



ADVETEC

GIVING VALUE TO THE NON-RECYCLABLE

Bending the Line: SRF and the Path to a Circular Economy



Executive Summary

Against a backdrop of growing regulatory change and legislative pressure, waste handlers must think differently - moving away from traditional routes such as exports, landfill and low-level incineration in favour of more innovative, environmentally friendly and cost-effective alternatives.

This is part of a broader global movement towards a circular economy – where waste is designed out of our behaviours in favour of a reuse, recycle and regenerate mentality.

However, much of the conversation around circularity focuses on the environmental and economic utopia of a 100% circular model rather than the decades-long and vastly expensive journey required to get there, or the changes that can and should be made now.

More focus must be placed on ‘bending the line’ – that is finding ways to transition from a linear economy to a circular one.

One way to support the move from a linear to a circular economy and deliver improvements now rather than tomorrow, is to increase the focus on residual waste, specifically non-recyclable waste, as this presents an area of urgent interest for waste handlers.

Currently, close to 20 million tonnes of post-consumer plastic waste (approx. 65%) goes to landfill or for low-level incineration each year across Europe because of the presence of organic matter¹ – a fact that gets largely overlooked. But this waste stream could be valuable in helping the UK’s transition to a more circular mindset.

This can be achieved by turning it into Solid Recovered Fuel (SRF), which holds far greater value than Refuse Derived Fuel (RDF). Doing so not only gives waste handlers the means to lower their own and their customers’ costs and carbon emissions immediately, it reduces the world’s reliance on fossil fuels - a change

1. Plastics Europe. (2022) The Circular Economy for Plastics – A European Overview. Available at: www.plasticseurope.org/knowledge-hub/the-circular-economy-for-plastics-a-european-overview-2/ (Accessed: 10th January 2024).

A key strategy is to move waste that cannot be recycled up the thermal hierarchy

we know we must all get behind.

It’s because of this that SRF is a growing market. As large-scale industries like cement production seek to decarbonise, demand for alternative fuels like SRF increases. This demand is driven by the fact that SRF can be made with a higher proportion of biogenic carbon – which is not subject to the Emissions Trading Scheme (ETS).

Although smaller and mid-sized waste handlers have been priced out of the SRF market historically, and some have had limited knowledge about SRF offtake as an option – that is all changing. This strong demand for SRF, coupled with Advetec’s on-site biotechnology solution, is levelling the playing field and enabling independent waste businesses to enter the SRF market with ease for the first time.

Waste handlers can put Advetec’s cost-effective biotechnology on-site and configure it to fit within their existing operations without requiring significant capex or vast amounts of time to make it happen. It gives smaller waste handlers access to an offtake route that was previously unavailable. It’s also a localised solution that reduces mileage, takes collection lorries off the road, and throws a lifeline to remote communities where waste infrastructure is often lacking.

There are plenty of other benefits, too. Turning non-recyclable waste into SRF can divert 100% of it from landfill or low-level incineration, lower GHG emissions by over 70% (compared with landfill) and help energy-intensive industries decarbonise. And, as SRF is well suited to other applications such as gasification and further recycling, it opens up even greater uses for waste once deemed worthless. Through SRF creation, waste handlers can harness innovation, protect profits, and guard customers against price increases.

In the global war on waste, we all have to re-educate ourselves about the impact of our behaviours and embrace the solutions and technologies with the power to deliver meaningful change. While global leaders concentrate on making the long-term infrastructural changes we need to live in a circular society, we must act now and make immediate improvements.

Greater use of SRF from non-recyclable waste helps to bend the line, moving us away from a linear ethos and putting us firmly on the path towards a more circular economy.



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Waste is simply
a valuable
resource
in the wrong
place, at the
wrong time.



Dr Stephen Wise
Chief Strategic
Development Officer

For decades, non-recyclable waste has been considered at the end of its useful life. Yet, this waste stream is a valuable commodity with the power to replace carbon-heavy fossil fuels. Consequently, non-recyclable waste has the potential to lessen our environmental impact and conserve natural resources – both of which are now time-critical objectives.

By focusing on this waste stream, we can help the world's collective efforts to bend the line, an important transitional step as we move away from a linear economy (where we 'take, make and waste') towards a circular one (where, eventually, waste will be eradicated).

This whitepaper will explain how turning non-recyclable waste into Solid Recovered Fuel (SRF) helps society take another step towards the circular economy. It will set out the role of Advetec's biotechnology in making that possible and explain how independent waste handlers can now access the SRF market easily with their own on-site solution for the first time. We will also illustrate why SRF is integral to greater global resource efficiency.



Chapter 1 | Understanding Solid Recovered Fuel (SRF)

What is SRF?

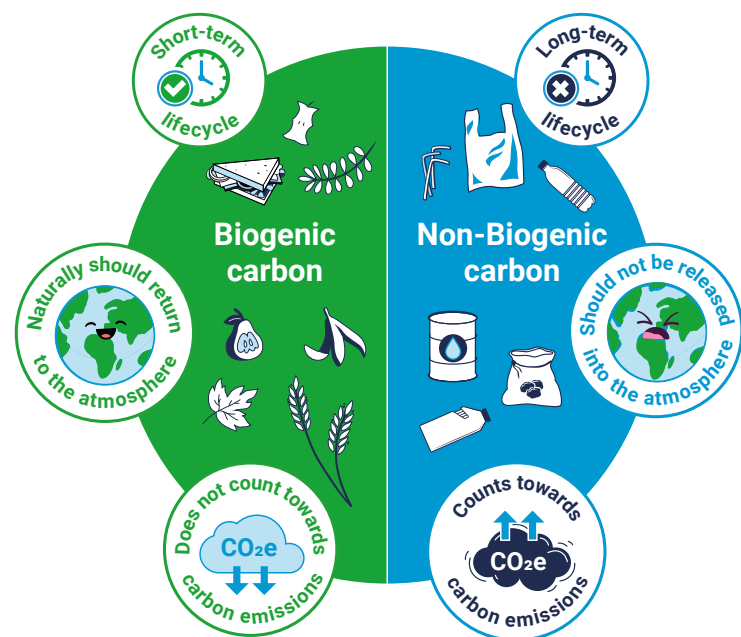
SRF is a fossil fuel replacement produced by refining ordinary household and industrial waste.

SRF can derive from recycle, which is often the case, but this isn't the best use of a waste stream that can be repurposed. However, SRF derived from non-recyclable waste extracts value from something that would otherwise go to landfill or for low level incineration. It is an ideal waste stream for SRF creation.

SRF is often made using Mechanical Biological Treatment (MBT), although some methods do not include the biological part of the process.

To make SRF derived from non-recyclable waste, the waste has to be shredded and then dehydrated to produce a dry, homogenous material. The composition of the waste determines the quality of the SRF produced.

SRF is subject to BS EN 15359: 2011 SRF Definitions and Classes as SRF off-takers (those who buy and use the commodity) demand a high-quality, consistent product. There are strict control parameters to ensure that the composition of SRF meets compliance obligations and is suitable for the off-takers' product – be that cement, gas or paper, for example. Moisture content, calorific value, ash and chlorine content can all make a difference to the quality of the end product SRF is used to produce.



Increasing Biogenic Carbon

An even more significant environmental benefit of SRF comes from the increase in biogenic carbon that occurs when non-recyclable waste is turned into a high-quality SRF.

Biogenic carbon has been created recently and stored within organic matter such as algae, grass and crop. It is unlike the carbon created from using fossil fuels. SRF with a more significant proportion of biogenic carbon, lowers the ratio of harmful CO₂ when the fuel is used and reduces the disposal cost, as biogenic carbon does not fall under the ETS.

Growing Demand for SRF

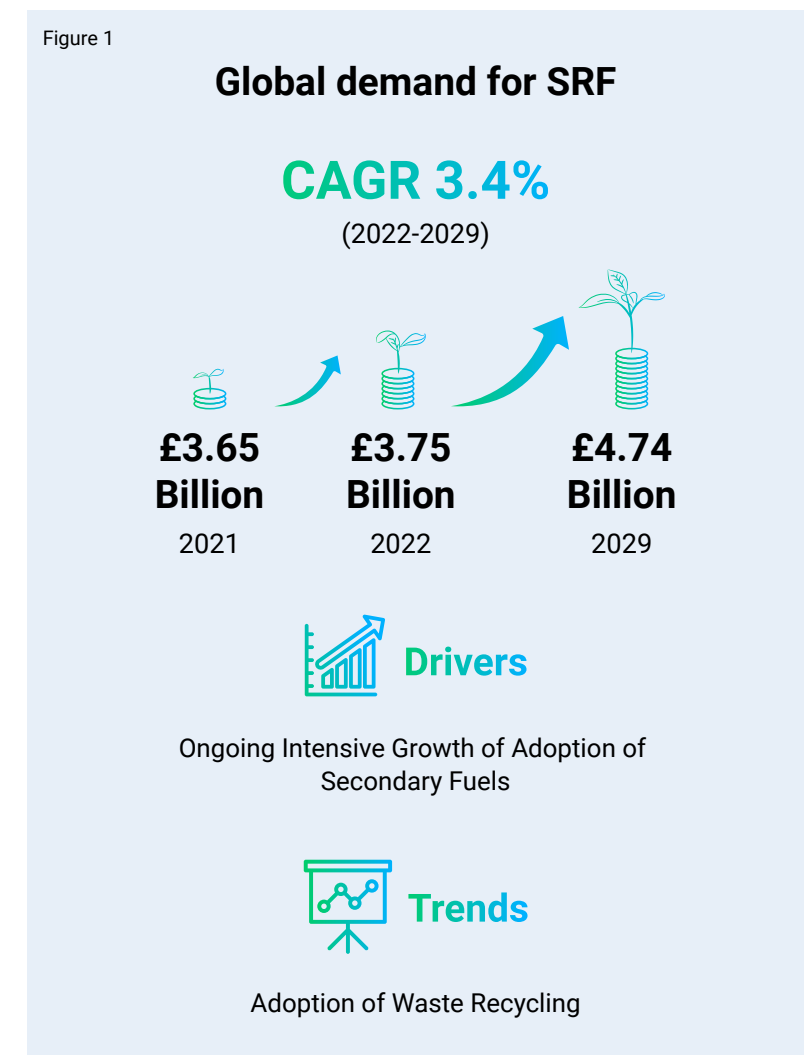
Solid Recovered Fuel's potential to reduce the need for landfill and decarbonise heavy industry is increasingly being recognised.

The global SRF market is projected to grow to £4.74 billion by 2029 (from £3.75 billion in 2022)² – growth which can be attributed, in part, to the EU's ETS.

The ETS makes polluters in the European energy and manufacturing sectors pay for their greenhouse gas emissions. This works as a 'cap and trade' system where affected businesses have a limit on their emission allowances, reducing annually in line with the EU's climate target to keep emissions in decline.

While polluters can buy and trade allowances on the EU carbon market, the overall focus is on emissions reduction. SRF is one way to do that, as it is not subject to the ETS. Demand is growing because it is a lower-cost, lower-carbon and efficient fossil fuel alternative.

Figure 1



² and Figure 1: Fortune Business Insights. (October 2022). The global solid recovered fuel market is projected to grow from \$4.75 billion in 2022 to \$6.00 billion by 2029, at a CAGR of 3.4% in forecast period, 2022-2029. Available at: www.fortunebusinessinsights.com/industry-reports/solid-recovered-fuel-market-101463 (Accessed: 10th January 2024).

For ease of information currency has been converted from USD to GBP on 31.01.2024



SRF made from Municipal Solid Waste (MSW)

SRF vs RDF

It's important to understand the difference between RDF and SRF. Refuse Derived Fuel is derived from municipal, commercial and industrial (C&I) waste like SRF. However, SRF is subject to much greater refinement and processing and therefore has a wider variety of uses.

The key differences are:

- SRF is refined to a high quality, unlike RDF which is a relatively crude fuel. SRF creation moves waste up the thermal hierarchy. Therefore, SRF is well suited to power cement kilns, which must operate at consistently high temperatures, without further refinement. RDF could not do this.
- SRF is much easier to sort post processing than RDF because it has become a consistent and dry material – which means plastics and metals can be extracted for processing with ease.
- SRF does not need further processing to be used in gasification – unlike RDF – as it's a more efficient, and higher-performing fuel.
- SRF has to meet a European standard to confirm it is of the right quality and consistency for SRF offtakers – RDF is not subject to the same rigours.
- RDF's use is typically confined to combustion in energy from waste facilities to generate energy, unlike SRF which has greater potential.



SRF made from Mixed Residual Waste (MRW)



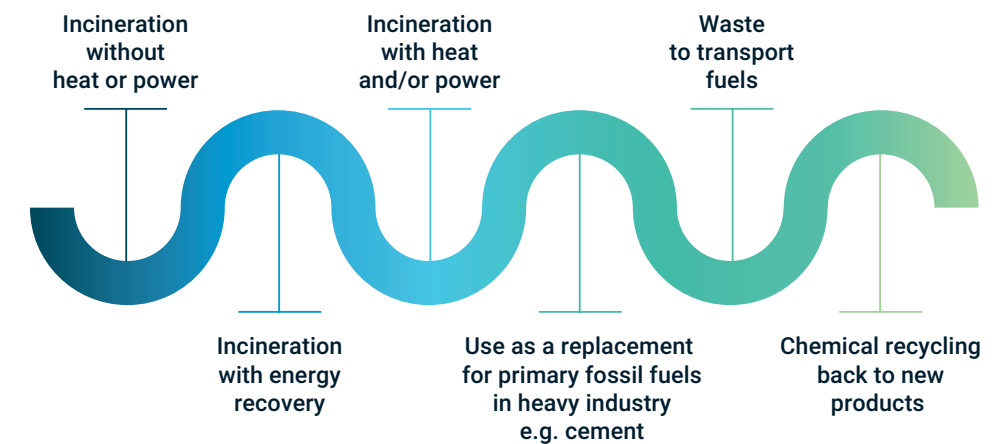
SRF made from Commercial and Industrial (C&I) Mixed Residual Waste (MRW)

Moving Waste up the Thermal Hierarchy

As more value is extracted from waste, it moves up the thermal hierarchy, and the closer it takes us to a fully circular model. For example:

- When non-recyclable waste is sent for incineration with heat or power offtake, it becomes a Refuse Derived Fuel (RDF). Some value has been extracted.
- But when that waste is refined further with biotechnology, it moves up the thermal hierarchy. Its potential is unlocked, and it becomes a SRF, capable of replacing primary fossil fuels in heavy industries such as cement.
- When waste is treated so it can be mined for valuable chemicals and recycled back into new products – its thermal value peaks, and its contribution to circularity greatens.

Thermal Hierarchy



Advetec XO Process



The Value of Waste that Cannot be Recycled

Defra estimates that the UK generates approximately 40 million tonnes³ of commercial and industrial (C&I) waste annually. Of the 29 million tonnes⁴ of plastic waste collected in the EU in 2018 – less than a third was recycled. That means almost 20 million tonnes went to landfill or for incineration.

There are two reasons this happens – the first is a lack of recycling infrastructure and, in some cases, inconsistent sorting practices. Access to recycling services depends on location and local authority. For Scotland and Ireland, which comprise many rural and often remote communities, this can be fraught with difficulty and cost. Differences between recycling and sorting practices and waste handlers' expertise add to the challenge. This often results in recyclate being treated as mixed residual or black bag waste.

The second reason is that not all waste can be recycled. The presence of organic matter – for example, packaging that still contains residual foodstuffs, such as a cardboard wrapper containing sandwich crusts or a container with pasta sauce - renders it unsuitable for recycling. This waste goes to landfill or for incineration instead.

We call this forgotten waste. It is forgotten because it's typically overlooked and not accounted for by waste handlers or declared by recyclers. It is forgotten because it's unseen by waste producers.

It is forgotten because consumers think they're recycling correctly – although the birth of wish-cycling suggests otherwise.

3. Department of Environment Food and Rural Affairs. (2023) UK statistics on waste. Available at: www.gov.uk/government/statistics/uk-waste-data/uk-statistics-on-waste (Accessed: 10th January 2024).

4. European Environment Agency. (2020) Plastics, the circular economy and Europe's environment – A priority for action. Available at: www.eea.europa.eu/publications/plastics-the-circular-economy-and (Accessed: 10th January 2024).



What is wish-cycling?

Wish-cycling describes a new phenomenon in human behaviour where people put waste in recycling bins in the hope it can be recycled, even though it cannot. This stems from people being unsure what can be recycled (especially when materials are contaminated). This is often the result of misinformation or poor communication, and thinking all materials have recycling value.

The Value of SRF

Creating SRF from non-recyclable waste helps to bend the line away from the linear economy towards the circular economy.

Once waste has been turned into SRF, it can be:



Sent to an SRF-offtake for use as fuel

SRF is a valuable fuel for the cement manufacturing industry as it is a high-quality combustible that can achieve the specific high temperatures required for the clinker, the base mix of limestone and minerals, to transform into cement. It also helps to limit ETS costs as SRF contains more biogenic carbon than other fuels. SRF is also a valuable fuel for the aviation industry.



Segregated further by removing the plastics and sending them for recycling

This plastic is suitable for recycling because it's clean and free from organic matter.



Turned into hydrogen to power cars and trucks

Only waste pre-treated to SRF standard and with a particular composition is suitable for use in this way.



Turned into oils and chemicals

SRF can be gassified to produce syngas which can be used to produce heavy and light oils and chemical for manufacturing process. This avoids use of raw materials is often considered the most environmentally friendly method for converting waste into energy – as it's already a homogenous and consistent material.



We need to stop viewing mixed residual waste (MRW) as something at the end of its useful life and instead recognise it as an alternative fuel source. Turning this waste into a high-yield energy source provides a ready alternative to fossil fuels. It provides a way for the cement industry to halve its fuel-associated carbon footprint and benefit the circular economy virtually overnight. The cement industry has to decarbonise and SRF is one way how.



Dr Stephen Wise, Chief Strategic Development Officer.

Chapter 2 | Opening up the Market for Independent Waste Handlers

Historically, independent waste handlers have struggled to access the SRF market for three primary reasons:



Volume

Waste handlers need a significant volume of waste to make SRF production financially feasible – something that small to mid-sized waste handlers often don't have.



Cost

Historically, the MTB infrastructure required to produce SRF from non-recyclable waste has been price-prohibitive and, therefore, the preserve of the largest operators – especially when the cost of regular laboratory testing and the expertise required to operate the machinery and achieve consistent, stable material is added.



Control

SRF producers have strict control parameters to ensure that SRF meets compliance obligations and is a consistent product every time – smaller waste handlers have not had the means or funds to do this. Additionally, the different parameters of each off-taker can make it challenging to ensure the SRF product is suitable for its specific production requirements.

Biotechnology is one of the solutions helping to change this picture for independent waste handlers. It provides a cost-effective way to turn non-recyclable waste into SRF on-site for the first time.



Independent waste handlers can now turn non-recyclable waste into Solid Recovered Fuel (SRF). There's no need for large-scale plant, infrastructure or capex budgets as we've put our technology 'in a box' that can live on-site and dovetail with existing systems.

It gives smaller waste handlers the means to compete with the larger players in the industry and, crucially, to innovate. Our biotechnology gives waste handlers who wouldn't previously have thought about SRF the means to enter that market, and that's a game-changing opportunity.

Lee Knott, Chief Executive Officer, Advetec.



The Benefits of SRF

The benefits of turning non-recyclable waste into a commodity are numerous:



Reduce disposal costs

In the WRAP 2022-2023 Gate Fees Report, the median cost for sending waste to Energy from Waste (EfW) facilities was £103 per tonne. The most frequently observed costs fell within the range of £115 to £120⁵. Transforming that same non-recyclable waste into SRF for a cement kiln or gasification can cost 40% less. This is because SRF creation process increases the biogenic carbon fraction which isn't subject to the ETS. This is a significant incentive for independent waste handlers to change waste management practices – especially in the face of increasing gate fees at EfW plants and landfill sites and the rising cost of RDF exports. It's also how they can compete with larger waste handlers.



Reduce the amount of waste sent to landfill

Legislative change is making landfill the least acceptable form of waste disposal. As well as diverting non-recyclable waste from landfill, turning waste into SRF also helps to extend the lifespan of existing landfill sites which is particularly important until we achieve a 100% circular economy.



Stabilise what does have to go to landfill

The process of creating SRF also stabilises non-recyclable waste which means if it still has to go to landfill, it can't breakdown further or produce methane or leachate. With AT4 testing already in place in Ireland, soon to be in Scotland and expected in England – this will be the only way to keep landfill open as a disposal option for MRW.



Reduce greenhouse gases

Turning non-recyclable waste into SRF lowers greenhouse gas emissions and helps to combat climate change. For every two tonnes of MRW turned into SRF instead of going to landfill or incineration, zero methane is emitted and 1.2 tonnes of CO₂e are saved.



Deliver a more sustainable energy mix

Turning non-recyclable waste into SRF conserves natural resources, reduces the reliance on fossil fuels and promotes important energy diversification and security. SRF is suitable for use in gasification, which turns waste into energy.



A local solution

Giving communities and organisations the means to treat their own waste on site is key to reducing emissions. When waste is treated locally it reduces the road miles and emissions associated with collection – and provides a more environmentally and community friendly alternative to waste travelling cross country to processing plants or abroad as RDF waste exports.



Help energy intensive industries decarbonise

SRF derived from non-recyclable waste presents a high value coal replacement product for heavy industry. One tonne of SRF can replace 0.5 tonnes of coal in a cement kiln so, delivered at scale, residual waste-derived SRF could help to rapidly decarbonise cement and therefore construction.



Compliance with regulations

An increasing amount of government targets and legislation require waste handlers to change their practices. Turning waste into SRF locally shows a commitment to sustainable waste management practices and reduces costs under the ETS.



Support developing countries with their environmental progress

Turning waste into SRF on-site could play a significant role in helping developing countries with limited waste handling infrastructure to reduce their reliance on landfill and lower carbon emissions dramatically. Waste should not be travelling around the world for processing.



Supporting the transition to a circular economy

Even when the world has moved to a circular economy there will always be some degree of residual waste. Turning non-recyclable waste into SRF extracts greater value from the materials we have in circulation.

5. Wrap.org.uk. (2023) Gate fees report 2022/23, comparing the costs of alternative waste treatment options. Available at: www.wrap.org.uk/resources/report/gate-fees-report-2022-23 (Accessed: 10th January 2024).

Chapter 3

How Advetec's Biotechnology Turns Non-Recyclable Waste into SRF

For decades, SRF production has been the preserve of the larger waste handlers who've had the means to invest heavily in infrastructure, technical knowledge and testing.

Only now can independent waste handlers access the SRF market easily – a change providing valuable cost and carbon benefits.

This is possible thanks to a pioneering way of converting non-recyclable waste into SRF on-site without onerous costs, infrastructural investment or decades of planning.

Advetec's XO technology uses unique blends of bacteria inside enclosed aerobic digestors to achieve in 48-72 hours what other processes would need more than 16 weeks to do.

The XO system comprises three industrial-grade machines that can be built into systems that process from 1.5 to 80 tonnes of waste daily. These machines act as a mini form of Mechanical Biological Treatment (MBT) and enable waste handlers to

- ✓ Reduce the mass of customers' contaminated waste by up to 50%
- ✓ Divert 100% from landfill or for incineration
- ✓ Cut overall associated GHG emissions by over 70%, compared with landfill
- ✓ Generate cost and carbon savings without needing expensive or complex new infrastructure.

Advetec's digestors are based on-site at waste handlers' operations, dovetail seamlessly with existing processes and operate almost autonomously. This decentralised approach to waste management gives handlers a local solution and cuts the cost incurred for collection, transportation and disposal.

The material produced by Advetec's biotechnology process is floc, which can be used as SRF. This floc is sampled and tested independently to prove its SRF quality. As the process gives waste a moisture content of less than 15% and an increased calorific value, it moves up the thermal value chain.

When SRF is produced from non-recyclable waste, it bends the line and moves us one step closer to the circular economy – recovering resources, lessening the reliance on fossil fuels and reducing carbon emissions.



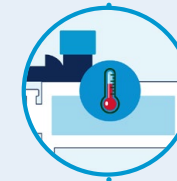
The Advetec Process is Simple



Step 1 - Waste stream testing – Advetec's XO technology is the only on-site solution to handle various waste streams, including mixed organic content. We test clients' waste to ensure the most efficient bio-process with a significant mass reduction.



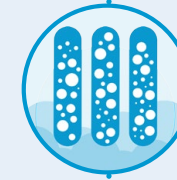
Step 2 - Waste shredding – Waste goes through an industrial shredder. This begins the process and ensures a consistent and optimum particle size enters the biomass.



Step 3 - Heating and bacteria – The system initially heats the waste to kick-start the bacterial activity. Once optimum temperatures have been achieved, the exothermic reaction self-generates most of the heat required. The heating system then maintains the temperature above a minimum threshold for continual operation 24/7. This creates resiliency in the system for periods of inactivity.



Step 4 - Biostimulants – Advetec's unique biostimulants are added automatically. This ensures a robust biomass is maintained and allows the system to cope with the inevitable existence of biocides within the waste stream.



Step 5 - Rapid digestion – Each Advetec XO machine has multiple chambers. These chambers are aerated to allow the aerobic process to flourish. The waste is indexed through the process, allowing for the addition of fresh waste at regular intervals.



Outcome: Solid Recovered Fuel (SRF) - The output material is the inorganic fraction, such as plastics – called post-process floc or SRF. Depending on the waste stream and customers' requirements, this SRF can be used as a fuel or have further value extracted – negating the need for incineration or landfill.

Chapter 4 | Moving Towards the Circular Economy

At Advetec, we think it's essential to understand that transitioning from a linear to a circular economy to tackle climate change and benefit society will not occur overnight.

To be fully circular, waste would not be produced in the first place, with products and materials kept in circulation through processes such as reuse, repair, remanufacture and recycling so that fewer new resources are needed altogether.

This is an important goal. But it will take decades to achieve, as governments, industry and infrastructure have to overhaul how they work. It requires seismic investment in production methods and materials development, a significant commitment to behavioural change and the right skills and expertise in the labour market to make this possible.

So, what do we do until we get there? And what about the waste we have right now?

Reducing, reusing, and recycling is one solution, and these behaviours must be encouraged. But, we should also look to optimise recovery solutions for waste streams that would otherwise go to landfill or for low-level incineration. This non-recyclable waste could have greater value for society and help to reduce the reliance on fossil fuels. It just needs its value to be unlocked.

Decarbonising Energy-Intensive Industries: Use Cases



“

When non-recyclable waste is turned into Solid Recovered Fuel (SRF), it supports the move to a circular economy. SRF derived from non-recyclable waste is ideal for green cement production or gasification. It moves waste once considered worthless up the thermal hierarchy and creates a high-value alternative fuel rich in biogenic carbon, which has an important role to play in decarbonising vital industries. It turns waste into a commodity.

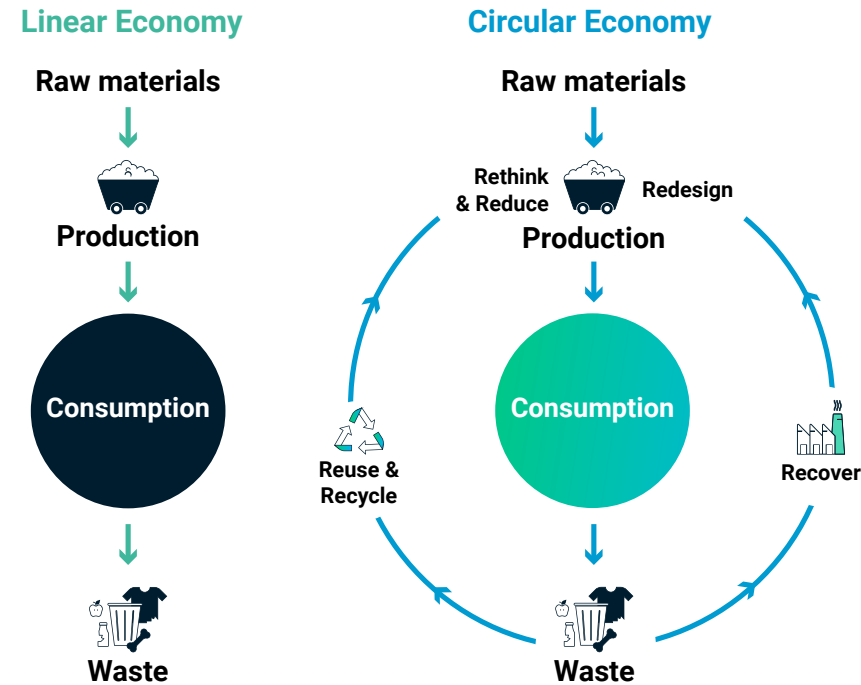
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Lee Knott, Chief Executive Officer, Advetec.



Defining the Linear Economy

The linear economy refers to the world as we know it – where there's a 'take-make-waste' system. This means we use raw materials and natural resources to create products that are used and discarded as waste. This model depletes our natural resources, with little concern for the environmental consequences as the planet continues to be polluted.



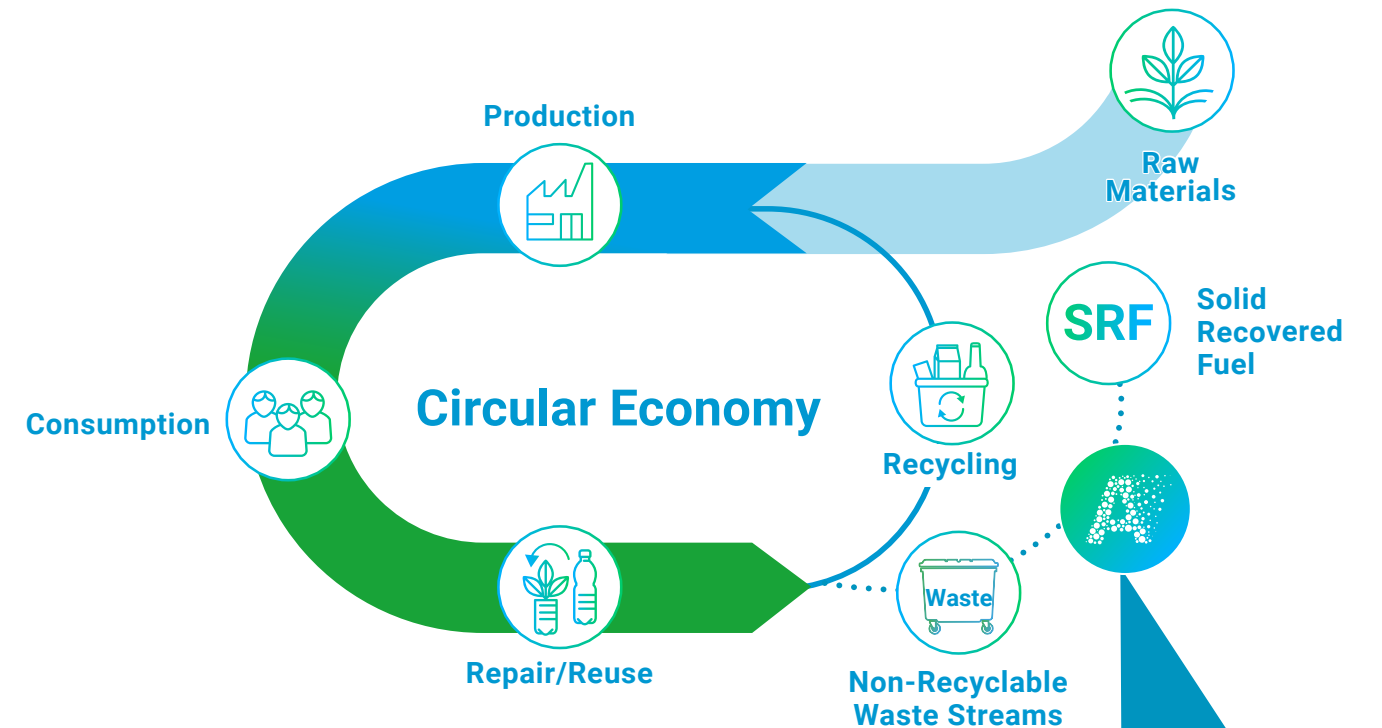
Defining the Circular Economy


One of the most widely known and often referenced definitions of the circular economy comes from the Ellen McArthur Foundation. This describes the circular economy as being based on three principles designed to:

- ✓ Eliminate waste and pollution
- ✓ Circulate products and materials at their highest value
- ✓ Regenerate nature


The achievement of a circular economy would transform our world and deliver significant environmental, economic and social benefits, including:

- ✓ Removing the environmental harm caused by waste and disposal will slow climate change and improve public health.
- ✓ Reducing our use and reliance on natural resources that cannot be regenerated.
- ✓ Protecting biodiversity and respecting the natural world by reducing carbon emissions.
- ✓ Driving economic growth and creating new jobs.
- ✓ Support global sustainability and the targets outlined in the United Nations' Sustainable Development Goals (SDGs).





Non-Recyclable Waste Streams




SRF

Linear economy

**Incineration
EfW
Landfill
Export**

**Cement Production
Gasification
Chemical Mining
Further Recycling**



Advetec's technology supports the transition from a linear economy to a circular economy by helping to extract value from waste streams that cannot be recycled. It significantly reduces the amount of associated pollutants such as GHG emissions and leachate.

Can we ever be Fully Circular?

Moving toward a circular economy is essential to protect our natural resources and environment and extract as much value from the materials we already have in circulation.

However, even after we've applied the waste hierarchy, there will always be some residual waste. It is not possible to achieve a 100% circular model on a global scale.

As long as that is the case, we need other solutions to treat those residual waste streams and to extract as much value as possible from them, while limiting and eliminating emissions associated with it.





It's time to act now

The climate emergency is increasingly pushing nations to embed circularity into their economies.

The UK has pledged to achieve carbon neutrality by 2050, and the sustainable management and use of waste have become significant concerns for governments. Regulation aimed at reducing the environmental damage caused by waste has been stepped up.

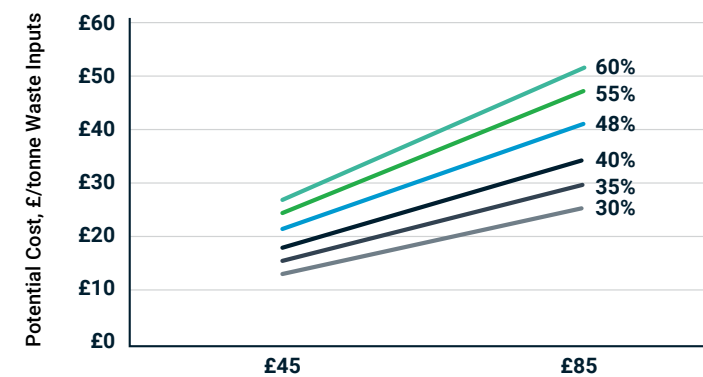
This includes bringing non-recyclable waste to the fore with the UK's ambition to halve the waste sent to landfill or for incineration by 2042 and an active focus on biodegradable landfill reduction measures. The AT4 test, which means biodegradable waste not meeting stipulated levels will not be permitted for landfill, is already being applied to waste in Ireland and is expected to be implemented and enforced in Scotland from 2025. England looks set to follow, subject to the findings of an ongoing Defra consultation.

Changes to the ETS will also be felt in the UK as Energy from Waste will be included from 2028. We can expect EfW gate prices in the EU and RDF waste exports to become significantly more expensive.

These changes are welcome news for the circular economy – as they make the status quo uncomfortable and costly and will force the uptake of new methods and ideas.

Set against this backdrop of shifting regulation, waste handlers have an opportunity to be at the vanguard of sustainability.

Indicative cost of ETS, by % fossil content



Recent UK Carbon Prices, high and low, £/t of CO₂

Indicative ETS cost based upon recent carbon prices & variable % fossil content⁶

Estimated gate fees by treatment method (£, 2022 prices)

Technology (all include transport)	2030
Landfill (excluding landfill tax)	28
MRF	80
Abated EfW	130
Unabated EfW	175

Note: EfW gate fees under the ETS will vary over time depending on carbon prices. This table provides a snapshot of 2030 gate fee estimates in 2022 real prices.⁷

6. Source: Tolvik Consulting. (2022) Response to C all for Evidence on Inclusion of EfW in the UK Emissions Trading Scheme. Available at: www.tolvik.com/wp-content/uploads/2022/06/Tolvik-Response_Inclusion-of-EfW-in-the-UK-ETS_27052022_web.pdf (Accessed: August 2023)

7. Ricardo. (2023) Waste Infrastructure Technology Mix Report. Available at: www.nic.org.uk/app/uploads/Waste-Infrastructure-Technology-Mix-Report-Ricardo.pdf (Accessed: 11th January 2024).





Conclusion

Minimising waste and improving global recycling rates are crucial to the circular economy ethos and key goals we must pursue – but we cannot wait while governments, industries and societies reset their values and invest in the infrastructure required for sustainable change.

In the global war on waste, we must re-educate ourselves about the impact of our behaviours and embrace the solutions and technologies with the power to deliver change now.

Greater SRF production can do this and will have a very real role to play in delivering a circular economy, but it is not a silver bullet.

Turning non-recyclable waste into SRF provides an important transitional step away from linear thinking towards a more circular economy. It is part of a process of change and presents a much-needed, immediate way to reduce the reliance on landfill and incineration, protect natural resources and reduce costs for waste handlers and customers.

Plus, treating waste locally, rather than relying on centralised solutions or export, helps us move closer to Net Zero by 2050 and empowers communities to be the change we need to see.



Appendix: Your Questions Answered

Will turning non-recyclable waste into SRF discourage recycling and waste sorting?

No, waste that cannot be recycled is such because it's contaminated with organic matter. This means it cannot be recycled. Technologies that turn waste that would otherwise go to landfill or for incineration provide a positive solution to the waste we have today and help to bridge the gap between a linear economy and a circular economy.

How will we ever solve the issue of waste at source if we have technologies like this?

The move to a circular economy will take decades, but the climate change emergency is happening now. In the future, we hope that waste is eliminated at the source and that the reuse, repair, remanufacture, and recycling model is fully adopted, but we can't sit back and do nothing until then. Technologies like ours allow value to be extracted from something previously considered worthless and, in doing so, reduce the need for fossil fuels.

Does the Advetec process reduce the recycling potential of plastic in the SRF if it goes on to be separated?

No. Advetec's process removes the organic fraction of the waste only; it does not change the chemical characteristics of the plastic, just the size of the pieces due to shredding at the start of the process. This plastic can be sent to recycling plants for further use as pellets or flakes.

Could plastics from the Advetec process become an essential source of feedstock for the emerging chemical recycling of the plastics sector?

Yes, plastics processed through Advetec could become a preferred feedstock for chemical recycling. The Advetec process pre-treats plastic-containing floc, making it easier to process chemically. This could enhance its suitability for recycling.

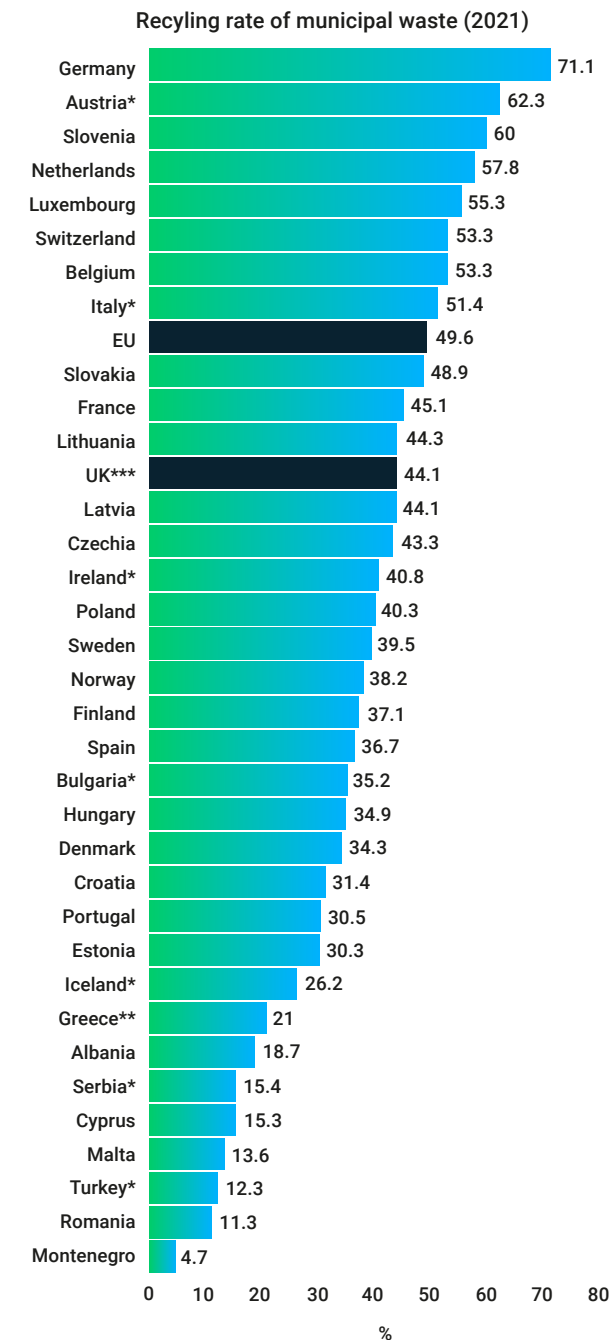
Wouldn't it just be better to recycle more instead of using technologies like this?

'Recycle more' is often presented as the catch-all answer to the world's waste problems. Recycling is a hugely important component of the move to a circular economy, improving waste practices and respecting the world's natural resources. Still, there are limits to what is possible right now. It's also widely known that there is still non-recyclable waste, even in the countries with the best recycling rates, such as Germany, Austria, South Korea, and Wales.

The waste industry needs years and significant investment to advance enough to recycle all materials, including contaminated plastics, change operational practices, add new infrastructure and create new markets – but even then, we must acknowledge that recycling cannot go on indefinitely.

Materials such as plastic are not infinitely recyclable and, in some cases, can only be recycled two to three times before the quality decreases and can no longer be used. And even though we are starting to see some packaging move away from plastic towards other materials, the pace of consumption may outweigh that gain.

Figure 2



Source: Eurostat • (*2020, **2019, ***2018)

Figure 2: euronews.green. 2023. Italy, Belgium, Latvia: Which European countries are the best and worst at recycling? Available at: www.euronews.com/green/2023/10/17/italy-belgium-latvia-which-european-countries-recycle-the-most (Accessed: 10th January 2024)



Advetec is an environmental biotechnology business specialising in reducing the volume and environmental impact of waste that cannot be recycled. Advetec's XO systems combine robust, clever engineering with biostimulants, allowing rapid aerobic digestion to turn contaminated waste into Solid Recovered Fuel (SRF).

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