

Waste-to-Energy in the Circular Economy

ESWET Factsheet

Circular Economy Act strengthening EU competitiveness

The forthcoming **Circular Economy Act (CEA)** is set to strengthen the EU's economic security and competitiveness by advancing circular business models, facilitating the free movement of circular products, secondary raw materials (SRMs) and waste, and boosting both the supply of and demand for high-quality recycled materials.

The Waste-to-Energy (WtE) sector is a necessary enabler of these objectives. This factsheet sets out the sector's contribution to a functioning circular economy and outlines the policy conditions needed to unlock its full potential. Drawing on the comprehensive analysis outlined in our [position paper](#) on the CEA and in our upcoming report on material recovery, this factsheet sets out the sector's contribution to a functioning circular economy and outlines the policy conditions needed to unlock its full potential.



Why Waste-to-Energy matters for the Circular Economy: climate neutrality, industrial resilience, and economic security



01

Circularity

WtE plants successfully recover materials that conventional separate collection methods miss. By turning leftover waste into a resource, they actively advance the EU's circular economy objectives in line with the EU waste hierarchy. Rather than competing with recycling, WtE is complementary to it.

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Energy recovery

Advanced WtE technologies process non-recyclable waste to generate clean electricity and heating while capturing valuable raw materials from incineration residues. In 2024, WtE in the EU produced around 39 billion kWh of electricity and around 76 billion kWh of heat. Over 50% of the energy produced is considered renewable due to the biogenic content of treated waste.

03

Material recovery

Europe's approximately 500 WtE facilities produce more than 20 million tonnes of Incinerator Bottom Ash (IBA) annually – a key source of secondary metals and minerals. IBA is composed of 80–85% minerals, 10–12% ferrous metals (iron, steel), and 2–5% non-ferrous metals (aluminium, copper, zinc, lead, silver, gold, and others). Advanced dry extraction technologies could enable the recovery of up to 0.2 million tonnes of aluminium – equivalent to 3% of EU imports.

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Economic security

WtE residues – in particular IBA – constitute a readily available, fully domestic source of SRMs. Metals and minerals recovered from IBA can be reintroduced directly into European industrial value chains, supporting low-carbon manufacturing and reducing the EU's dependence on imported primary raw materials. With a market potential estimated at €2 billion, scaling up recovery represents both a strategic and economic opportunity for the EU's resource security.

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Industrial resilience

In an era of heightened geopolitical uncertainty and fragmented supply chains, recovering strategic metals and minerals from IBA and reintroducing them directly into European production lines as high-quality recycled resources strengthens local supply chains and shields domestic industries from volatile global material markets, directly advancing the EU's strategic autonomy objectives under the Critical Raw Materials Act (CRMA).

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Climate mitigation

WtE delivers major climate advantages across three channels: landfill diversion, fossil fuels displacement, and carbon capture. According to CEWEP, diverting non-recyclable waste from landfills to WtE avoids the emission of more than 600 kg of CO₂ per tonne of waste treated (100-year perspective). Energy recovery displaces fossil fuels at an estimated 360 kg CO_{2eq} per tonne, while material recovery abates 60 kg CO_{2eq} per tonne. Overall, WtE plants help prevent CO₂ emissions with avoided emissions amounting to more than 1,000 kg CO₂ per tonne of waste treated. With Carbon Capture, Utilisation and Storage (CCUS), the total climate benefit reaches - 1,040 kg CO_{2eq} per tonne.

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Environmental protection

Modern WtE facilities operate as advanced pollution prevention systems, ensuring that non-recyclable, waste streams, like contaminated plastic or sanitary waste, are managed under strictly controlled conditions. Through sophisticated flue gas treatment technologies, these plants significantly reduce hazardous compounds – including persistent pollutants such as per- and polyfluoroalkyl substances (PFAS) – while effectively controlling acid gases, particulates, and heavy metals. Without WtE, these contaminated waste streams would be landfilled or illegally burned, posing far greater risks of uncontrolled pollution to soil, water, and air.

The background of the slide is a photograph of a large pile of scrap metal. The metal is heavily rusted and discolored, with various shapes including coils, sheets, and rods. The pile is set against a plain, light-colored wall.

Challenges to fully unlocking WtE's potential

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Regulatory fragmentation

One of the most critical barriers is the absence of harmonised EU-level End-of-Waste (EoW) and by-product criteria for treated IBA to enable its use as a SRM and construction aggregate. Furthermore, while metals recovered from IBA are recognised as recycling under the WFD, minerals are not, and nor are metals and minerals recovered from fly ash.

Exclusion from the EU Taxonomy

Despite its legal recognition across the Waste Framework, Landfill, and Renewable Energy Directives, WtE is not yet covered by the EU Taxonomy for sustainable activities. This inconsistency restricts the sector's access to sustainable finance, despite its demonstrated contributions to circularity, energy recovery, and pollution prevention.

Price distortion between virgin and SRMs

SRMs remain structurally more expensive than virgin ones because environmental externalities are not priced in, and recycling is still often more costly than landfilling or using primary materials. Without fiscal tools to internalise the environmental costs of virgin resource extraction, the playing field remains tilted against circularity.

Challenges to fully unlocking WtE's potential

Uneven WtE capacity across Member States

Countries with mature WtE infrastructure (Belgium, Denmark, Sweden, Germany, Netherlands) have virtually eliminated municipal waste landfilling, while others (Greece, Romania, Bulgaria, Cyprus, Malta) still landfill more than 50%. Beyond greenhouse gas emissions, landfills are major sources of air, water, and soil pollution – with a recent investigation revealing PFAS levels in landfill leachate 260 times above safe limits – and the materials buried are lost forever, undermining the goals of a circular economy.

Underestimation of WtE's broader environmental and climate contributions

WtE plants generate approximately 400–450 kg of fossil CO₂ per tonne processed, but prevent emissions amounting to more than 1,000 kg CO₂eq per tonne. Without a lifecycle-based environmental and climate assessment framework, the benefits of WtE – including avoided methane from landfill diversion, displaced fossil energy, and material recovery – are not fully captured. As a result, policies risk not reflecting the sector's true contribution to decarbonisation and resource efficiency.

Lack of support for carbon capture

The EU ETS framework treats most CO₂ used in Carbon Capture and Utilisation (CCU) products as "emitted", providing no incentive for operators to invest in capture technologies. WtE plants generate a continuous, concentrated CO₂ stream – approximately 60% of which is biogenic – making them strategically suited for CCU, yet this potential remains commercially unviable without policy recognition.

Challenges to fully unlocking WtE's potential

Rising plastic production

Global virgin plastic production continues to rise (reaching 414 million tonnes in 2023) yet only 9% of all plastics ever produced have been recycled. Many products remain technically unrecyclable due to composite materials, complex additives, or material degradation, meaning a significant share of plastic waste inevitably ends up in WtE or landfill. Without binding upstream targets to reduce virgin plastic production, downstream waste management systems will continue to bear a disproportionate burden.

Export of waste to non-EU countries

Residual waste exported outside the EU often ends up in countries lacking the infrastructure to treat it safely, leading to uncontrolled dumping, pollution, and public health risks. Contaminated and non-recyclable waste is frequently mixed into shipments labelled as recycling, undermining EU circularity goals while shifting the environmental burden beyond Europe's borders.

Fragmented EPR schemes

Current EPR schemes remain fragmented across Member States, with significant gaps in accountability, enforcement, and cost-efficiency. The problem of free riders – non-compliant producers who avoid their obligations – persists, while transboundary shipments of second-hand goods and waste bypass national EPR obligations, creating loopholes that undermine fairness. As the WtE sector does not generate the waste it treats, EPR fees should reflect the real environmental impact of products and ensure that the costs of end-of-life treatment are borne by producers and upstream waste holders – not by waste management facilities.

Recommendations for a CEA that delivers

Regulatory Framework – Waste Management and Critical Raw Materials



1 Maintain the recovery status of Waste-to-Energy in EU legislation and acknowledge its role in the circular economy, particularly in supplying partly renewable energy and SRMs.

2 Recognise minerals recovered from (treated) IBA as recycling, and similarly recognise metals and minerals from fly ash, too.

3 Recognise metals and minerals recovered from incineration residues as **potential contributors to the production of advanced materials**, reflecting their proven performance and circularity benefits.

4 **Strengthen landfill regulation by introducing clear acceptance criteria for biodegradable waste**, ensuring proper monitoring of legacy sites, and linking landfill diversion directly to circular economy targets.

5 **Integrate landfill methane pricing and mandatory remediation plans**, to further align environmental protection with the EU's climate and resource-efficiency objectives.

6 Recognise other thermal processes - such as gasification - as recovery operations when producing usable energy or fuels, and as recycling operations when generating SRMs.

7 Ensure strong rules and effective implementation governing **waste shipments**, to guarantee that waste is managed within the EU according to high environmental and circular economy standards.

8 Improve the coherence, transparency, and cost-efficiency of EPR schemes across the EU, ensuring fees reflect the real environmental impact of products and incentivise design for recyclability.

9 Ensure policy coherence between CRM-related legislation, the Waste Framework Directive, the Net Zero Industry Act, the Clean Industrial Deal State Aid Framework, and the upcoming Circular Economy Act.

10 Strengthen the application of the Polluter Pays Principle by ensuring financial and regulatory responsibility for waste-related environmental costs lies with those who generate waste and its embedded pollution.

Regulatory Framework – Decarbonisation



- 11** Recognise CCUS as a circular solution within the CEA, establishing criteria for the environmental performance and traceability of carbon-derived products.

- Ensure alignment between the CEA, the EU Carbon Management Strategy,
12 and all relevant EU legislation, to promote the integration of carbon capture into circular value chains.

- Adopt a unified, life-cycle-based environmental and climate assessment framework across the entire waste management chain that balances direct,
13 avoided, delayed, and negative emissions so that each route's true contribution to decarbonisation, resource efficiency, and circularity. is properly assessed.

- 14** Reduce plastic production to tackle the plastic pollution problem at the source.

Market conditions



Create a true Single Market for SRMs and waste-derived products, ensuring a **level playing field between virgin and SRMs** through **fiscal measures**,
15 such as reduced Value Added Tax (VAT) for recycled materials and taxes on primary raw materials, and regulatory measures such as **mandatory recycled-content** requirements in key sectors.

Introduce mandatory Green Public Procurement (GPP) criteria that drive demand for recycled and circular products, leveraging the purchasing power of public authorities to create a lead market for secondary raw materials.
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Expand recycled content targets beyond plastics to construction materials.
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Streamline permitting procedures for IBA treatment and recovery installations (both for metals and minerals), by recognising these activities under EU industrial and circular economy priorities. Faster and more predictable permitting would support investment certainty, accelerate deployment of recovery infrastructure, and strengthen the EU's circular materials value chains.
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Recognise SRMs recovered from WtE residues as **low-carbon materials under EU industrial policy frameworks**. Metals, minerals, and aggregates recovered from IBA should be recognised within the Industrial Accelerator Act and related industrial policy instruments as low-carbon material streams. Their use avoids emissions associated with virgin material extraction and processing, strengthens domestic resource availability, and contributes directly to the EU's decarbonisation, competitiveness, and strategic autonomy objectives.
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Financial instruments



20 Include IBA treatment and recovery in the EU Taxonomy, as referenced by the European Commission in June 2023.

Support investment, innovation, and scale-up of material recovery technologies from WtE residues, through dedicated financial support **21** and by ensuring their eligibility under EU funding and financing instruments such as InvestEU, the Innovation Fund, the EIB instruments, and other relevant schemes.

22 Promote public-private partnerships to support innovation and scale-up of high-efficiency IBA recovery technologies.



About ESWET

ESWET European Suppliers of Waste-to-Energy Technology – is the European association representing manufacturers in the field of Waste-to-Energy.

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