too many, the UK does not have sufficient energy recovery capacity to manage its current or future residual waste needs without relying on the continued use of landfill and export of waste abroad.

Many different organisations have forecast the UK's energy recovery capacity requirements in the context of future waste volumes and recycling scenarios. In 2017, the ESA commissioned Tolvik[6] to produce an independent compilation and analysis of these forecasts in order to isolate and identify the impact that different recycling rates have on the treatment capacity gap between 2017 and 2030.

Tolvik's review shows that the UK is heading for serious under-capacity for residual waste treatment for all but the most unrealistic future recycling rates and that, even if the UK achieves its ambitious target of 65% average recycling rates by 2035 – this trajectory still results in a capacity shortfall of around 4.5 million tonnes in 2030. This is the equivalent of around 20 energy recovery plants of a typical size.

6 Tolvik (2017), Residual waste capacity gap analysis. **http://www.esauk.org/application/files/6015/3589/6453/UK_Residual_Waste_Capacity_Gap_Analysis.pdf**

Is energy recovery from waste compatible with the UK's pursuit of net zero carbon emissions by 2050?

Waste treatment and disposal is an essential component of society and will remain so in future – certainly within the UK's transition to a net-zero carbon economy by 2050. The carbon-reduction performance of the recycling and waste management sector is recognised by the Committee on Climate Change[7] and we have reduced our emissions by 63% compared to 1990 levels – which has largely been achieved by moving waste material out of landfill. However, increasing recycling and lowering carbon from energy recovery are both essential to our sector achieving net zero carbon emissions and therefore playing our role in hitting the UK's carbon targets.

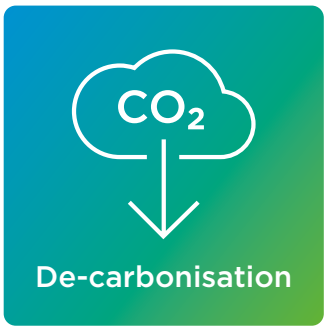
The ESA and its members will publish a Net Zero Carbon Strategy for the recycling and waste sector in 2021 setting out how it will lower carbon from the full range of activities, including energy recovery.

What is the industry doing to reduce carbon emissions from energy recovery facilities?

The ESA and its members are developing a Net-Zero Carbon Strategy which will drive down carbon emissions associated with energy recovery by working with others to remove as much recyclable fossil-based materials from residual waste streams as possible.

This will be most effectively achieved through upstream interventions designed to encourage greater recycling of plastics; while longer term secondary interventions will include maximising the use of heat-energy from these facilities as well as electrical energy; and by exploring the potential for carbon capture and storage – which is in line with recommendations made by the Committee on Climate Change.

De-carbonising our sector is the top strategic priority for the ESA and its members, and this is reflected in our 2019/20 Annual Report.



7 Committee on Climate Change (2020) Sixth Carbon Budget.
https://www.theccc.org.uk/publication/sixth-carbon-budget/

Can energy recovery operators just remove plastic from residual waste before the waste is treated?

Attempting to segregate materials once they enter the residual waste stream is expensive, energy-intensive and produces poorer quality recycled material. Experience tells us that pre-treament solutions, such as MBT, have been unreliable and costly, and often fail to meet their promised performance.[8]

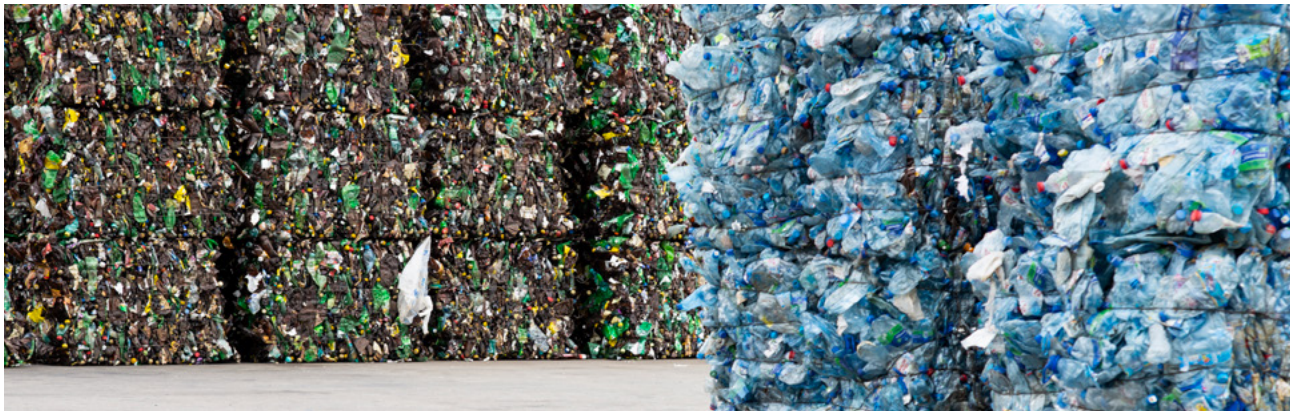
Furthermore, any plastics (or any other material) removed from the residual waste stream are often low quality or heavily contaminated and still require a viable use or alternative treatment solution. As such, experience tells us that interventions should be focussed further upstream to stop recyclable plastics from entering the residual waste stream in the first place.

Segregating material for recycling is most effective when it occurs further upstream of waste disposal activities. Everyone in the UK has access to comprehensive recycling services and recyclable materials should be separated for recycling, with only those materials that cannot be recycled placed in the residual waste stream.

Should Government introduce an "incineration tax" to drive more material further up the waste hierarchy?

At present, landfill and energy recovery are the only viable options for disposing of the millions of tonnes of residual waste arising in the UK each year. In landfill, this waste releases more CO2e than it does when treated through energy recovery, which is one of the primary reasons why landfill has been largely phased out in favour of energy recovery. The Landfill Tax, introduced in 1996, helped to facilitate this transition by ensuring that landfill became the more expensive disposal option over time compared with energy recovery – thereby unlocking investment in new energy recovery facilities.

The ESA's position is that any new carbon pricing or taxation on energy recovery, however, will simply make residual waste disposal more expensive for individuals and businesses without driving a greater proportion of waste material further up the waste hierarchy. This is because the drivers of recycling are much more complex and very different to those for residual waste treatment.



8 Tolvik (2017), Briefing Report: *Mechanical Biological Treatment – 15 Years of UK Experience.* **https://www.tolvik.com/published-reports/view/mechanical-biological-treatment-15-years-of-uk-experience/**

Any material segregated for recycling must have a viable end market and, without new demand-side interventions, these markets are currently constrained. Furthermore, any additional cost on disposal would not serve as a direct incentive for manufacturers or retailers to develop more resource-efficient and/or recyclable products and packaging to help consumers, since those placing products and packaging on the market will be insulated from additional cost.

The interventions proposed under the Defra's Resources and Waste Strategy, particularly around Extended Producer Responsibility, are expected to address many of these issues affecting recycling over the next decade. The ESA therefore agrees with the Government's approach that it should only consider a new tax or carbon pricing on energy recovery if the Resources & Waste Strategy fails to meet its objectives – helping our sector to reduce carbon emissions from both energy recovery and landfill.

What do energy recovery facilities emit?

Like any other source of energy generation based on the combustion of solid or liquid fuels, the energy recovery process produces emissions. These emissions are predominantly steam, oxygen, nitrogen and carbon dioxide along with very small quantities of pollutants.

These emissions are closely regulated in England by the Environment Agency, and by the regulatory authorities of the devolved administrations, and plants must operate within strict emissions limits set by the regulators and informed by health authorities.

Modern energy recovery facilities are among the most heavily regulated industrial installations in Europe and meet strict environmental standards as a result – often operating at just a fraction of permitted emissions levels. As a result, they make only a small, if detectable, contribution to local concentrations of pollutants, such that any impact on health from reduced air quality is negligible.

UK energy-from-waste plant operators take their responsibilities for monitoring emissions and protecting air quality very seriously and continually strive to achieve emissions performance well under the regulatory thresholds.

Do emissions from energy recovery facilities pose a health threat?

Emissions from energy recovery facilities are among the most heavily scrutinised and regulated in Europe. Operators have very strict emissions limits imposed upon them and performance against these limits is closely monitored by the environmental regulatory authorities. In practice, modern, well-run, facilities operate well within their permitted levels across a range of emissions factors.

The use of energy recovery in England is approved by Public Health England (PHE). Following the results of a major study on municipal waste incinerators by Imperial College London[9], published in 2018 and 2019, PHE stated that its

> *Well run and regulated municipal waste incinerators are not a significant risk to public health.*
>
> *While it is not possible to rule out adverse health effects from these incinerators completely, any potential effect for people living close by is likely to be very small.*
>
> *This view is based on detailed assessments of the effects of air pollutants on health and on the fact that these incinerators make only a very small contribution to local concentrations of air pollutants.*
>
> *Public Health England*

9 Imperial College London (2019), Major study finds no conclusive links to health effects from waste incinerators. **https://www.imperial.ac.uk/news/191653/major-study-finds-conclusive-links-health/**

Additionally, in a recent study commissioned by the Greater London Assembly (GLA), independent consultancy Air Quality Consultants reviewed a range of prior studies and findings into health effects of energy recovery facilities and concluded from their literature review that "any potential health risks associated with direct emissions from modern, effectively managed and regulated EfWs in London are exceedingly low".

The ESA and its members do, however, welcome continued rigorous and peer-reviewed academic research in this area so both operators and the public alike can be assured over the safety of these operations. Our sector will strive to deliver continual improvement by appraising and utilising the best available technologies and techniques.

How are energy recovery facilities controlled and who regulates them?

Energy-from-Waste plants are permitted and regulated by the Environment Agency in England and the environmental regulators of the devolved administrations. These regulators impose strict emission limits for these facilities and all emissions are continually monitored – with the regulators having access to this data at all times. In addition to continuous emissions monitoring, the regulators will carry out regular independent checks to ensure compliance.

Emissions data for energy recovery plants is therefore a matter of public record and, in many cases, operators and local authorities voluntarily agree, where practicable, to provide facilities which enable members of the public to easily access live emissions data directly.

Energy recovery facilities serve a vital public function and, in accordance with the waste hierarchy, divert millions of tonnes of UK waste from landfill every year. In England, their operation is approved by Public Health England and permitted by the Environment Agency and each plant is only granted a permit if the Agency determines any and all appropriate risk mitigation is in place; and the plant can meet its permit conditions. The Environment Agency will not issue an environmental permit if the proposed plant will have a significant impact on human health and/or the environment.

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